

COMPUTED TOMOGRAPHY IN SUSPECTED BACTERIAL MENINGITIS

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"Today's proposition is tomorrow's dogma"- Francois Mauriac.

Recent dialogue in the British paediatric literature debates the safety of performing a lumbar puncture in the evaluation of a child presenting with suspected pyogenic meningitis (1-7). The arguments pit potential diagnostic certainty obtained via an emergent evaluation of cerebrospinal fluid (CSF) versus the risk of transtentorial herniation (coning) following lumbar puncture. Confounding variables include the availability of cranial computed tomography, the desire to "do everything possible," and medico-legal angst. This issue is also relevant to adult and paediatric medicine in Singapore. In the following paragraphs I will review the available facts, discuss physicians' concerns, and explore the potential disservice of *routinely* obtaining cranial computed tomography (head CT) prior to performing a lumbar puncture.

Bacterial meningitis can be a rapidly fatal process; urgent antibiotic institution is the cornerstone of therapy. The lumbar puncture remains the "gold standard" procedure allowing confirmation of pyogenic meningitis (8). Although there have been inroads into less invasive means of diagnosing infectious meningitis (e.g., blood cultures, serum latex agglutination, and counterimmune electrophoresis for bacterial antigen), the sensitivity of these tests has not routinely rivaled that of examining and culturing cerebrospinal fluid (9). The direct evaluation of cerebrospinal fluid (CSF) allows us to decide on specific antibiotic therapy and antibiotic alternatives based on microbe identification and sensitivity testing. Precise bacterial isolation provides other less obvious benefits, including patient contact prophylaxis counselling, the ability to chart changing patterns of regional meningitis, and information towards tracking specific outbreaks.

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Direct evaluation of the CSF also allows diagnosis of meningeal processes that may present in a fashion similar to pyogenic meningitis, but whose therapy may be quite different (e.g., viral, tuberculosis, cryptococcal, rickettsial, lupus cerebritis, etc.) (10, 11).

The risks of lumbar puncture include local hematoma, post-lumbar puncture headache, nosocomial meningitis, painful paresthesias, and herniation of the temporal lobe uncus through the tentorial hiatus or of the cerebellar tonsils through the foramen magnum. For the purpose of this discussion we will focus on herniation due to the high mortality associated with this complication. Herniation may occur during, immediately after, or within 48 hours of the spinal puncture (8). One published series reviewed lumbar punctures in patients with evidence of raised intracranial pressure or papilloedema and estimated the incidence of complications to be < 1.2% (12). Although such a low percentage of coning in this high risk group is somewhat reassuring, there is general agreement that a lumbar puncture should not be performed in this setting except under extraordinary circumstances. Of greater concern are scattered case reports of uncal herniation following a lumbar puncture in patients with bacterial meningitis and no apparent papilloedema (2, 3, 13, 14). Although the exact role of lumbar puncture in precipitating these events is uncertain (i.e., coning can occur in meningitis without lumbar puncture), its temporal association to the herniation is compelling (15). Unfortunately, there has not been a prospective study evaluating the incidence of coning following lumbar puncture in patients presenting with meningeal signs and symptoms alone. In the absence of this information we must objectively interpret retrospective data and case reports.

We presently have two diagnostic alternatives:

1. Obtain a cranial computed tomography (head CT) on every patient, looking for evidence of mass effect prior to performing a lumbar puncture (16). With the caveat, "We agree that computed tomography can be helpful in showing the presence of cerebral oedema, hydrocephalus, or a space occupying lesion, but it cannot be used to ascertain whether intracranial pressure is raised or not. The only way to establish this is by direct measure . . ." kept in mind (4).

2. Alternatively, we can use historically relevant clinical clues to stratify patients as to the likelihood of elevated intracranial pressure (ICP) being present. Those with

clinical evidence of elevated ICP will require head CT prior to LP; those without undergo LP immediately. The clinical clues elicited from reported series and individually cases include papilloedema, progressive deterioration in consciousness, recurrent vomiting, focal neurologic signs, and recent otitis media or sinusitis. No one sign is 100% dependable, but any of these individually or in combination suggest elevated ICP.

If a head CT is routinely ordered in all cases (at a cost of ≈ S\$300), the next decision is when to begin antibiotic therapy. There may be untoward consequences of immediate empiric antibiotics. We dramatically affect our ability to specifically diagnose the patient, due to the antibiotic's interference with gram stain and culture results. An expensive broad spectrum antibiotic is often selected to cover all organisms considered, when a narrow inexpensive drug may be more appropriate if the organism were known. We potentially expose the patient to the attendant risks of inappropriate antibiotics: hypersensitivity reactions, haematologic effects, and antibiotic-associated diarrhoea. We introduce uncertainty concerning what therapy to use if an unacceptable antibiotic reaction occurs. We risk the loss of epidemiologic data and loss of the accurate ability to counsel patient contacts regarding prophylaxis. We also incur the high cost of unnecessary hospitalization and antibiotics in those with viral aseptic meningitis. On the other hand, if antibiotics are withheld until an LP can be performed following a "negative" head CT, then we have lost valuable time that may be important with regard to the morbidity and mortality of this illness (9, 17-19).

If an emergent LP is performed on appropriately stratified patients, we have maximized our opportunity for diagnostic certainty, yet exposed our patients to a small but finite risk of coning. As a result of the 80-90% yield of the gram stain in those with microbiologically proven meningitis, we are able to minimize antibiotic

empiricism(9).

The approach one takes should be based on medical issues alone. However, we live in an era of threatened litigation whenever patient outcome is less than expected. Medico-legally, physicians are expected to be competent, to be knowledgeable of the benefits and risks of performing or delaying a procedure, and to inform the patient and/or family of the implications of immediate action versus delay. The benchmark standard of care for diagnosing meningitis has not been established as there is little data on which to base it, thus the call for national standard in the British Medical Journal (20). Community standards require a physician to be responsible for acts of omission as well as commission. In other words, obtaining a head CT to "cover oneself" if not justification alone, and the delay in diagnosis and appropriate therapy may actually put the physician at risk for litigation as well. Of note, legal action has not been taken in Singapore against any physician based on a patient herniating after a lumbar puncture for meningitis (Chao Tzee Cheng: personal communication).

Finally, experienced clinicians are the role models for trainees. The argument against routinely obtaining a head CT prior to an LP in suspected bacterial meningitis merely serves as a paradigm for all decision making in medicine. Empiricism, the presumptive treatment of disease prior to establishment of a diagnosis, is justifiable only when further diagnostic endeavours are fraught with unacceptable risks. We must acknowledge that decisions are made in a climate of uncertainty. No single test or battery of exams will provide a diagnosis in every case, nor will routinely obtaining these tests exonerate us in the event of an unexpected outcome. Only the sincere effort to keep abreast of the limitations and advancements in our chosen fields will assure that we provide excellent medical care and serve as responsible examples for the physicians that follow.

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