

**Neuroradiology Radiology
In-Training Test Questions
for Diagnostic Radiology Residents**



QUALITY IS OUR IMAGE

March, 2012

Sponsored by:
*Commission on Education
Committee on Residency Training in Diagnostic Radiology*

© 2012 by American College of Radiology. All rights reserved.

1891 Preston White Drive -- Reston, VA 20191-4326 -- 703/648-8900 -- www.acr.org

- 1 Which one of the following is the MOST common intra-axial posterior fossa neoplasm in adults?
- A. Glioblastoma multiforme
 - B. Hemangioblastoma
 - C. Meningioma
 - D. **Metastasis**

Rationale:

- A. Incorrect. Glioblastoma multiforme is the most common primary supratentorial neoplasm in adults. However, it is uncommon in the posterior fossa. Brainstem glioma, which is usually a lower-grade astrocytoma, is the most common glial neoplasm found in the posterior fossa in adults.
- B. Incorrect. Hemangioblastoma is one of the more common primary cerebellar neoplasms of adults. It is associated with von Hippel-Lindau syndrome. Metastases are much more common overall.
- C. Incorrect. Meningioma is the most common benign primary extra-axial neoplasm of the brain. The location of meningiomas follows the anatomy of the meninges, with the cerebral convexity being the most common location. This question is about intra-axial neoplasm.
- D. Correct. Metastasis is the most common intra-axial posterior fossa neoplasm in adults. Lung and breast carcinoma are the most common primary tumors.

Reference:

Osborn, A Diagnostic Neuroradiology (1994) p. 407-8.

2. Regarding acute epidural hematomas:
- A. They are low attenuation relative to the adjacent brain.
 - B. **They can result from a dural sinus tear**
 - C. Patients are comatose at presentation
 - D. They are more common than subdurals in the trauma patient

Rationale:

- A. The acute blood products are high-density in the acute phase.
- B. When they occur in the posterior fossa they are most commonly related to a tear of the transverse sinus.
- C. The "honeymoon" period of lucidity on initial presentation is part of the clinical presentation of this entity.
- D. Subdural hematomas are more common in the setting of acute trauma than epidural hematomas

Reference:

Gutierrez-Cadavid JE. **Head trauma.** In: Imaging of the Nervous System. Diagnostic and Therapeutic Applications. 869-901. Latchaw, Kucharczyk, Mosebey, Eds. Elsevier Mosby, Philadelphia PA, 2005.

3. Which statement regarding subdural empyemas is true?
- A. **Chronic subdural hematomas may appear identical.**
 - B. High diffusion weighted signal within subdural empyema is rare.
 - C. Less common than epidural abscess.
 - D. In adults, usually related to meningitis.

Rationale:

- A. Correct. Both subdural empyemas and chronic subdural hematomas may show rim enhancement.
- B. Incorrect. High diffusion weighted signal within a subdural empyema is common.
- C. Incorrect. More common than epidural abscess.
- D. Incorrect. In adults, usually related to sinusitis. Meningitis as a cause of subdural empyema is usually seen in children.

Reference:

Osborn A. **Diagnostic Imaging, Brain**. Amirsys 2004. Pps. I:8 30-31

4. Regarding intracranial vascular malformations, which of the following is TRUE?
- A. **Venous angioma (developmental venous anomaly) is the most common.**
 - B. The most common location of the cavernous malformation(cavernoma) is infratentorial.
 - C. A "caput medusa" is the classic imaging finding for capillary telangectasia.
 - D. Blue rubber bleb nevus syndrome is associated with intracranial arteriovenous malformation.

Rationale:

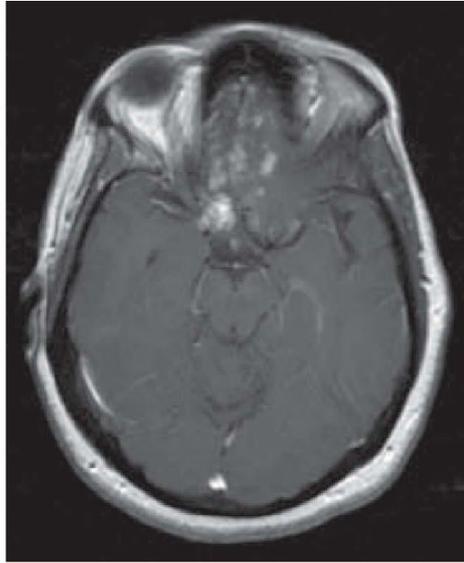
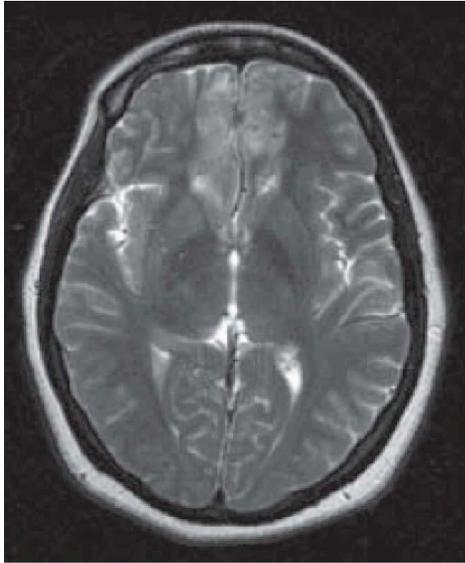
- A. Correct. Venous angioma is the most common intracranial vascular malformation found during autopsy.
- B. Incorrect. Most cavernous malformations are supratentorial (80%).
- C. Incorrect. Caput medusa or Medusa's head is pathognomonic for the venous angioma.
- D. Incorrect. In blue rubber bleb nevus syndrome, venous malformations or cavernous angiomas-not AVM's- are found commonly in the skin and GI tract.

Reference:

Okazaki H: Cerebrovascular disease. In Fundamentals of Neuropathology, pp 27-94, New York: Igaku-Shoin, 1989.

AG: Intracranial vascular malformations. In Diagnostic Neuroradiology, pp 287, Saint Louis: Mosby-Year Book, Inc, 1994.

5. You are shown axial T2 and post contrast axial and coronal T1-weighted images of a 39-year-old African-American woman with a long history of headaches. What is the MOST likely diagnosis?
- A. Viral encephalitis
 - B. Cryptococcal meningitis
 - C. **Sarcoidosis**
 - D. Multiple sclerosis



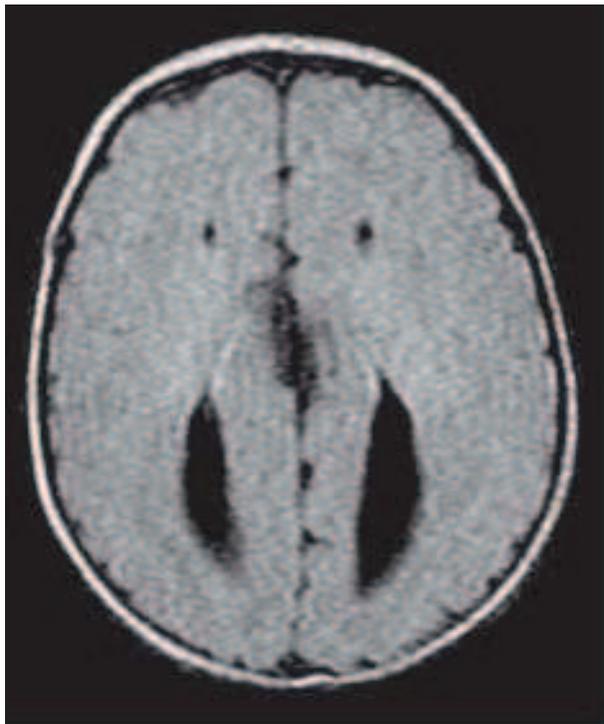
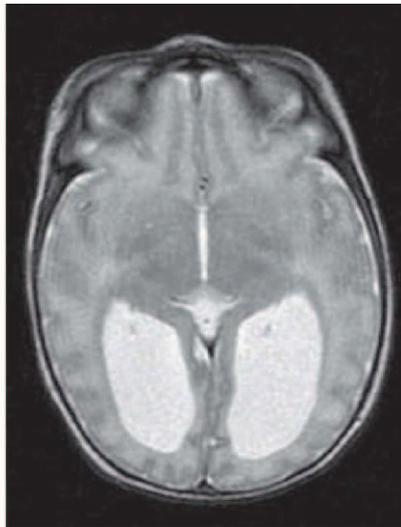
Rationale:

- A. Incorrect. This appears to be an extraaxial process with fairly marked enhancement. Encephalitis is an intraaxial process involving the brain parenchyma. This would also be an atypical distribution for viral encephalitis.
- B. Incorrect. While fungal meningitis would be a possible differential, there is little parenchymal involvement in this case. Cryptococcosis typically involves the perivascular spaces at the base of the brain, and there is little contrast enhancement.
- C. Correct. This is a case of sarcoidosis. Sarcoidosis and tuberculosis are both granulomatous processes with a similar imaging appearance in the brain. Contrast-enhanced scans reveal thick basilar meningeal enhancement. Chest x-ray (not shown) demonstrates classic bihilar adenopathy in this relatively asymptomatic patient. One of the hallmarks of sarcoidosis is a radiographic finding that is discordant from the clinical findings. Patients with tuberculous meningitis are frequently quite symptomatic.
- D. Incorrect. While multiple sclerosis may involve the cortex, it is uncommon and the degree of enhancement with no white matter abnormalities would make this a most unlikely diagnosis.

Reference:

None

6. You are shown sagittal T1-weighted, axial T2-weighted and axial FLAIR MR images in a newborn with questionable ventriculomegaly on prenatal ultrasound. What is the MOST likely diagnosis?
- A. Congenital hydrocephalus
 - B. Hydranencephaly
 - C. Dandy Walker malformation
 - D. **Agenesis of the corpus callosum**



Rationale:

A. Incorrect. Though the occipital horns of the lateral ventricle are dilated, the frontal horns as well as the third ventricle are small. The ventricles have a parallel appearance. In congenital stenosis the third and lateral ventricles are enlarged. In this case no evidence of transependymal flow of CSF is apparent in the periventricular region on FLAIR, a finding frequently seen with hydrocephalus.

B. Incorrect. Hydranencephaly has the appearance of absence of that part of the brain supplied by the anterior and middle cerebral arteries. The posterior circulation is spared. Clear evidence of the cortex in the frontal, temporal, and parietal regions is present in this case.

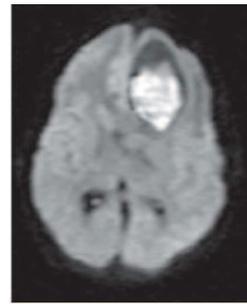
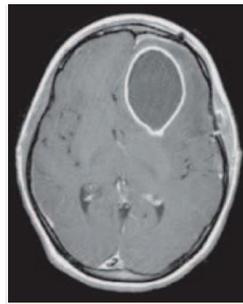
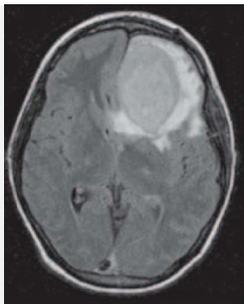
C. Incorrect. Dandy-Walker malformations classically appear as partial or complete absence of the vermis with dilatation of the fourth ventricle in an enlarged posterior fossa with associated hydrocephalus. As is seen on the sagittal, the vermis is present and no fourth ventricular dilatation or posterior fossa enlargement is apparent. Many variations of Dandy-Walker exist though in all some malformation of the vermis is appreciated.

D. Correct. Agenesis of the corpus callosum with absence of the splenium is what causes colpocephaly, dilatation of the occipital horns secondary to a decrease in white matter mass. Longitudinal Probst bundles running anterior to posterior are identified, as these are alternative white matter tracts when the corpus callosum is missing. The medial hemispheric sulci extend down to the third ventricle as a result of eversion of the cingulate gyrus and lack of formation of the cingulate sulcus.

Reference:

None

7. You are shown axial FLAIR (Figure 4A), T2-weighted (Figure 4B), gadolinium-enhanced T1-weighted (Figure 4C), and diffusion-weighted (Figure 4D) MR images of the brain of an 18-year-old woman with a history of sinusitis and increasing headaches. What is the MOST likely diagnosis?
- A. Glioblastoma multiforme
 - B. **Abscess**
 - C. Epidermoid
 - D. Recent infarction



Figures 4A and 4B

Figure 4C and 4D

Rationale:

- A. Incorrect. Glioblastoma multiforme may have a necrotic nonenhancing center but with a thick, irregular rim. DWI uncommonly shows restricted diffusion.
- B. Correct. These findings are characteristic of pyogenic abscess, including a thin enhancing rim, low-signal rim with T2 weighting, and restricted diffusion.
- C. Incorrect. Epidermoid tumors are extraaxial in location. Their contents follow CSF in imaging with the exception of FLAIR, on which they tend to have slightly greater signal than CSF, and DWI, on which they exhibit restricted diffusion. The mixed signal on the T2 weighted image and parenchymal location as well as enhancing rim make answer C incorrect.
- D. Incorrect. Rim enhancement of this cystic or necrotic appearance lesion is inappropriate for infarction. High signal intensity with DWI does not always indicate ischemia.

Reference:

None

8. You are shown unenhanced axial (Figure 1A) and coronal (Figure 1B) CT scans of the orbits of a 24-year-old woman who presents with headaches. What is the MOST LIKELY diagnosis?
- A. Pleomorphic adenoma
 - B. **Dermoid**
 - C. Epidermoid
 - D. Hematic cyst



Figure 1.A

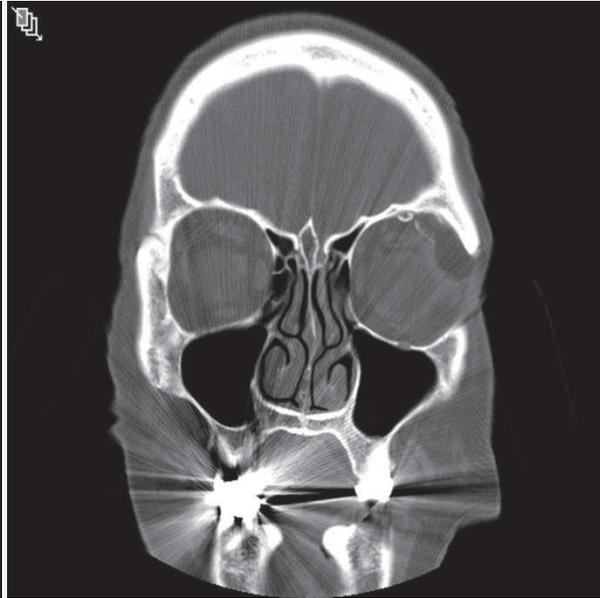


Figure 1.B

Rationale:

- A. Incorrect. Pleomorphic adenoma is the most common benign tumor of the lacrimal gland. There may be cystic areas within the mass and lesions of long standing may remodel adjacent bone. Mild enhancement is often present. However, fatty degeneration within this neoplasm would be exceedingly unlikely.
- B. Correct. Dermoids are the most common benign congenital orbital mass. Arising from epithelial rests, most often at the frontozygomatic suture, they usually present in the first decade of life. CT demonstrates a fat density extraconal mass which may have peripheral calcification and may remodel adjacent bone. MR demonstrates fat signal intensity and the lesion may also contain a fat fluid level.
- C. Incorrect. Similar to dermoids, epidermoids are congenital epithelial inclusion cysts in the extraconal space. However, epidermoids contain no fat. They are composed of squamous debris and cholesterol. For that reason, epidermoids are of fluid density on CT and are approximately isointense to CSF on T1 and T2 weighted MR images.
- D. Incorrect. A hematic cyst is an incompletely resorbed hematoma which may remain clinically silent for long periods of time. Patients usually present with diplopia and painless unilateral proptosis. There may be history of prior orbital trauma or surgery. The cyst contains hematogenous debris surrounded by a fibrous pseudocapsule. On imaging, the cyst is usually a well defined nonenhancing extraconal mass. They are often hyperdense on CT secondary to their elevated protein content and usually hyperintense on both T1 and T2 weighted MR sequences.

Reference:

Literature citations: 1. Som/Curtin, Head and Neck Imaging, St. Louis, Mosby, 1996 Grossman/Yousem, Neuroradiology Requisites, Philadelphia, Mosby, 2003

9. An 85-year-old man presents with progressive inability to walk. You are shown sagittal T2-weighted (Figure 4A), axial T2-weighted (Figure 4B), sagittal T1-weighted post-contrast (Figure 4C) MR images, and a source image for spinal MRA (Figure 4D). What is the MOST LIKELY diagnosis?
- A. Transverse myelitis
 - B. **Dural arteriovenous fistula**
 - C. Anterior spinal artery occlusion
 - D. Leptomeningeal carcinomatosis



Figure 4.A

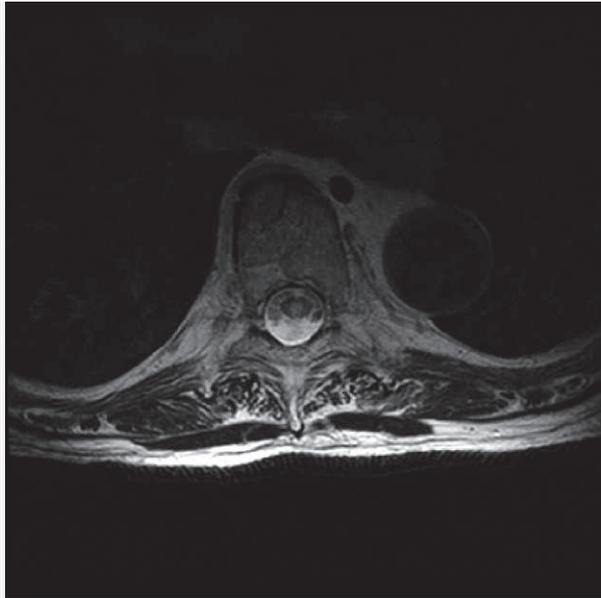


Figure 4.B



Figure 4.C



Figure 4.D

Rationale:

A. Incorrect. Transverse myelitis is an inflammatory condition of the spinal cord associated with rapidly progressive neurologic dysfunction. The disease is associated with many conditions including ADEM, MS, connective tissue disease, sarcoid, to name a few. Though the T2 appearance may be consistent with transverse myelitis in this case, the dilated surface vessels evident on T2, T1 post imaging and the spinal MRA are inconsistent with this diagnosis.

B. Correct. The combination of a spinal dural arteriovenous fistula in combination with myelopathy is given the eponym Foix Alajouanine Syndrome. The lesions are generally supplied by a radiculomeningeal artery with abnormal venous drainage to the perimedullary venous plexus. The lesions become symptomatic due to shunting of blood leading to venous hypertension and chronic passive venous congestion of the spinal cord.

C. Incorrect. Spinal cord infarction usually presents with acute onset of loss of bowel and bladder function as well as moderate impairment of lower extremity motor and sensory function. Location is usually in the conus with an enlarged conus associated with increased T2 signal. Occasionally abnormal increased T2 signal in the neighboring vertebral body can be seen. Spinal MRA has not been able to reliably demonstrate the anterior spinal artery secondary to its small size.

D. Incorrect. Metastatic disease in the subarachnoid space is seen as either discrete nodules on the surface of the cord and cauda equine or as thick, frosting-like enhancement coating the cord. Metastatic disease would not show flow signal on the MRA images. Lumbar puncture is the best diagnostic procedure to confirm meningeal carcinomatosis.

Reference:

Farb R, Kim J et al. Spinal Dural Arteriovenous Fistula Localization with a Technique of First-Pass Gadolinium-enhanced MR Angiography: Initial Experience. *Radiology* 2002; 222:843-850

10. A 35-year-old woman presents with cranial nerve palsies on the left. You are shown axial T2-weighted (Figure 5A), T1-weighted post-contrast (Figure 5B) and diffusion-weighted (Figure 5C) MR sequences. What is the MOST LIKELY diagnosis?
- A. Arachnoid cyst
 - B. Meningioma
 - C. **Epidermoid**
 - D. Schwannoma

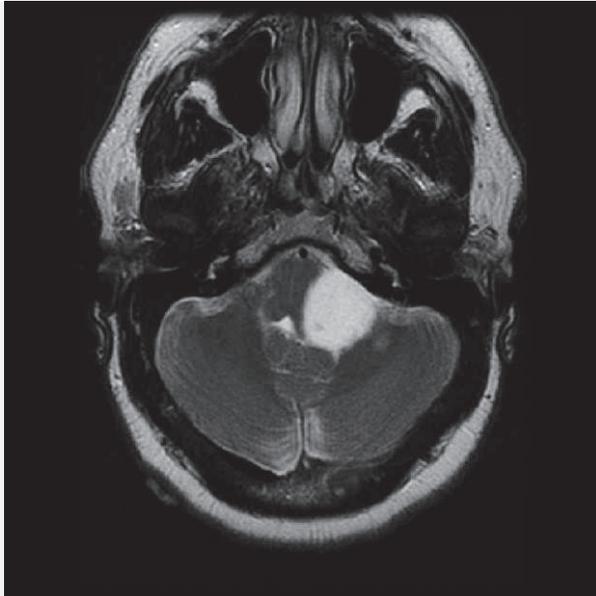


Figure 5.A

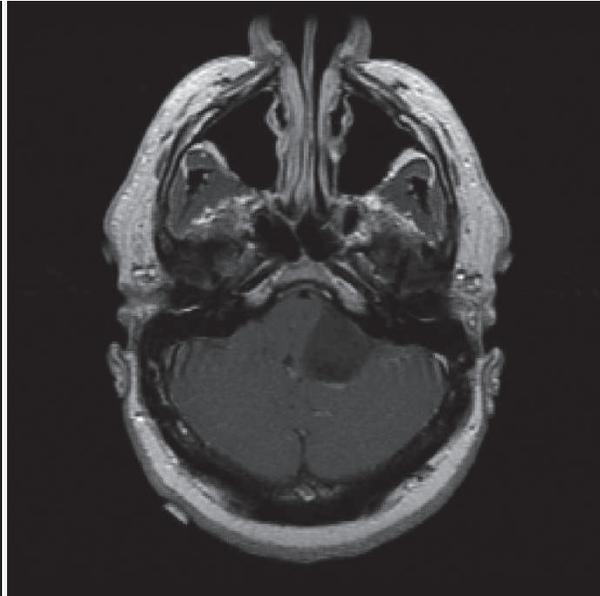


Figure 5.B

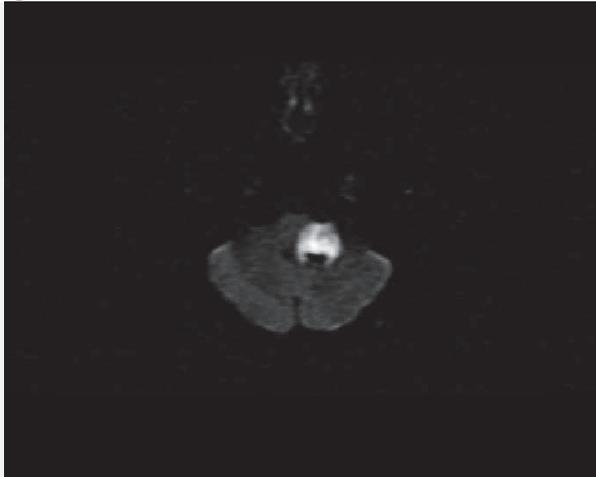


Figure 5.C

Rationale:

A. Incorrect. Though the fluid like signal identified on T1 and T2 as well as the lack of contrast enhancement are all consistent with arachnoid cyst, the presence of marked hyperintensity in the lesion on DWI separates epidermoid from arachnoid cyst in this case. Arachnoid cysts are hypointense on DWI secondary to free diffusion in the lesion.

- B. Incorrect. Though a commonly found mass in this location, the signal characteristics and enhancement characteristics argue against meningioma. Meningiomas are typically soft tissue signal on T1 and T2 and enhance homogeneously.
- C. Correct. Epidermoid cysts are frequently found in this location. They follow fluid on all MR sequences but the distinguishing feature is the bright signal on DWI as opposed to the arachnoid cyst which is hypointense on DWI as a result of free diffusion.
- D. Incorrect. Though again a commonly encountered lesion in this region, the lack of contrast enhancement argues against schwannoma as the diagnosis as these lesions avidly enhance with contrast.

Reference:

Moritani T, Ekholm S, Westesson PL. Diffusion-Weighted Imaging of the Brain. Springer-Verlag Berlin Heidelberg 2004