Howard A. Rowley, MD
CNS Venous Disease

SAM Questions

1. A 26 year old woman on oral contraceptives presents with severe headaches. Initial imaging shows T1-bright signal in the right transverse sinus, concerning for slow flow versus thrombus. The BEST sequence to exclude or confirm sinus thrombosis is:

A. Time of flight MR venography  
B. Phase contrast MR venography  
C. T2 FLAIR  
D. Post-contrast T1  
E. Susceptibility-weighted MRI

ANSWER: B


Comment: The dephase-rephase attributes of phase contrast MR venography will be most definitive in distinguishing fixed clot from slow flow in this setting. Early thrombus in the methemoglobin phase will be bright on T1, and this pitfall may falsely simulate flow on time of flight MR venography (‘shine through’ effect). Acute thrombus may also show dark signal on T2 and T2 FLAIR images due to intracellular methemoglobin, mimicking a flow void (false negative result). Post contrast images may show a filling defect - but may not, due to isointensity of thrombus with enhanced blood, or even thrombus enhancement. SWI may show blooming of thrombus but this is an indirect sign and may be hard to distinguish from normal deoxyhemoglobin in veins.

2. Hemorrhagic infarction in the posterior temporal lobe suggests possible occlusion of which structure?

A. Recurrent artery of Heubner  
B. Anterior choroidal artery  
C. Occipital sinus  
D. Vein of Labbe
E. Vein of Trolard

ANSWER: D


Comment: The vein of Labbe drains the posterior temporal lobe. The most common predisposing factor is transverse sinus occlusion with secondary propagation of clot into the vein of Labbe (which normally drains into the transverse sinus).

3. An infant with a recent gastrointestinal illness presents with somnolence and thalamic edema on routine CT. A key diagnosis of exclusion is:
   A. Carbon monoxide inhalation
   B. Sagittal sinus thrombosis
   C. Straight sinus thrombosis
   D. Transverse sinus thrombosis
   E. Methylmalonic academia

ANSWER: C


Comment: Deep system thrombosis commonly manifests as thalamic or basal ganglia edema, and is a common pattern seen in dehydrated infants. Thrombosis of the superior sagittal sinus would more likely cause frontal or parietal edema, and transverse sinus thrombosis would be associated with posterior temporal lesions. The edema seen with carbon monoxide is typically prominent in the globi pallidi, and in methylmalonic ademia edema occurs in the tegmentum of the brainstem.
Blake A. Johnson, MD, FACR  
Cranial Nerves I-VI  
SAM Questions

1. Which of the following statements is true?
   A. A lesion affecting the optic chiasm would be expected to cause a homonymous hemianopsia.
   B. The sixth cranial nerve controls four of the six extraocular muscles.
   C. There are 2 sensory nuclei associated with the fifth cranial nerve.
   D. The mesencephalic nucleus is responsible for proprioception of the masticator muscles.
   E. Cranial nerves III, IV, VI and VII course through the cavernous sinus.

   The correct answer is D, proprioception of the masticator muscles is the function of the mesencephalic nucleus of the fifth cranial nerve, located in the midbrain, as its name would imply. A is incorrect, as the optic chiasm contains neurons that originate in the medial retina, and decussate to contralateral optic tract. The medial retina perceives visual input from the lateral visual fields, thus a bitemporal hemianopsia would result if these neurons are compromised. Pathology dorsal to the chiasm (optic tract) would result in a homonymous hemianopsia. B is incorrect, because the abducens nerve (VI) innervates the lateral rectus muscle. The oculomotor nerve (III) innervates 4 extraocular muscles. C is incorrect, because the trigeminal nerve (V) is served by one motor and 3 sensory nuclei (mesencephalic, chief sensory and the spinal tract nucleus). E is incorrect, because the facial nerve (VII) exits the brain stem at the mid-lateral pons and passes through the cerebellopontine angle cistern to the internal auditory canal. Cranial nerves III, IV, V1, V2, and VI course through the cavernous sinus.

References:  

2. Which of the following cranial nerves traverses the medial aspect of the cavernous sinus?
   A. Abducens nerve  
   B. Trochlear nerve  
   C. Ophthalmic division of the trigeminal nerve  
   D. Maxillary division of the trigeminal nerve  
   E. Oculomotor nerve

   The correct answer is A, the abducens nerve. The other nerves listed traverse the lateral wall of the cavernous sinus. The abducens nerve is located medial to the other the nerves as they course through the cavernous sinus.

References:  

3. Which of the cranial nerves exits the dorsal brainstem?
   A. Abducens nerve
   B. Trochlear nerve
   C. Trigeminal nerve
   D. Optic nerve
   E. Oculomotor nerve

   The correct answer is B, the trochlear nerve. It exits the dorsal midbrain and is also the only cranial nerve to cross the midline after it exits the brainstem. The other cranial nerves exit the ventral or ventrolateral brainstem and remain ipsilateral to their exit points.

   References:
Erik Gaensler, MD  
Spine Neoplasms  
SAM Questions  

1. The most common primary spinal tumor in adults is:  
A. Meningioma  
B. Schwannoma  
C. Astrocytoma  
D. Ependymoma  
E. Metastasis  

   Answer: B  

Explanation:  
Extramedullary intradural tumors (principally schwannomas and meningiomas) far outnumber intramedullary tumors such as astrocytomas. Schwannomas are more common than meningiomas. 
See series of Hirano et al. below (http://www.ncbi.nlm.nih.gov/pubmed/22581192)"  

"Of the 678 patients in our study, 377 patients (55.6 %) were males and 301 patients (44.4 %) were females (male/female ratio 1.25). The mean age at surgery was 52.4 years. Of these tumors, 123 cases (18.1 %) were intramedullary, 371 cases (54.7 %) were intradural extramedullary, 28 cases (4.1 %) were epidural, and 155 cases (22.9 %) were dumbbell tumors. The pathological diagnoses included 388 schwannomas (57.2 %), 79 meningiomas (11.6 %), 54 ependymomas (8.0 %), 27 hemangiomas (4.0 %), 23 hemangioblastomas (3.4 %), 23 neurofibromas (3.4 %), and 9 astrocytomas (1.3 %).”  

References:  

2. Spinal CSF “drop” or leptomeningeal metastases can be distinguished from enhancing blood vessels by which following criteria:  
A. Drop metastases show quicker washout of Gadolinium than vessels, so become less visible on delayed imaging.  
B. Drop metastases typically are found at “noon” and “6 o’clock” with respect to the spinal cord,  
C. Drop metastases have a linear appearance, and can be followed along multiple axial images in the same location.  
D. Drop metastases can be seen involving the pia and sub-pial spinal cord.  
E. Drop metastases spare the cauda equina.  

Answer: D
Explanation:

The coronal venous plexus which lies posterior to the spinal cord enhances vigorously, particularly with newer Gadolinium agents, and can be mistaken for leptomeningeal metastases. These veins are mostly dorsal to the cord, with the largest directly posterior to the cord. As tubular structures, they can be traced over multiple slices, which is not the case with drop metastases. They do not “invade” the pia and sub-pial cord, and will wash out sooner on delayed imaging than true metastases, where the gadolinium has crossed the blood brain barrier and “leaked out” irreversibly.

References:

3. Unlike vertebral metastases, vertebral compression fractures:
   A. Often involve the pedicles.
   B. Show “restriction” of water movement and thus become bright on DWI.
   C. Typically show sparing of the posterior superior corner of the vertebra and pedicles.
   D. Begin as small rounded areas of infiltration.
   E. Enhance vigorously with Gadolinium, best seen on T1 images with Fat-Saturation.

Answer: C

Explanation:
Metastases spread to the vertebrae hematogenously, and individual clumps of metastatic cells then grow, giving the normal bright fatty marrow of the spine a “Swiss Cheese” appearance, with multiple low signal areas of marrow replacement. These then coalesce, replacing the entire marrow space. No area is spared—the superior posterior vertebral endplate and the pedicles, typically intact in osteoporotic fractures, are infiltrated by metastases. In theory, more of the water is intracellular (within the cancer cells) in metastatic infiltration of vertebral bodies, and more water extracellular in the osteoporotic fracture. This suggests that DWI would be an ideal technique from telling malignant from osteoporotic compression fractures. Despite initial promising reports, DWI has not been highly predictive. PET scanning with flurodeoxyglucose (FDG) is more helpful but still problematic. In difficult situations, biopsy remains the gold standard, and Vertebroplasty/Kyphoplasty can be performed at the same time.

References:

4. Regarding spinal nerve sheath tumors:
   A. Neurofibromas are the most common type.
   B. The vertebrae are not affected, as these are soft tissue tumors.
   C. Enhancement is robust and homogenous, unlike meningiomas.
   D. Neurofibromatosis Type 2 is associated with plexiform lesions.
   E. Most patients do not have NF-1 or NF-2.

   Answer: E

   Explanation:
   Most spinal schwannomas are sporadic, just like their intracranial counterpart the vestibular schwannoma (aka “acoustic neuroma”). These patients have true schwannomas and not neurofibromas. These grow slowly, and as they enlarge the neural foramina, they can erode the pedicles, resulting in findings visible on plain films. These are the most common primary spinal tumor (http://www.ncbi.nlm.nih.gov/pubmed/22581192)

   Patients with neurofibromatosis (NF) Type 1 have a defect on chromosome 17, and the classic findings plexiform neurofibromas, “ribbon ribs”, and cutaneous stigmata such as café au lait spots. When they have spinal nerve sheath tumors, they are neurofibromas. (http://www.ncbi.nlm.nih.gov/pubmed/1846409)

   NF Type 2 patients have bilateral vestibular schwannomas and a defect on chromosome 22. When they have spinal nerve sheath tumors, they are typically schwannomas. Meningiomas and ependymomas are other tumor features.

   The blood supply of nerve sheath tumors is less robust than meningiomas, and enhancement is there more variable, and areas of cystic necrosis are common.

References:
1. Which of the following statements is true regarding the “Stenting and Aggressive Medical management for the Preventing Recurrent Stroke in Intracranial Stenosis” (SAMMPRIS) trial?
   A. The patients who were treated by stenting had lower than expected 30-day complication rates.
   B. At 30 days, the rate of stroke and death was lower in the patients treated by stenting and angioplasty compared to patients treated with aggressive medical management.
   C. Patients who entered the SAMPRIS trial were believed to have a high risk of stroke from their intracranial stenosis.
   D. The results of this study only apply to patients with intracranial stenosis in the anterior circulation.
   E. The conclusions of the trial also apply equally well to disease in the carotid bifurcations.

   Answer: C.

   The SAMMPRIS trial was a randomized trial of 451 patients designed to test whether a strategy of angioplasty and stenting was superior to that of aggressive medical management for prevention of stroke in patients with significant intracranial stenosis. The trial included patients with >50% stenosis in a major intracranial artery, including the internal carotid, proximal middle cerebral artery, vertebral artery or basilar artery (Answer D is false) with recent ischemic symptoms. Based on prior studies, these patients were believed to have a high risk of stroke (Answer C is true). At 30 days, patients treated with stenting had a higher than expected complication rate (Answer A is false). The major finding of the study is that the stenting group had a significantly higher rate of stroke and death than patients treated with aggressive medical management (Answer A is false). The 30-day rate of stroke and death was 14.7% in the angioplasty and stenting group (12.5% nonfatal stroke, 2.2% fatal stroke) vs. 5.8% in the group treated with aggressive medical therapy (5.3% nonfatal stroke, 0.4% nonstroke death). The SAMMPRIS trial did not study interventions at the proximal carotid arteries (Answer E is false).


2. Which of the following statements is true regarding the imaging of patients with acute stroke?
   A. The presence of a few small chronic microhemorrhages on MRI is a contraindication for IV thrombolysis.
   B. Patients whose CT had a low ASPECTS score (less than or equal to 7) had poorer functional outcome and higher likelihood of symptomatic hemorrhage than those with higher scores.
   C. Perfusion-weighted CT and MR imaging have been shown to reliably identify penumbra and help triage patients for IV thrombolysis in patients presenting later than 4 hours after symptom onset.
   D. MRI is substantially less accurate than CT in detecting hyperacute intraparenchymal hemorrhage when gradient echo images are obtained.
E. Based on recent studies, the finding of large intraparenchymal brain hemorrhages on CT in patients with acute stroke is no longer considered a contraindication for intravenous thrombolytic therapy.

Answer: B.

Non-contrast CT remains the standard of care choice for the evaluation of hemorrhage in patients with acute stroke. The finding of intracerebral hemorrhage in patients with acute stroke is a critical contraindication for IV thrombolytic therapy (Answer E is false). The accuracy of MRI for hyperacute intraparenchymal hemorrhage is equivalent to that of CT if gradient echo images are obtained, although the sensitivity of CT for subarachnoid hemorrhage is likely superior to that of CT (Answer D is false). Patients with acute stroke and MR showing a few (less than 5) microhemorrhages did not demonstrate a higher incidence of symptomatic or asymptomatic hemorrhage after intravenous thrombolysis (Answer A is false). Use of a scoring system such as ASPECTS on non-contrast CT may be helpful in this patient group. Patients with a low ASPECTS score (less than or equal to 7) had poorer functional outcome (78% sensitivity and 96% specificity) and more frequent symptomatic hemorrhage (90% sensitivity and 62% specificity). (Answer B is true). Several trials, including the recently completed MR-RESCUE trial, have not demonstrated that perfusion-weighted CT or MRI could help triage patients who might benefit from late administration of IV thrombolysis (Answer C is false).

References:

3. Which of the following statements is true regarding complications in patients with acute stroke?
   A. The risk of symptomatic hemorrhage in patients undergoing IV thrombolytic therapy for acute stroke is similar to that of untreated patients.
   B. Approximately 30% of patients with acute stroke have seizures as a complication.
   C. Vasogenic edema after acute strokes peaks approximately 2 weeks after symptom onset.
   D. Patients with an acute stroke who present with a large vascular territory infarction and selling within 24 hours of symptom onset are more likely to develop brain herniation.
   E. Decreased capillary endothelial permeability has been associated with increased risk of hemorrhage after acute stroke.

Answer: D.
After acute stroke, swelling from vasogenic edema usually peaks by 72 hours after symptom onset (Answer C is false). Patients with a pattern of infarction called malignant have large territorial infarctions with signs of swelling within 24 hours of symptom onset. Patients with this pattern of infarction have increased risk of brain herniation (Answer D is true). Only a small fraction of patients with acute stroke (likely well under 25%) will have seizures as a complication of their stroke (Answer B is false). The risk of hemorrhage after IV thrombolysis in these patients varies (between 2 and 10%), but is higher than the risk of hemorrhage without treatment (roughly 1 to 4%) (Answer A is false). Studies of imaging of patients with acute stroke using dynamic contrast-enhanced MRI or CT have shown that increased capillary endothelial permeability in areas of stroke is associated with increased risk of hemorrhagic transformation (Answer E is false).

References: