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CLINICAL PRESENTATION AND RADIOLOGY QUIZ QUESTION

The patient is a 45 year old woman who woke up with the worst headache of her life. She had three episodes of vomiting. She had no fever or chills, blurry vision, double vision, or light sensitivity.

What is the imaging study of choice for this patient?

a. plain films of the skull
b. head computed tomography (CT)
c. brain magnetic resonance imaging (MR)
d. no imaging is necessary for this patient

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RADIOLOGY QUIZ QUESTION, ANSWER, AND EXPLANATION

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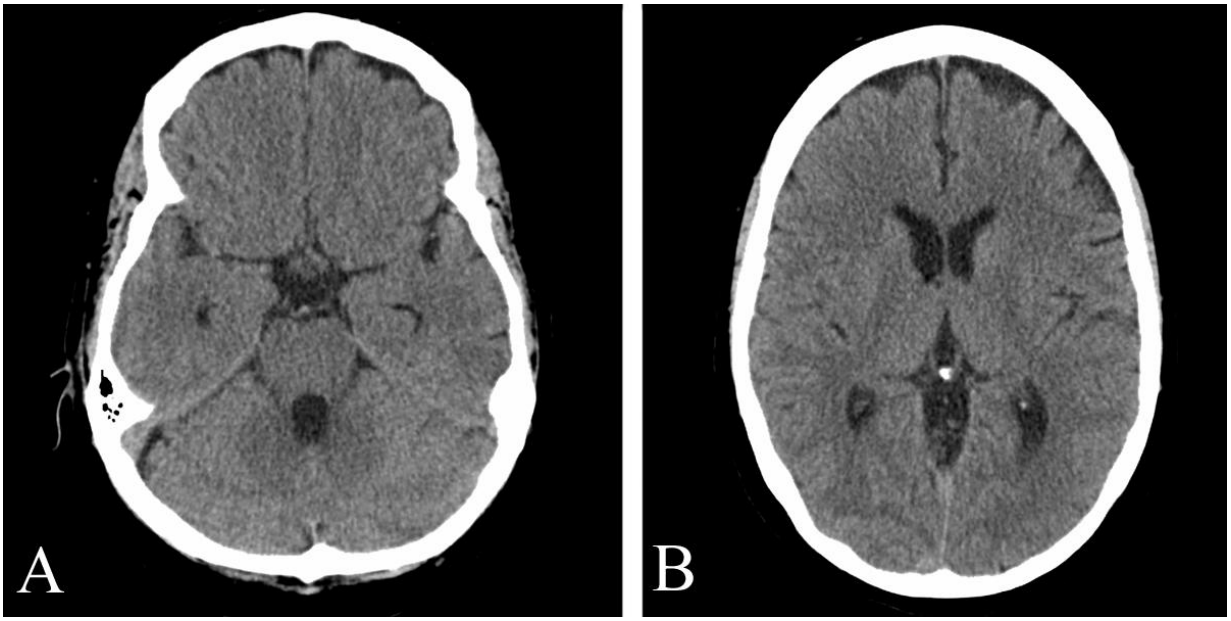
Answer: (b), head computed tomography. The patient has a "worst or first" headache, and one of the prime considerations for such headaches is a subarachnoid hemorrhage secondary to aneurysm leakage or rupture, with potentially catastrophic consequences. The patient needs to be imaged immediately.

Plain films of the skull are virtually worthless in this situation, and (a) is incorrect. Brain magnetic resonance imaging (MR) typically takes longer both in terms of machine availability and in terms of performance of the examination itself, so MR is usually not the ideal imaging method for emergent work-ups, and (c) is incorrect. Imaging is necessary in this case, so (d) is also incorrect.

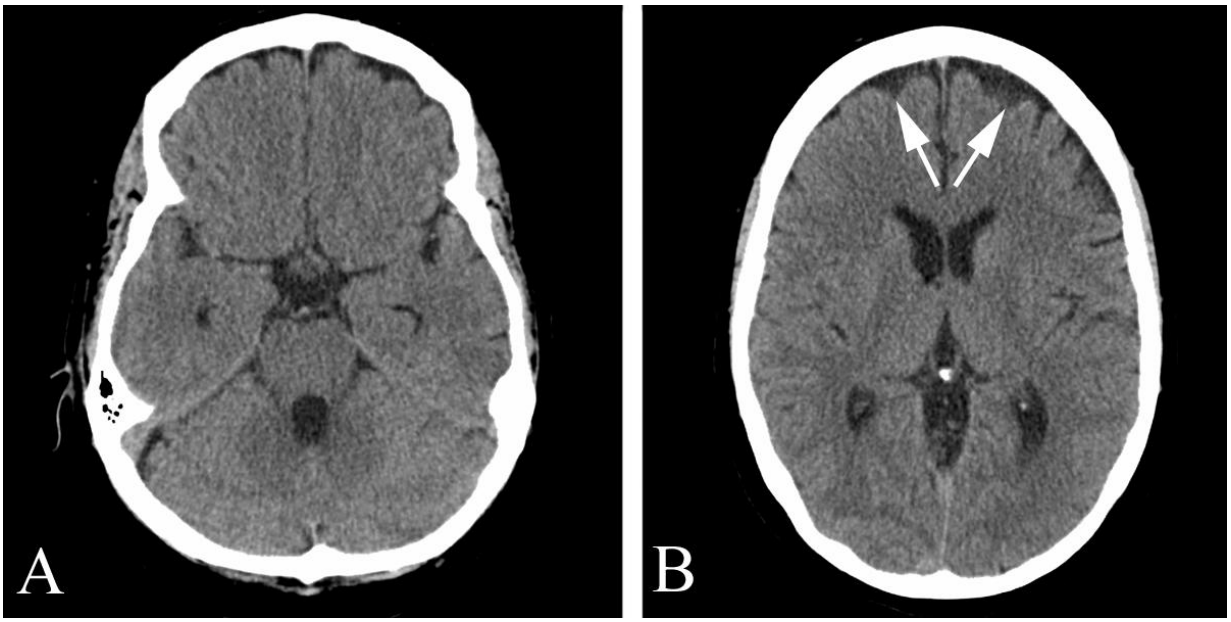
IMAGING STUDY AND QUESTIONS



Imaging questions:

1) What type of study is shown in figures A and B?
2) Is there any evidence of subarachnoid hemorrhage or mass on this study?
3) Is there any abnormality on this study?

IMAGING STUDY QUESTIONS AND ANSWERS

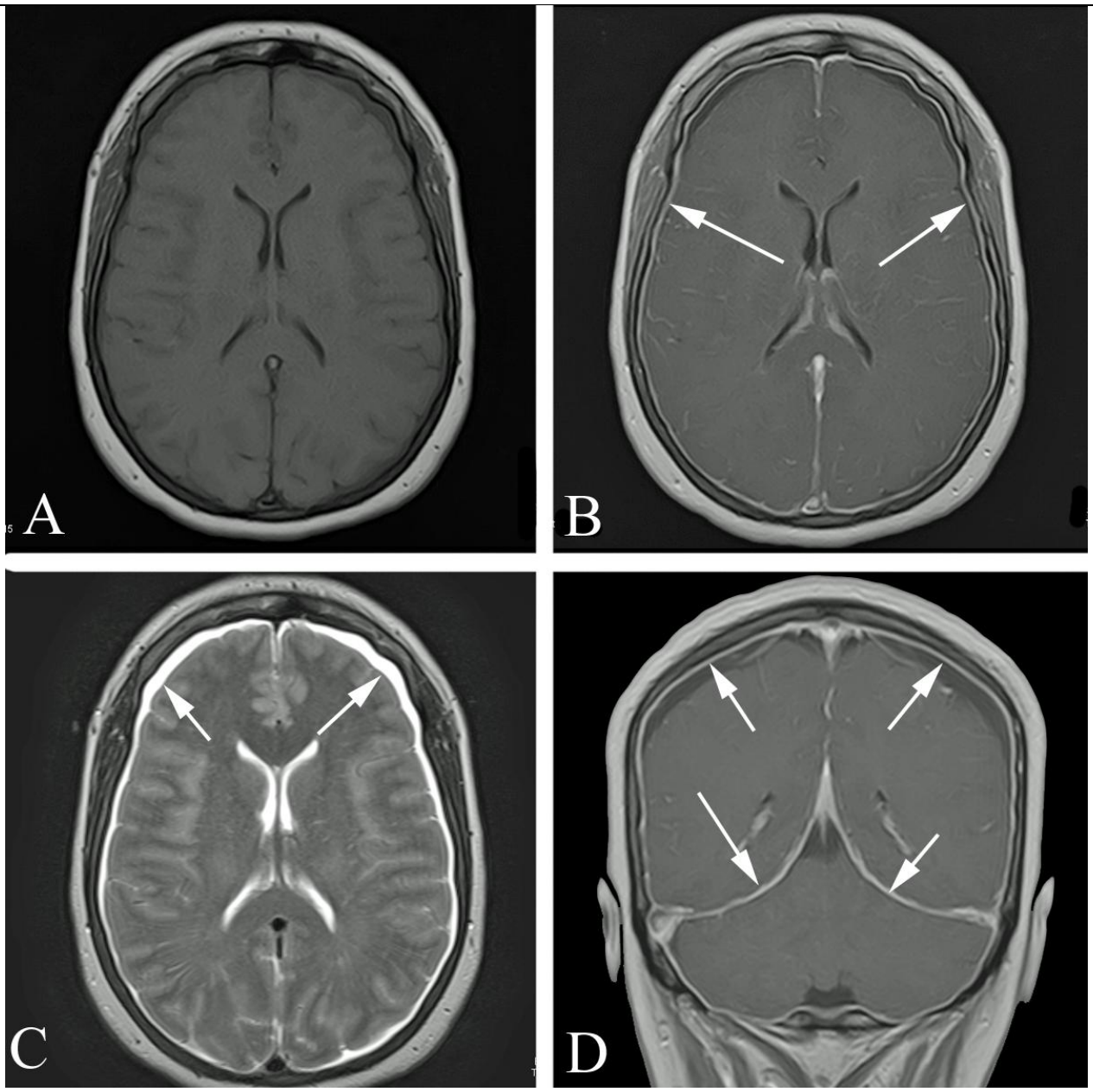


Imaging questions and answers:

1) What type of study is shown in figures A and B? A noncontrast head computed tomogram (CT).
2) Is there any evidence of subarachnoid hemorrhage or mass on this study? No.
3) Is there any abnormality on this study? There is a low density (gray/black) rim of fluid along the frontal lobes, more conspicuous on along the left frontal lobe (arrows). This amount of CSF density may be seen along the frontal lobes in some normal patients, but in this case it actually represents an abnormal finding.

The patient was treated symptomatically. Her headache persisted over for the next two weeks and an additional imaging study was performed.

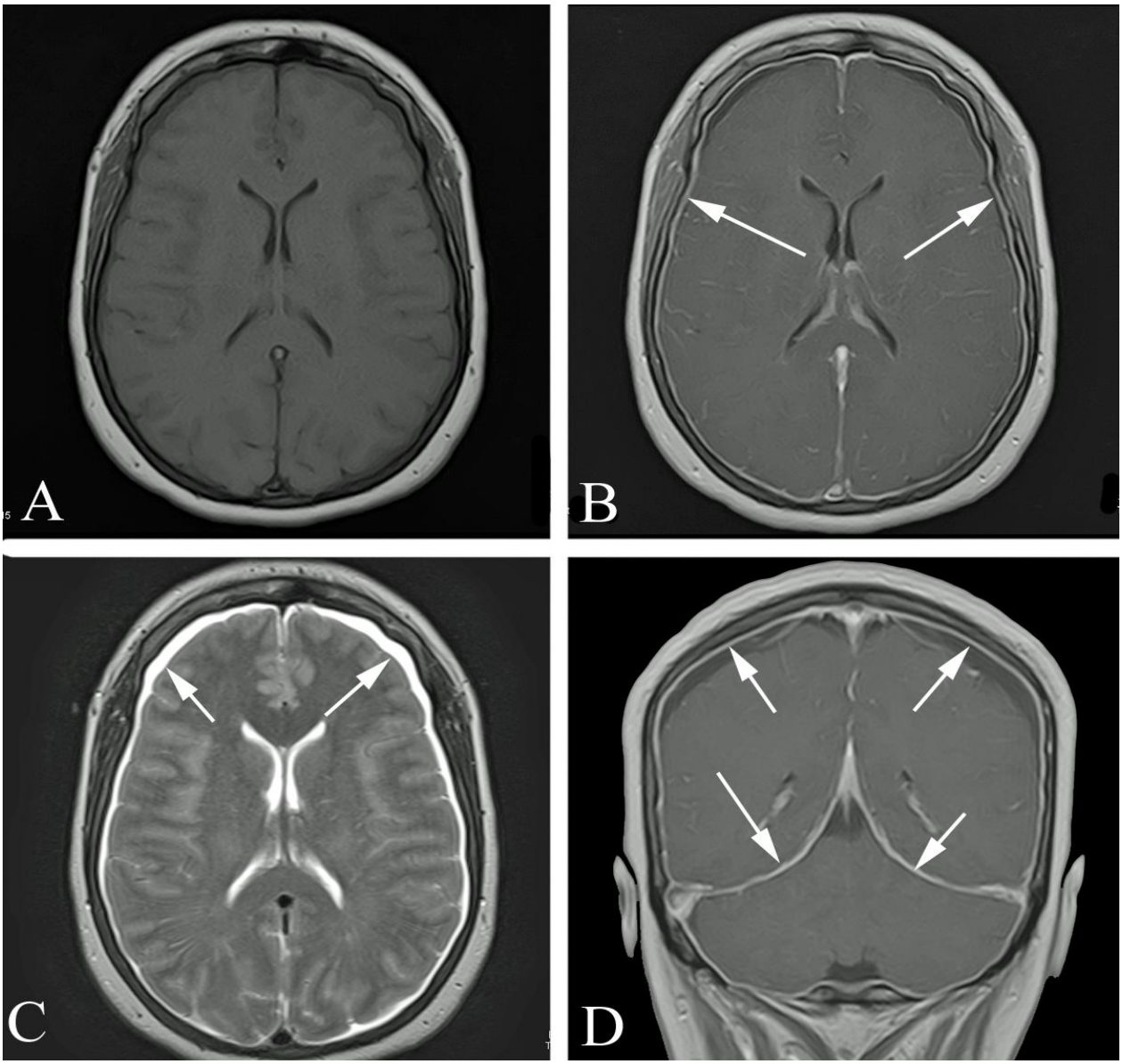
ADDITIONAL IMAGING STUDY AND QUESTIONS



Imaging questions:

1) What type of study is shown here?
2) What is the difference between the image in A and the image in B?
3) What is the structure at the location of the white arrows in B and D? Is this normal?
4) What is the finding along the cerebral hemispheres at the location of the arrows in C?

ADDITIONAL IMAGING STUDY QUESTIONS & ANSWERS



Imaging questions:

1) What type of study is shown here? Brain magnetic resonance imaging (MR).
2) What is the difference between the image in A and the image in B? A is an axial, T1 weighted imaged obtained *without* IV contrast, and B is obtained *with* contrast material.
3) What is the structure at the location of the white arrows in B and D? The dura. Is this normal? The enhancement pattern is strikingly abnormal.
4) What is the finding along the cerebral hemispheres at the location of the arrows in C? There are bilateral effusions along the cerebral hemispheres.

PATIENT DISPOSITION, DIAGNOSIS, AND FOLLOW-UP

After the patient's initial visit (to the emergency room) the patient followed up the next day with a nurse practitioner. Because of neck pain, plain films of the cervical spine were obtained. These were negative. The patient was given a soft cervical collar and a prescription for pain medication.

Approximately two weeks later, she was no better and actually getting somewhat worse. Therefore, a brain magnetic resonance imaging study (shown above) was ordered. After this showed extensive meningeal enhancement, the patient was sent to the emergency room for a lumbar puncture. Additional history and physical examination confirmed multiple pertinent negatives, including: no rash or joint pain; no travel; no contact with ill family members or coworkers; no sinus congestion, sore throat, earache, or cough; no antibiotic administration; and no exposure to mosquitoes or wild animals. A lumbar tap was performed, which showed no WBC, RBC, or bacteria but did show slight elevation of protein.

The patient was treated empirically for viral meningitis with acyclovir. She developed two separate headaches (in addition to the one she presented with): a post-tap headache following the lumbar puncture (which remitted with bed rest and time) and a headache related to the acyclovir (which remitted after discontinuation of the drug). Polymerase chain reaction (PCR) testing for Borrelia burgdorferi DNA, Epstein-Barr virus, Herpes Simplex CR1 & CR2, enterovirus, and west Nile virus were all negative. The patient was eventually discharged from the small rural hospital where the initial imaging, diagnostic work, and admission were done.

The patient's initial headache did not remit, and on the basis of the brain MR the additional diagnostic consideration of intracranial hypotension was considered at about the time the patient was seen by a neurologist for follow-up. The neurologist admitted the patient to a larger, regional referral hospital. Sequential MR studies showed increased size of subdural hygromas/effusions. Echocardiography, angiography of the cerebral vasculature, and chest, abdomen, and pelvis CT were performed, all of which were negative. A lumbar blood patch was performed which did not improve the headache.

The patient was then referred to a university hospital. The treating physician elected to perform a thoracic blood patch without further diagnostic imaging (such as a radioisotope cisternography, CT myelography, or MR myelography). Within two hours, the patient's headache, which had ranged from a 7 to a 9 (on a ten-point scale) for the previous 45 days, dropped to a 1. She became completely headache free over the ensuing week.

SUMMARY

Presenting symptom: For a brief discussion of headache as a presenting symptom, see the previous Radiology Quiz of the Week, "Headache I" from 3/5/2011, or the chapter from *Symptom Based Radiology* (cited below).

Imaging work-up: For a brief discussion of the imaging work-up of headache, see the previous Radiology Quiz of the Week, "Headache I" from 3/5/2011. Note that the imaging work-up is complicated in this unusual and challenging case. The initial presumptive diagnosis was meningitis based on the MR study and the neck pain, but on the basis of MR imaging findings and the negative work-up for a cause of meningitis the alternative diagnosis of intracranial hypotension was raised.

Establishing the diagnosis: The diagnosis in this case is the rare entity of intracranial hypotension. Diagnostic criteria for headache attributed to spontaneous low CSF pressure headache include a diffuse and/or dull headache that worsens within 15 minutes after sitting or standing, with at least one of: neck stiffness, tinnitus, hypacusia, photophobia, and nausea. The patient must also have at least one of the following: pachymeningeal enhancement on MR, evidence of CSF leakage on myelography or cisternography, CSF opening pressure < 60 mm H2O in a sitting position. Finally the headache must resolve within 72 hours after epidural blood patching. The most puzzling feature in this case is that patient's headache was, at least initially, not orthostatic, and furthermore she had a typical orthostatic headache following a diagnostic lumbar puncture which she specifically stated was *not* like the headache that brought her to medical attention in the first place. Interestingly, this patient had no relief from a lumbar blood patch, but complete relief from a thoracic blood patch. This supports a structural abnormality of the thoracic spine with CSF leakage repaired by the blood patch, although no myelography or cisternography was performed in this case.

Take-home message: Initial imaging for "thunderclap" headache is usually an emergent CT scan. If this study is negative, further evaluation may include additional imaging (particularly brain MR examination), lumbar puncture, or other imaging methods.

FURTHER READING

Johnson RP. Aseptic meningitis in adults. UpToDate, accessed 11/15/2010.

Renfrew, DL. Headache. Chapter 3 of *Symptom Based Radiology*, Symptom Based Radiology Publishing, Sturgeon Bay, WI, 2010, available for no charge at www.symptombasedradiology.com.

Sun C, Lay CL. Pathophysiology, clinical features, and diagnosis of spontaneous low cerebrospinal fluid pressure headache. UpToDate, accessed 11/22/2010.