



# Pearls & pitfalls in emergency radiology

## Brain- CT scan



**DR. OSAMA SAMARA**

**ASSISTANT PROFESSOR ,DIAGNOSTIC & INTERVENTIONAL RADIOLOGY.**

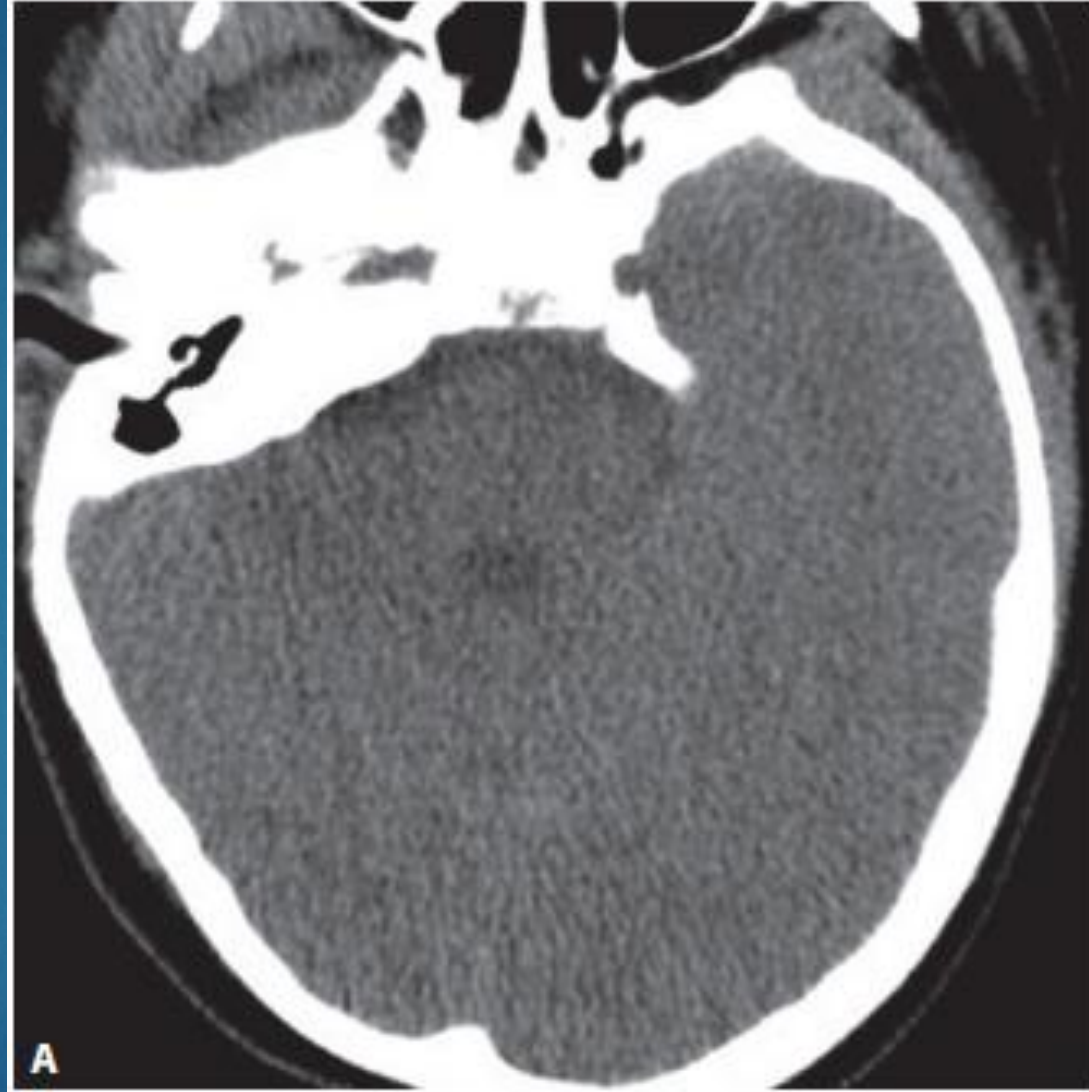
**UNIVERSITY OF JORDAN.**

# Missed intracranial hemorrhage

- ▶ Certain types of subtle hemorrhages may be overlooked, especially subdural and subarachnoid hemorrhages.
- ▶ A study of overnight preliminary head CT interpretation by strub WM found that the types of hemorrhages most often missed were *subdural* hemorrhages 39% (especially frontal & parafalcine) .
- ▶ *Subarachnoid* hemorrhages 33% ( interpeduncular cistern) .
- ▶ *Occipital horns* of the lateral ventricles should also be specifically evaluated, as these are sites where a tiny amount of hemorrhage may be seen

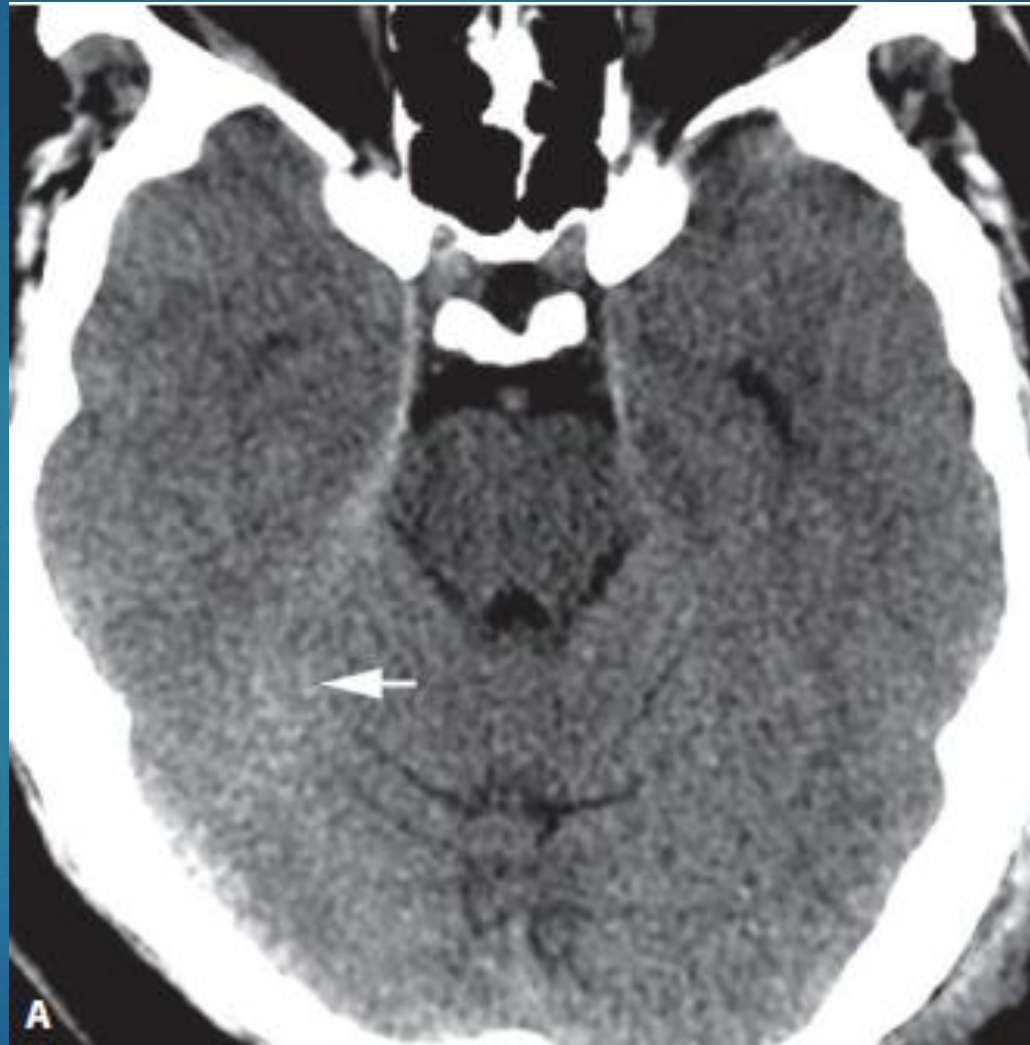
- 
- 
- ▶ Images from head scan are routinely reviewed in axial plane ,but hemorrhages oriented in a horizontal plane are prone( to volume averaging effects (false negative results ).
  - ▶ The additional of coronal and sagittal reformation scan lead to a more accurate diagnosis of intracranial hemorrhage
  - ▶ A study by ( s.c wei done at Massachusetts ) of 109 patients with intracranial hemorrhage found that the addition of coronal reformations resulted in a change in interpretation in approximately 25% of cases, compared with axial images alone.

Axial non-enhanced CT  
image from a 9-year-old  
boy with head trauma  
from a motor vehicle  
accident

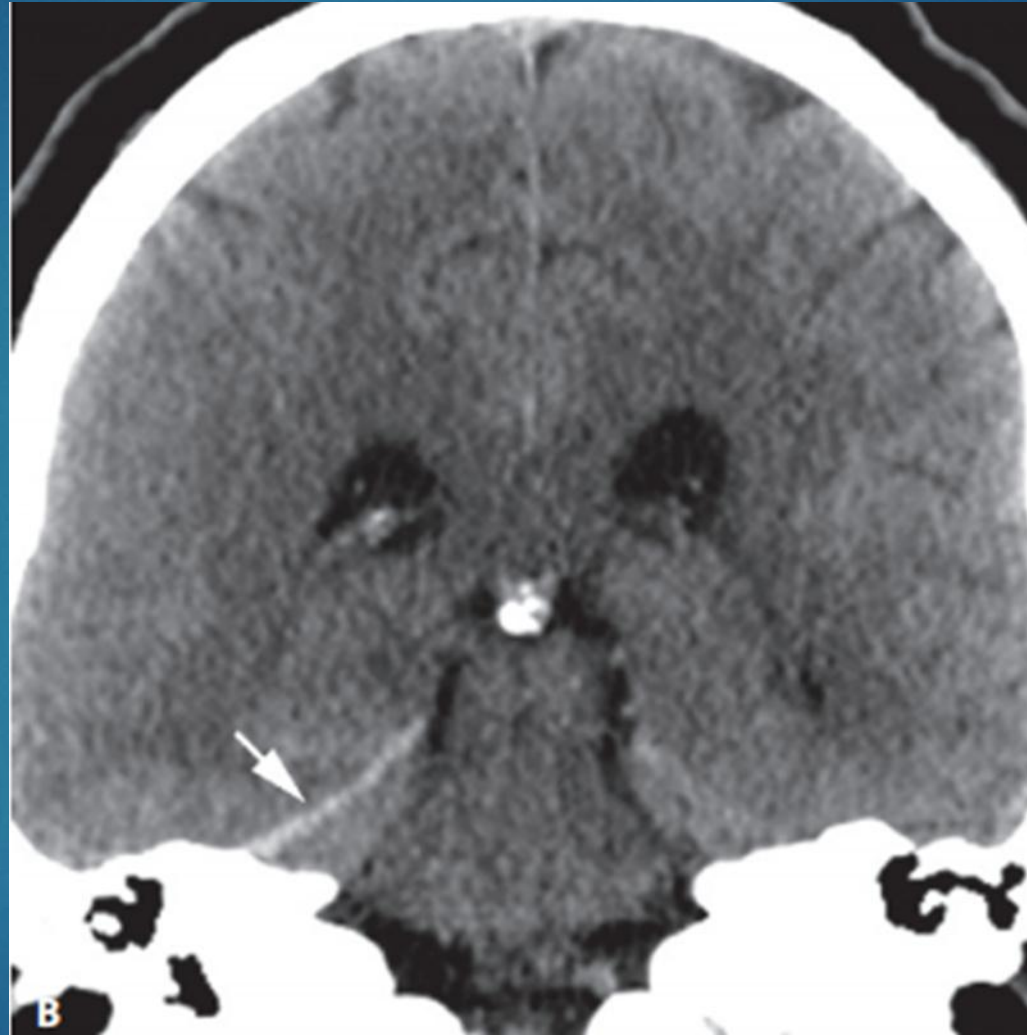




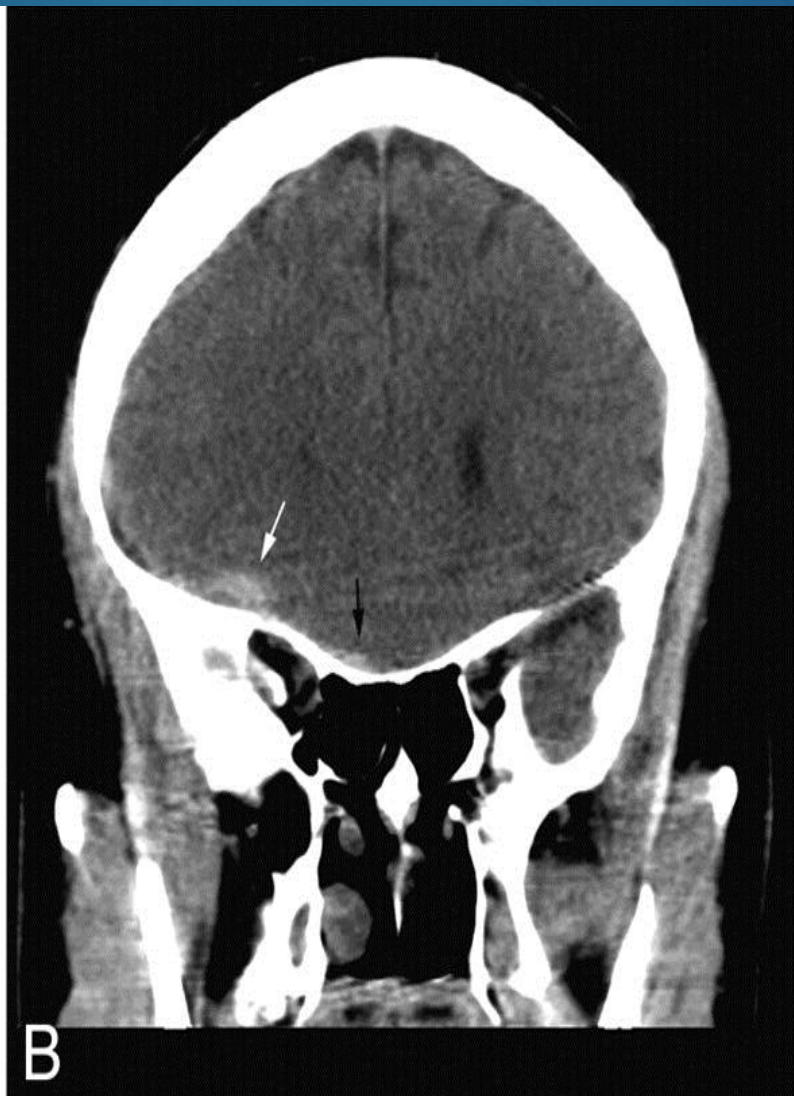




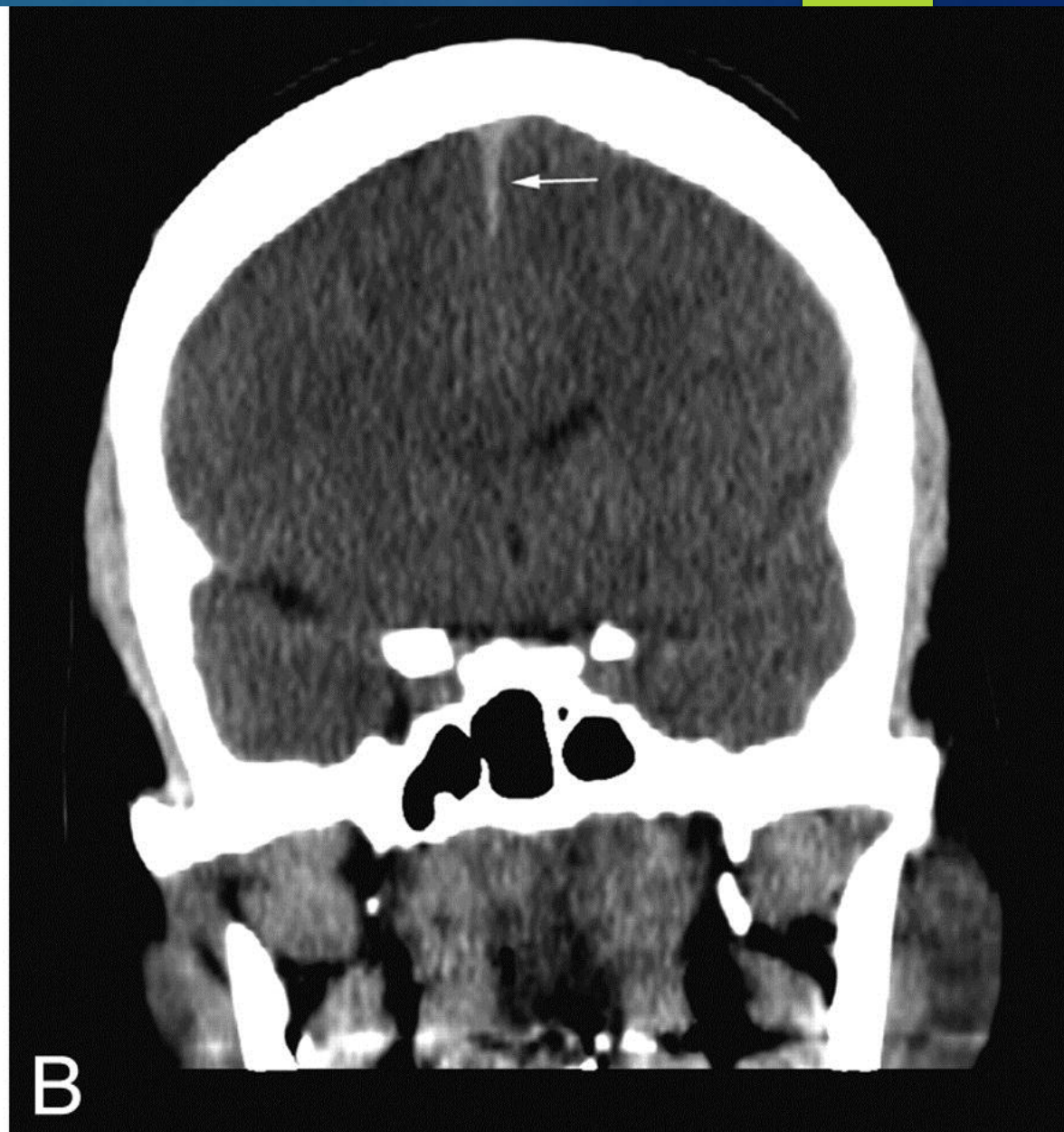
Axial non-enhanced  
CT image from a 43-  
year-old man

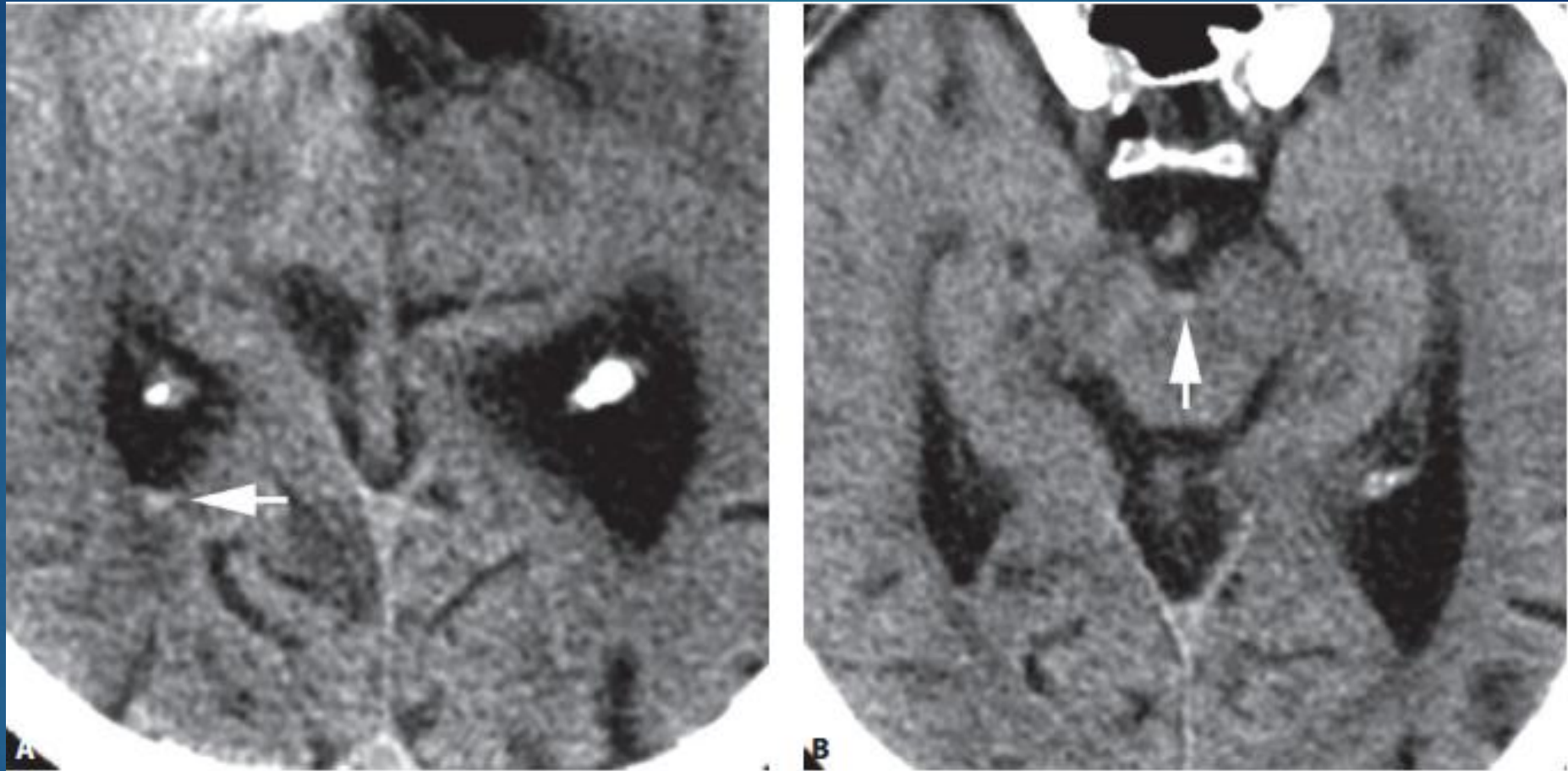












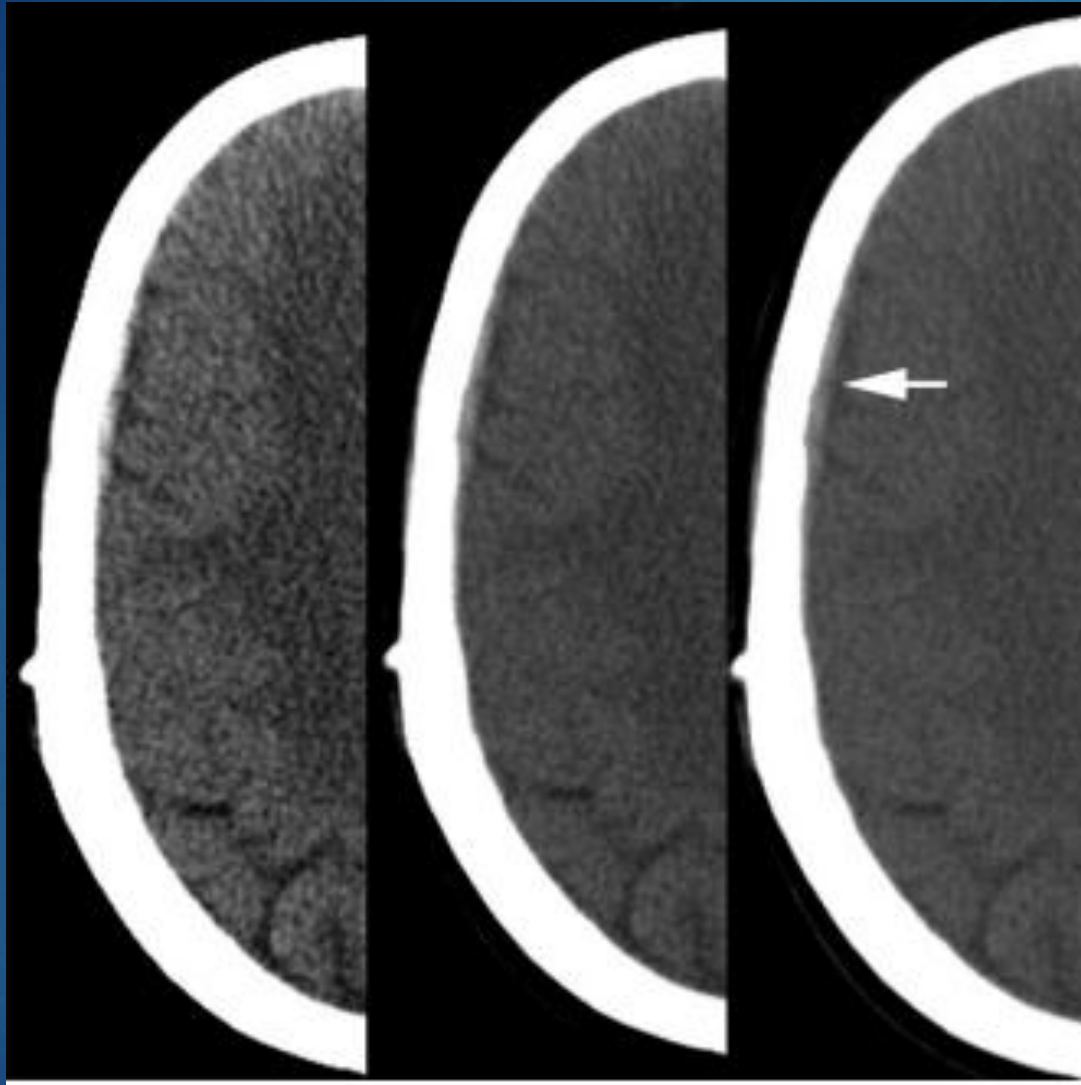


Axial non-enhanced CT image from a 67-year-old woman with head trauma



- 
- 
- ▶ Another cause of missed hemorrhage involves the use of ***inappropriate window width*** values .
  - ▶ If the window is too narrow, a small subdural hemorrhage may be difficult to distinguish from the adjacent bone.
  - ▶ Optimal values vary among scanners but a window width of 200 and a level of 50 is a reasonable starting point .





Montage of three axial non-enhanced CT images from a 22-year-old man shows a small right frontal subdural hemorrhage (arrow).

The image on the left has a window of 80 and level of 40; the middle image has a window of 150 and level of 50; the right image has a window of 200 and level of 50.

# Isodense subdural hemorrhage

- ▶ Subdural hematoma is the most common extra-axial collection and is present in up to 10-20% of head trauma patients
- ▶ Typically appear as a crescent-shaped fluid collection.
- ▶ **As a rule**, subdural hemorrhages can cross sutures, but cannot breach the dural attachments.
- ▶ Subdural hemorrhage will displace the cortical vascular structures medially ,compress and mildly displace the underlying brain.
- ▶ The typical attenuation of subdural hemorrhage can vary depending on acuity

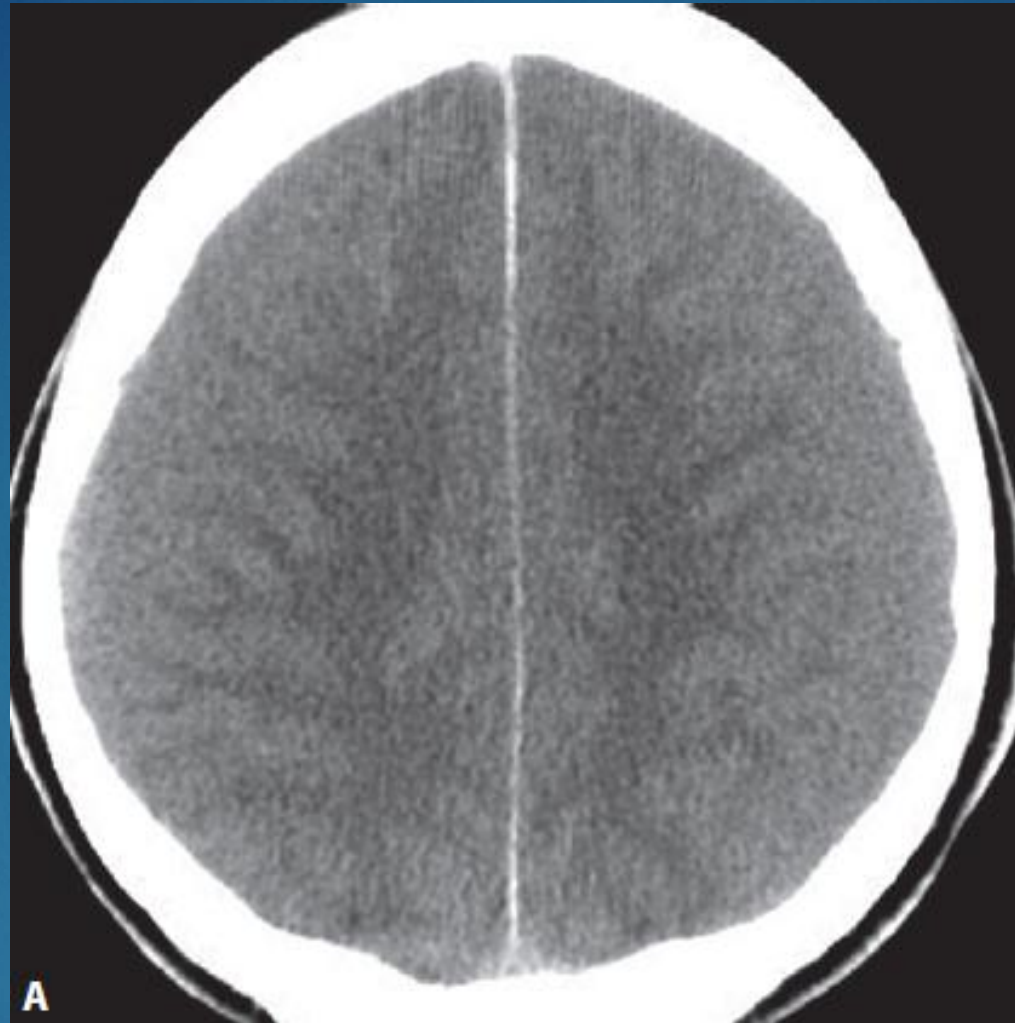
- ▶ Subdural hemorrhage that is isodense to brain parenchyma is typically subacute.
- ▶ But sometimes, isodense subdural hemorrhage can be **acute** in patients who are anemic (serum hemoglobin <8-10mg\dl)\*
- ▶ **Contrast-enhanced CT can detect isodense subdural hemorrhage.**
- ▶ Enhancement of the dura, displacement of the cortical veins away from the skull, and cortical enhancement all help make the hemorrhage more conspicuous



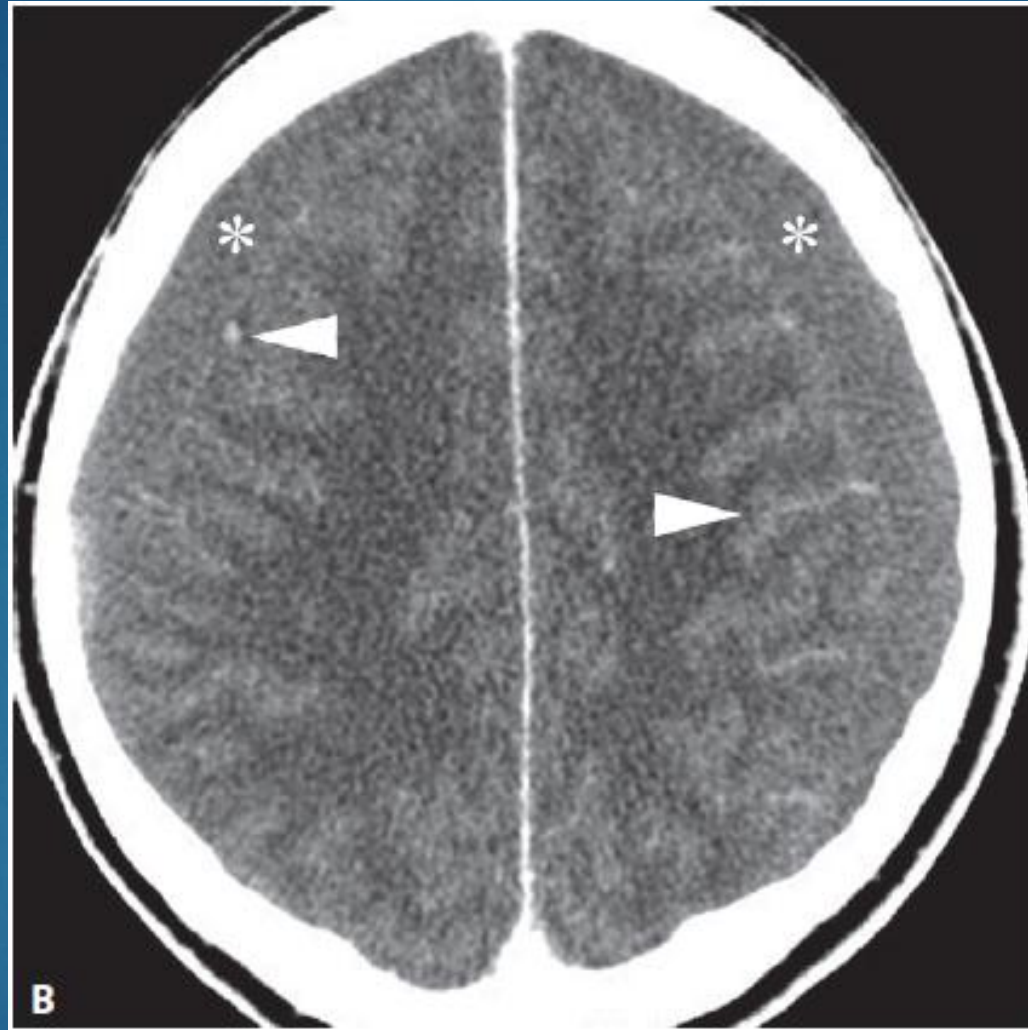
# Importance

Isodense Subdural hemorrhage can be difficult to detect on a non-contrast CT , but can grow rapidly if undetected .

Consider **contrast enhanced CT** to detect subtle subdural hemorrhage or isodense hemorrhage in *Anemic* patients .



Axial non-contrast head CT from a 69-year-old woman involved in a high-speed motor vehicle collision , The patient's Hb at the time of the study was 8.4 g/dL.



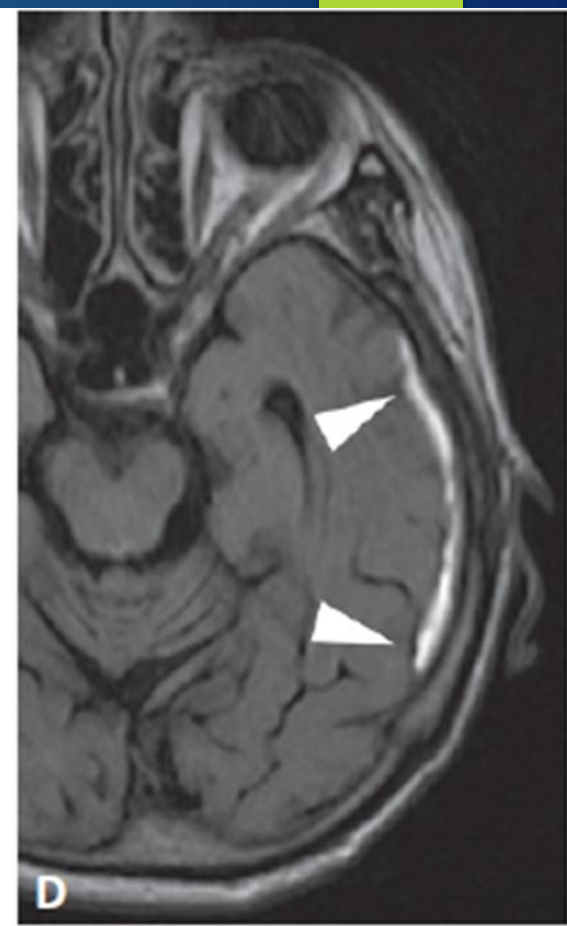
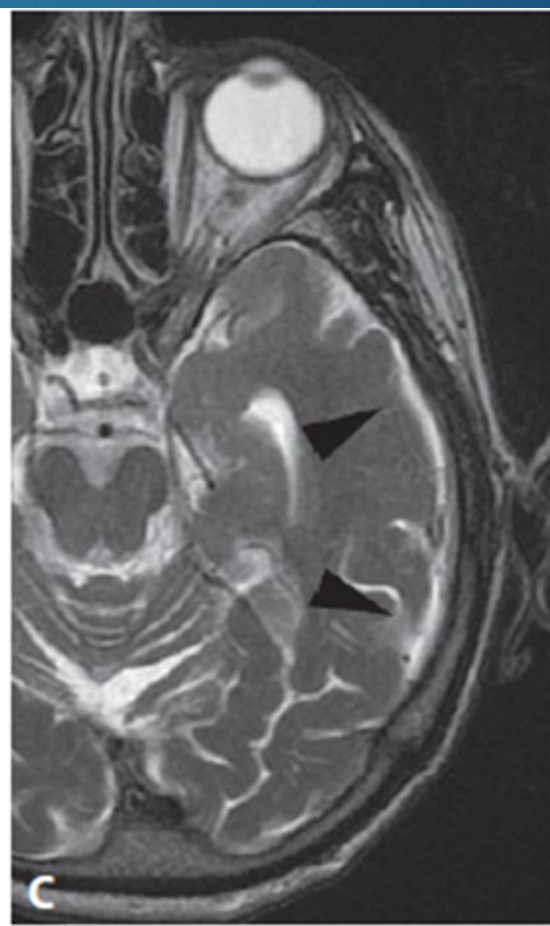
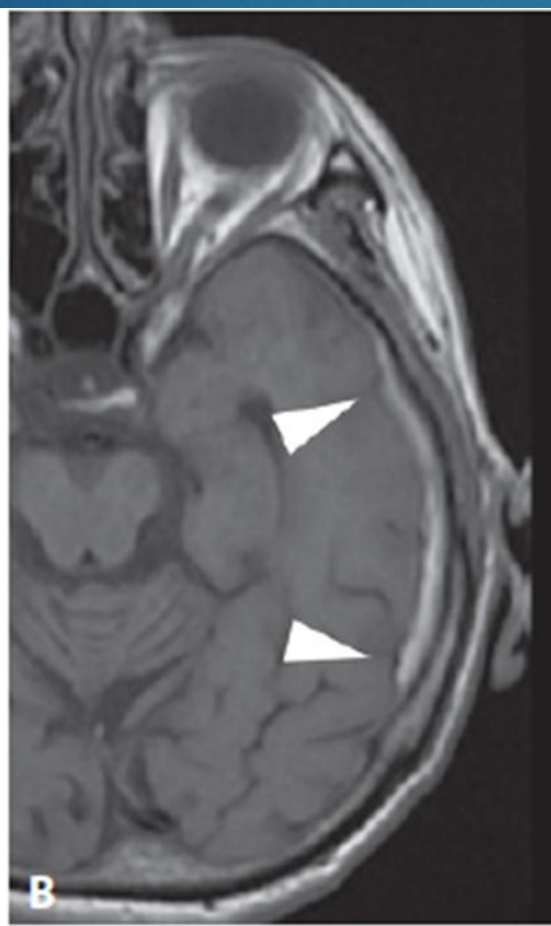


# Differential diagnosis

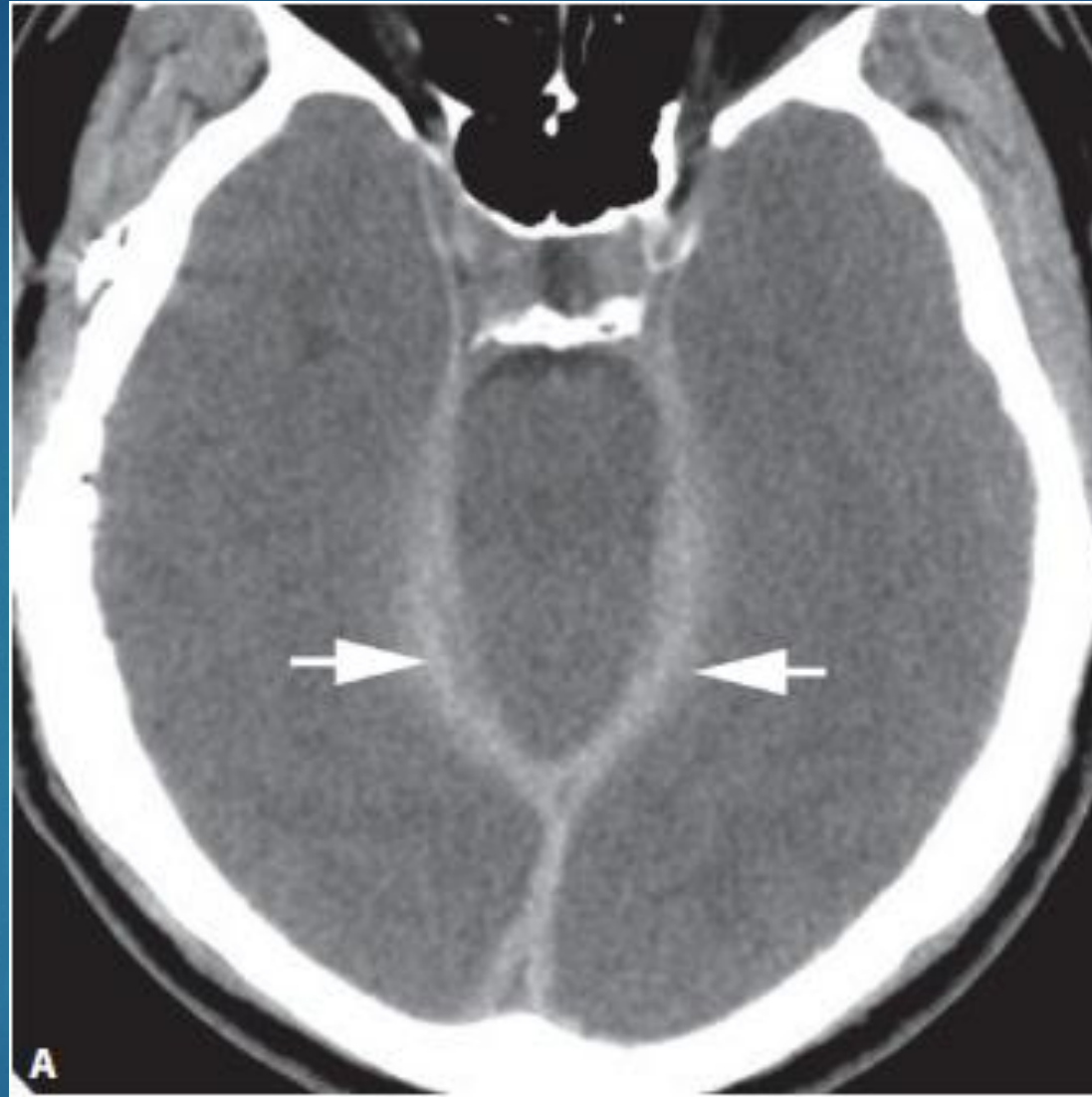
- ▶ **Subdural hygroma:** are isodense to (CSF) on non-contrast CT and follow CSF signal on all MR pulse sequences .
- ▶ **Dural thickening:** This can be patchy or diffuse.
  - ▶ CT is nonspecific.
  - ▶ MR demonstrates a *characteristic dural signal* that is
    - ▶ **Dark band on T2-weighted** images between the calvarium and subarachnoid CSF.
    - ▶ **bright on FLAIR.**
    - ▶ **Strongly enhances** on post-contrast images



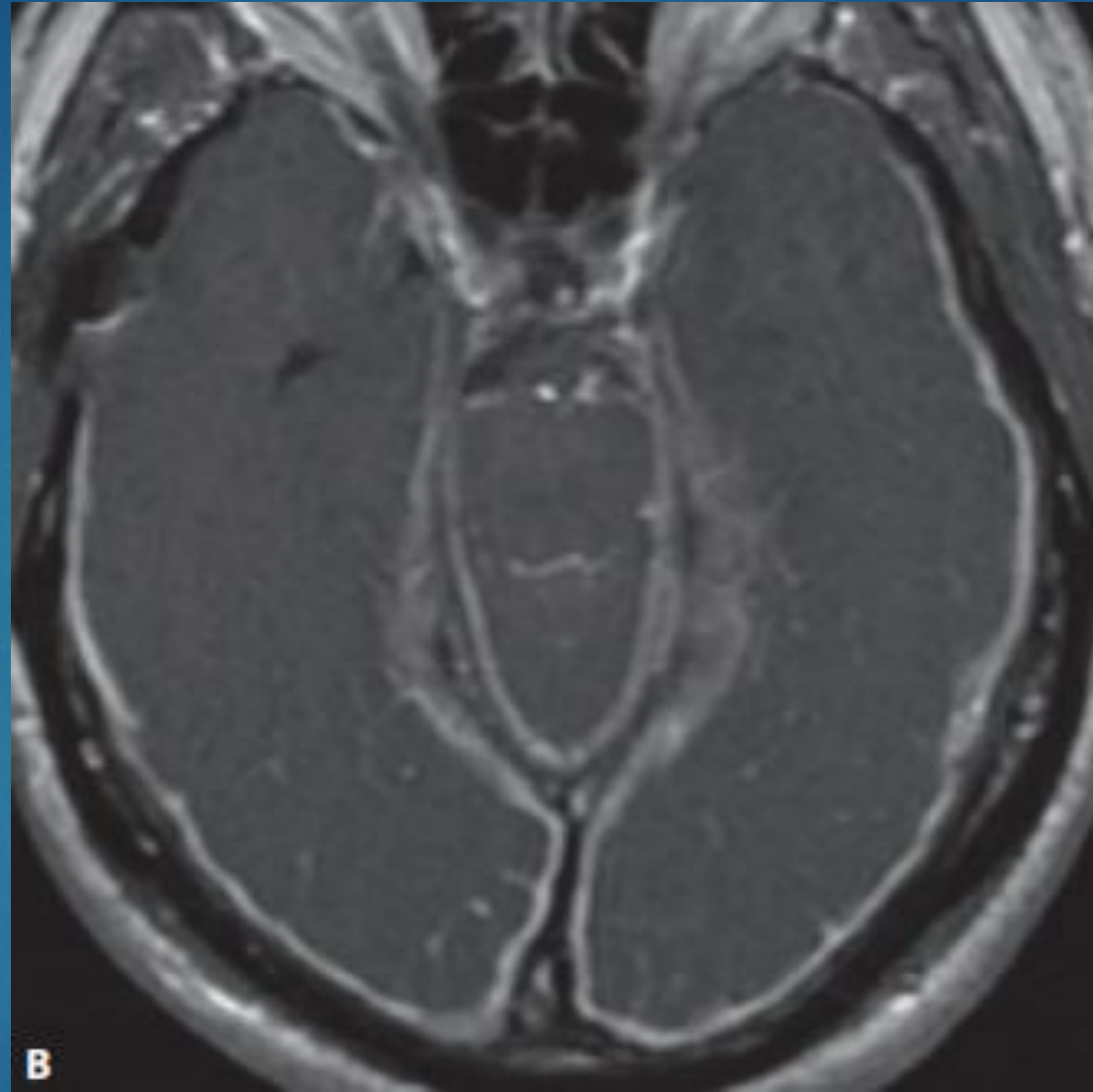
Axial non-contrast head CT from an 80-year-old man with altered mental status







Axial NON contrasted CT image shows diffuse pachymeningeal thickening (man with tuberculous meningitis)



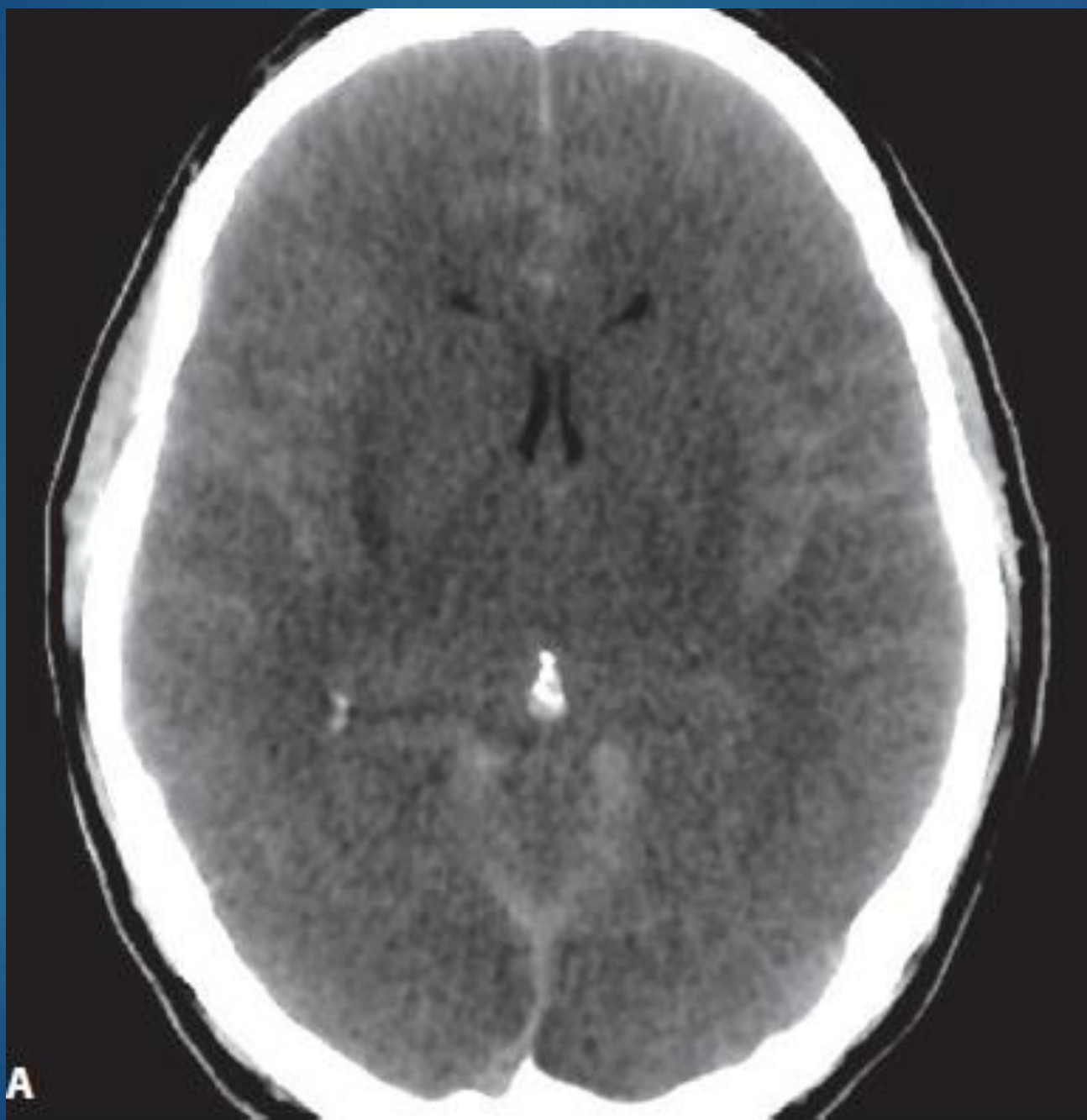
# Pseudo-subarachnoid hemorrhage

- ▶ **Pseudo-SAH** refers to increased attenuation within the basal cisterns and subarachnoid spaces that mimics SAH
  - ▶ Diffuse cerebral edema is the most common cause of pseudo-SAH, which leads to
    - ▶ Decreased brain parenchyma attenuation
    - ▶ Compression of Dural venous sinuses ,which may lead to venous congestion and engorgement of superficial veins
  - ▶ Other causes include meningitis, and intrathecal contrast



# Typical clinical scenario

- ▶ The clinical scenario is helpful in arriving at the correct diagnosis. Patients with pseudo-SAH often have a **history of an anoxic event**, such as cardiac arrest.
- ▶ The rare cases of meningitis that may cause pseudo-SAH will usually have supporting clinical signs and symptoms

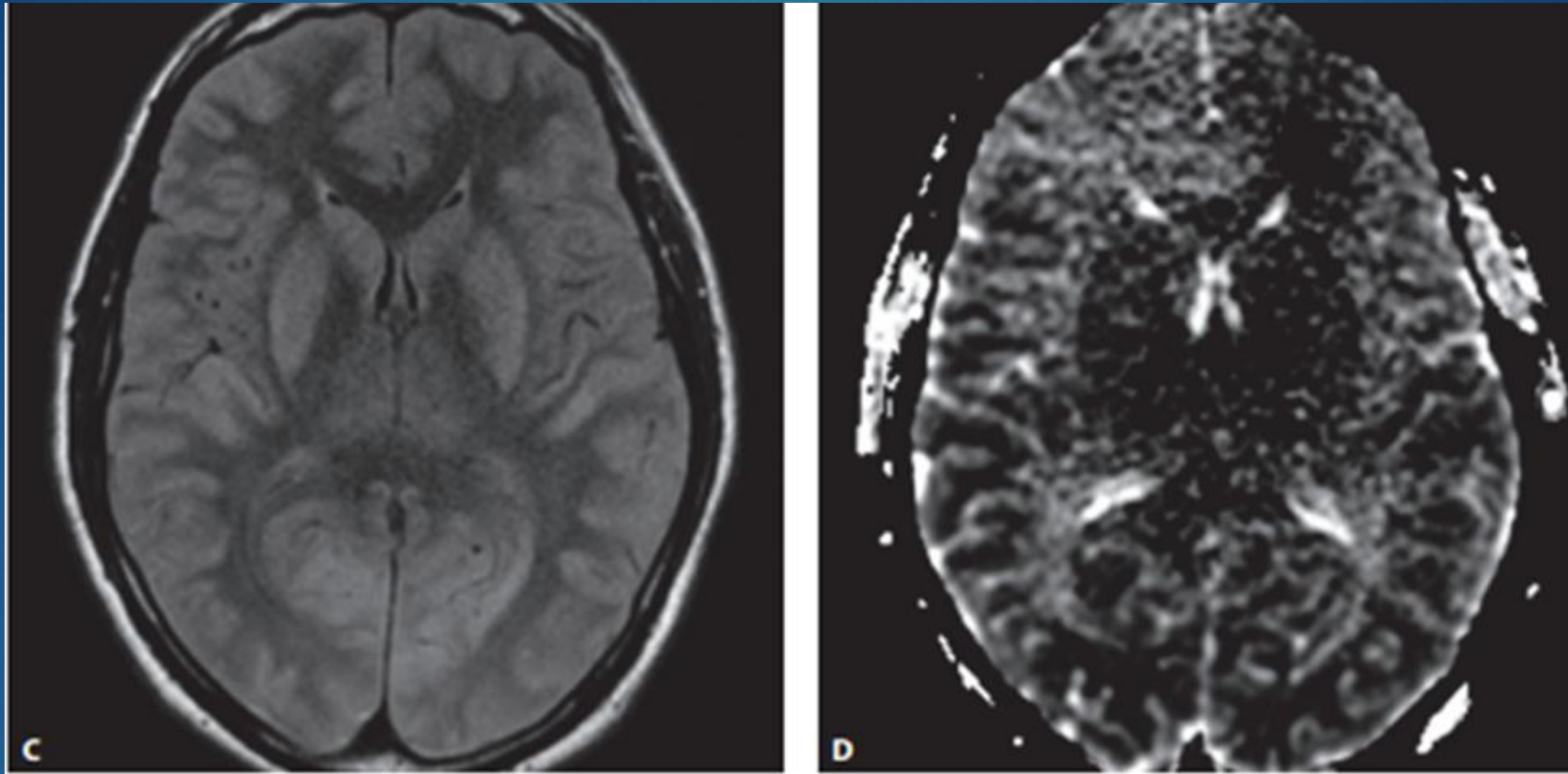


A

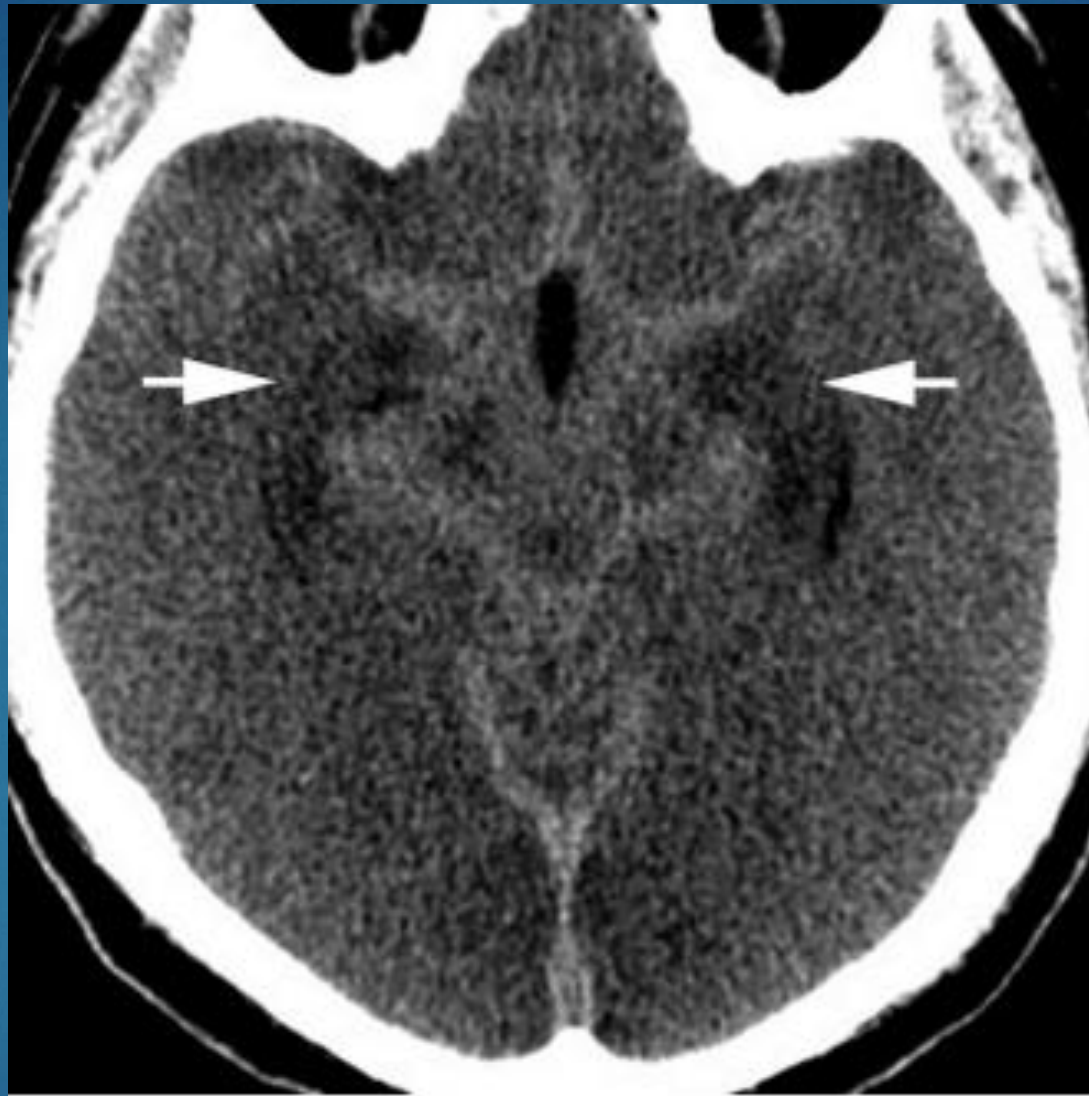




NEW



Axial non-enhanced CT image from a 35-year-old man with cardiac arrest



Axial non-enhanced CT image from a 48-year-old man two days after an acute myocardial infarction

# Non-aneurysmal perimesencephalic subarachnoid hemorrhage

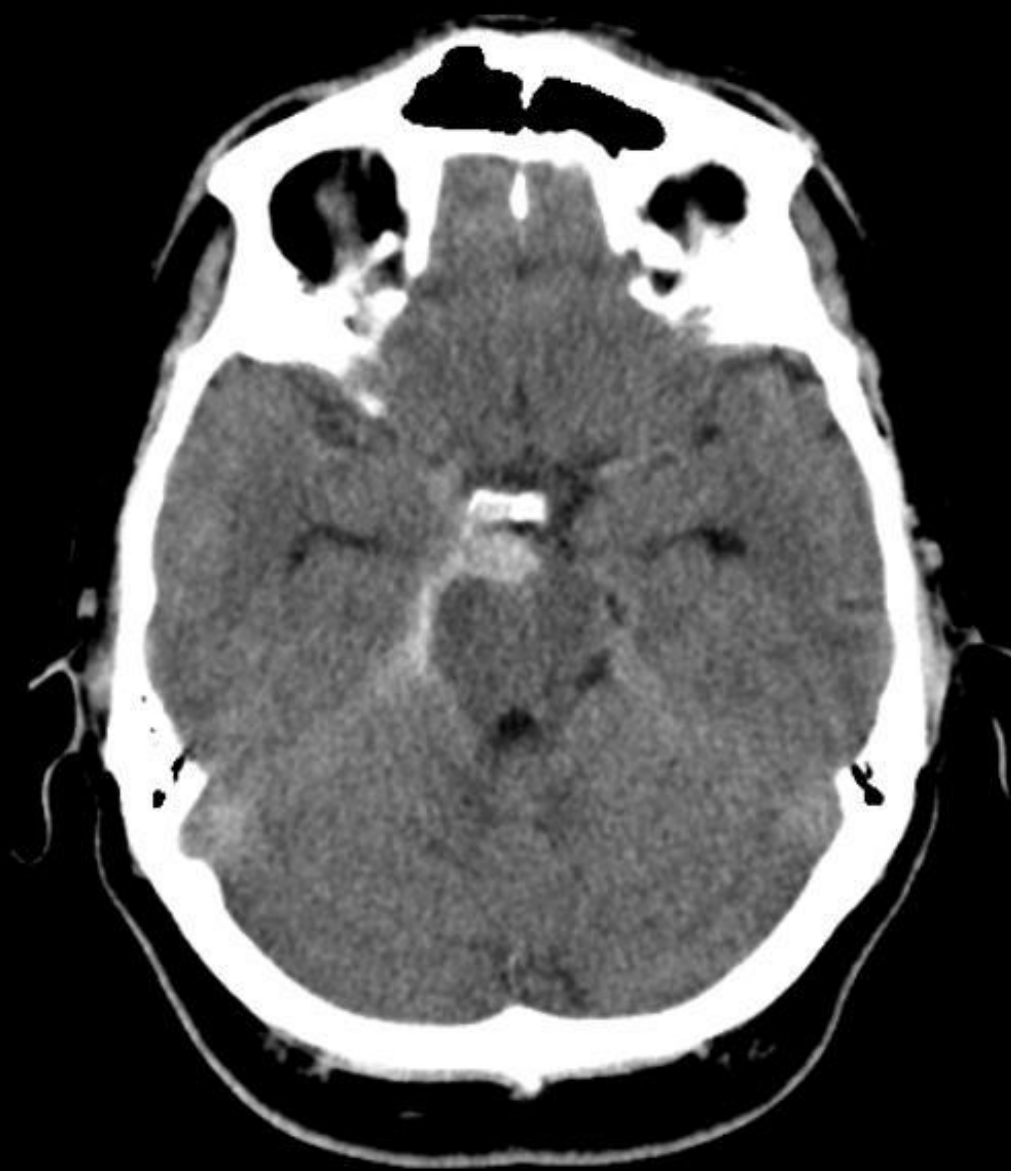
- ▶ Most common cause of non-traumatic subarachnoid hemorrhage (SAH) is **aneurysm rupture (85%)** .
- ▶ Approximately 15% of patients will have no identifiable cause on CT angiography (CTA), **SAH will have a pattern known as (NAPH)**

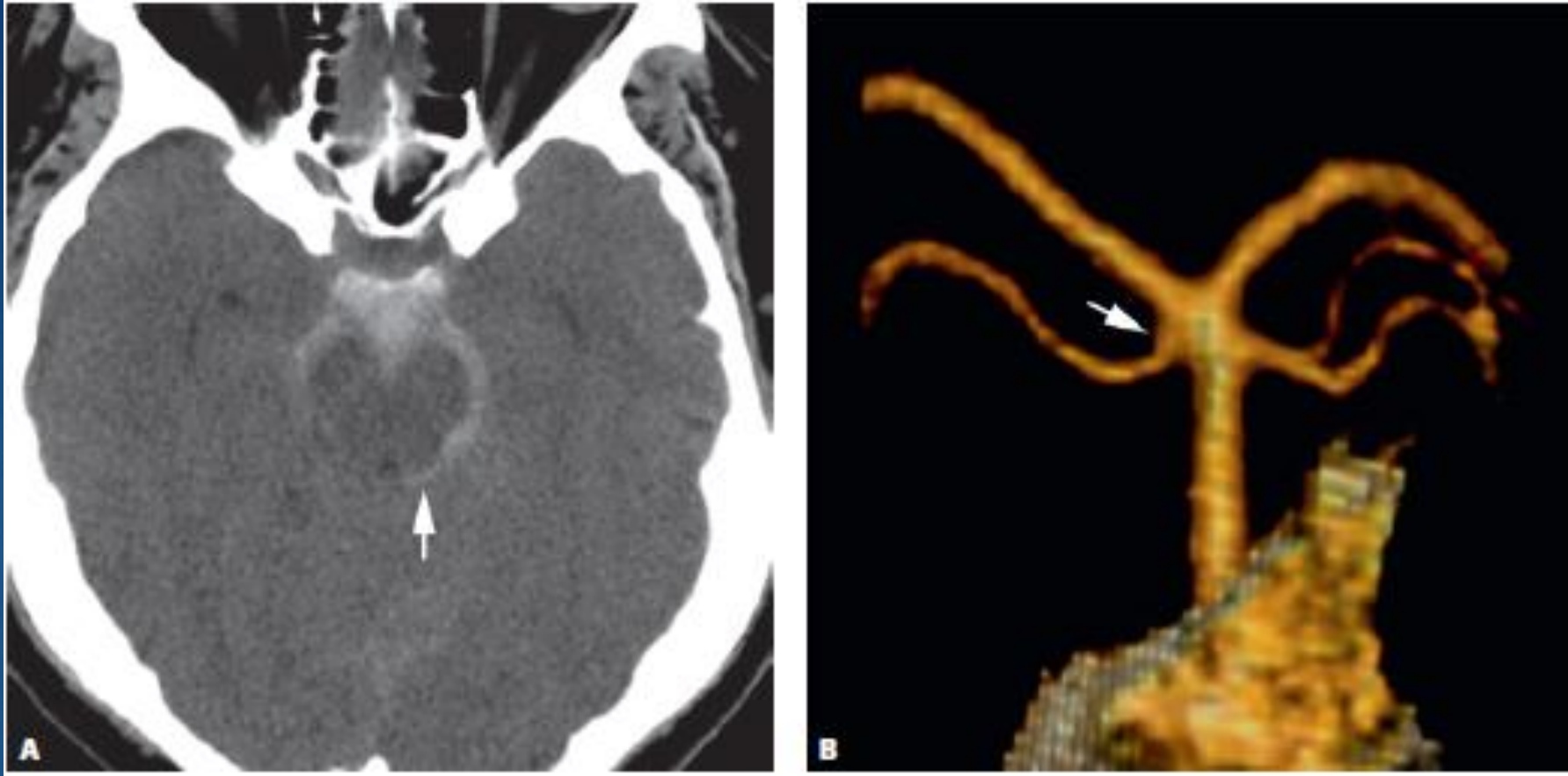


## Criteria have been established for NAPH, and include the following:

- Subarachnoid hemorrhage **within the perimesencephalic cisterns**, centered anterior to the midbrain.
- ▶ Possible extension into the **posterior aspect of the anterior interhemispheric fissure**, but not completely filling the anterior interhemispheric fissure.
- ▶ Possible extension into the **medial aspects of the Sylvian fissures**, but no extension laterally within the fissures.
- ▶ Possible small amounts of **layering intraventricular hemorrhage** sedimentation, but no frank intraventricular hemorrhage.
- ▶ No intraparenchymal hemorrhage.

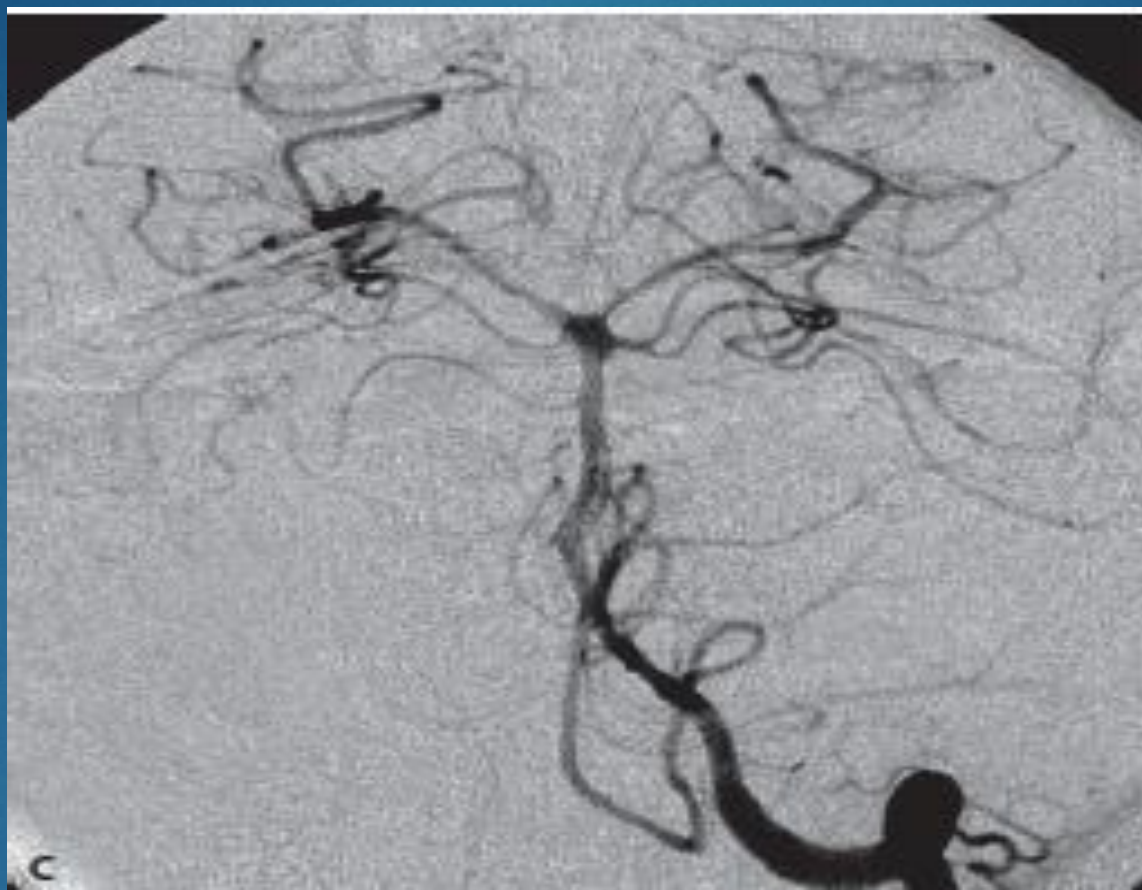
Warning: Not for diagnostic use

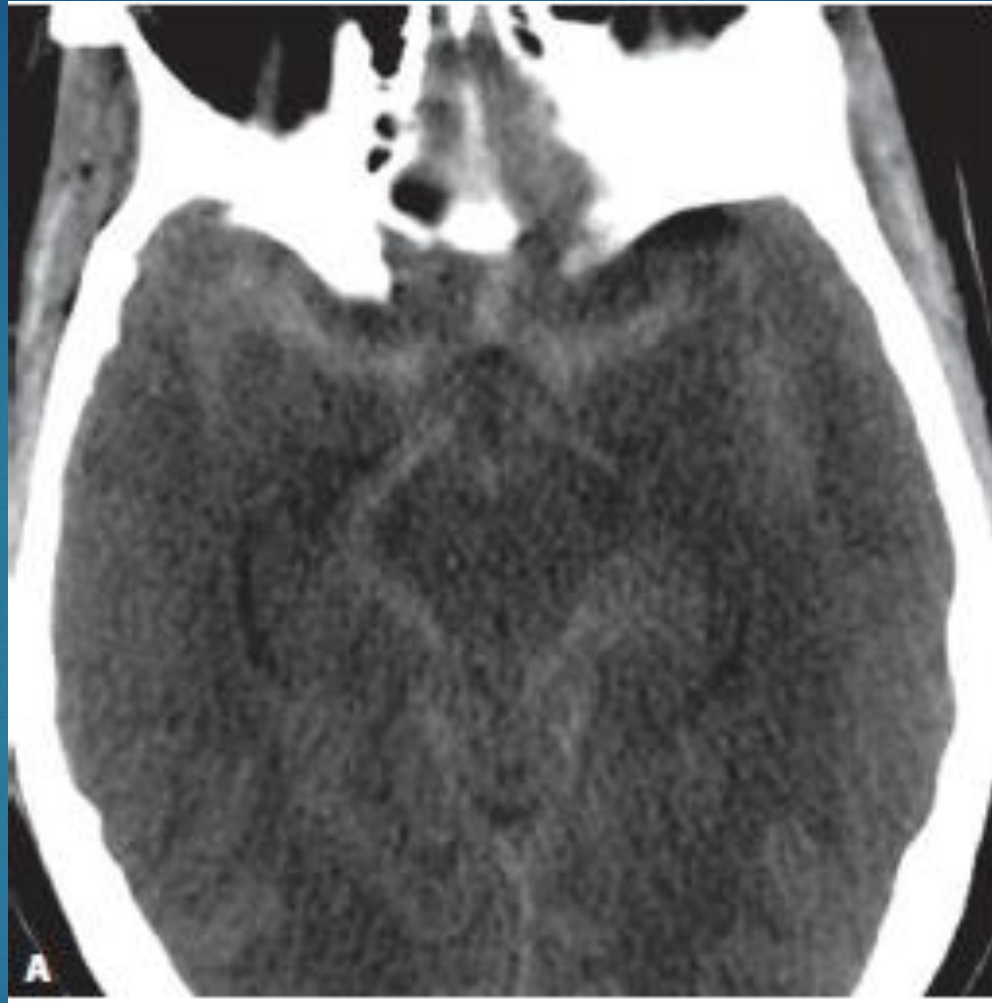




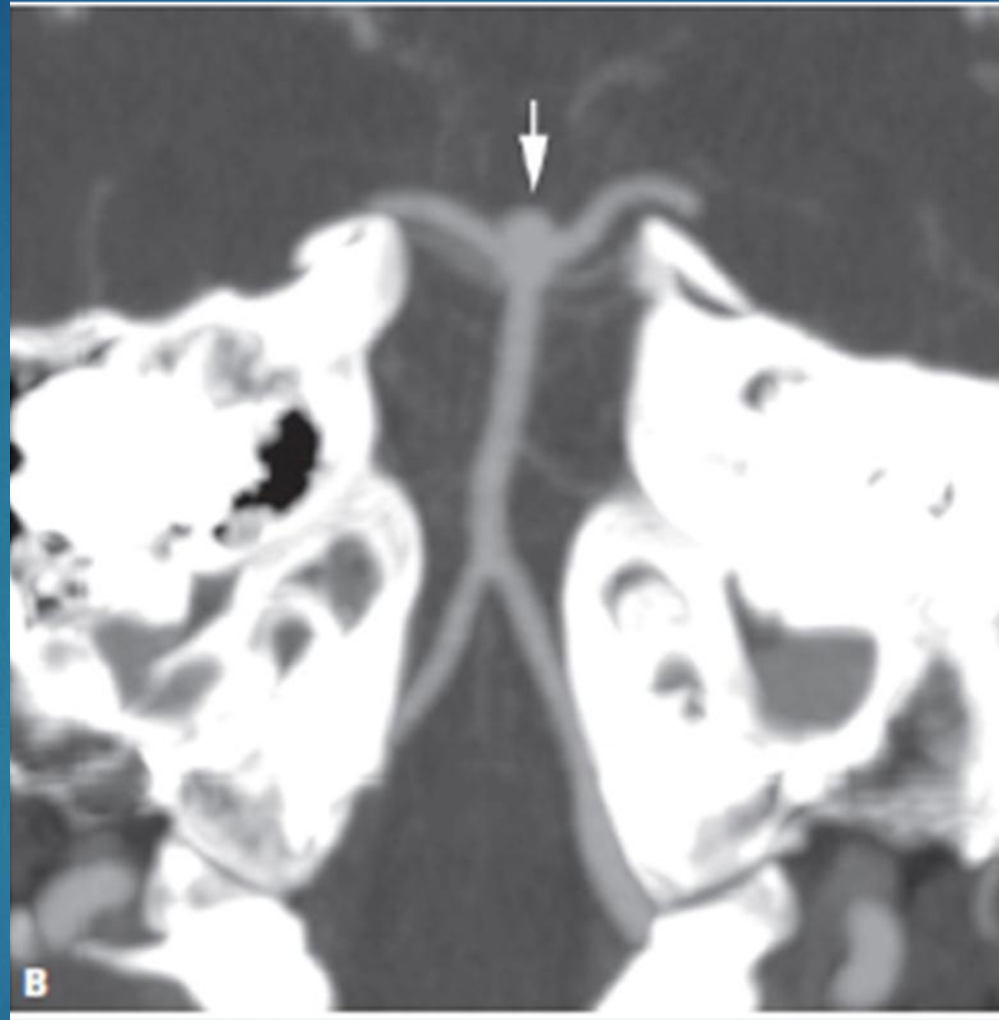
Axial non-enhanced CT image from a 42-year-old man with an acute headache









Axial non-enhanced CT image from a 48-year-old woman with an acute headache





- 
- 
- ▶ Patients with NAPH have a much more favorable outcome, **complete recovery in 97%** and can be managed less aggressively.
  - ▶ The patients are more likely to be ***younger and less likely to be hypertensive*** than those presenting with aneurysmal hemorrhage.
  - ▶ Cases which fulfill the criteria of NAPH and demonstrate no cause of hemorrhage on CTA **do not require further investigation with DSA**

# Teaching point

- ▶ Identification of NAPH is important in determining the prognosis and need for follow-up imaging.
- ▶ A confident diagnosis of NAPH may preclude the need for DSA.

Thank you