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GRAPHICS

Evaluation of Incidental Findings on MRI of the Central Nervous System: Part 1

Ruth G. Ramsey, MD, FACR

During the course of routine neuroradiologic imaging evaluation, various abnormalities are occasionally identified that may be considered ''incidental findings.'' The significance of these is not always clear, and additional evaluation may be necessary. This article presents a series of magnetic resonance (MR) images to illustrate a number of ''incidental findings,'' describes possible significance, and where additional evaluation or follow-up may be required.

Address: Premier Health Imaging, 664 N. Wells St, Chicago, IL 60610; ph: 312-335-1155; fax: 312-335-9098; e-mail: ruthgramsey@aol.com.

Correspondent: Ruth G. Ramsey, MD, FACR; Medical Director for Premier Health Imaging; Clinical Professor of Radiology for the University of Illinois Medical Center.

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During the course of routine neuroradiologic imaging evaluation, various abnormalities are occasionally identified that may be considered ''incidental findings.'' The significance of these findings is not always clear. Similarly, what additional tests or follow-up are necessary or indicated is also not always clear. In any individual case, these findings should be evaluated in conjunction with the clinical condition and initial indication for the study under consideration. These incidental findings may be seen on either CT or MRI scans.

These incidental findings include a variety of abnormalities (Table 1). A number of these incidental imaging findings will be illustrated in this article.

MENINGIOMAS

Meningiomas arise from arachnoid cells embedded in the dura and may be almost any size when initially identified (Figure 1). Meningiomas do not have a blood brain bar-

Table 1. Incidental Findings

- Empty sella
- Arachnoid cyst
- Chiari malformation
- Pineal cysts
- Brain tumors
- Metastatic disease
- Pituitary tumor
- Areas of increased signal intensity
- Aneurysm
- Sinusitis
- Venous angioma
- Cavernous angioma
- Lipoma of corpus callosum

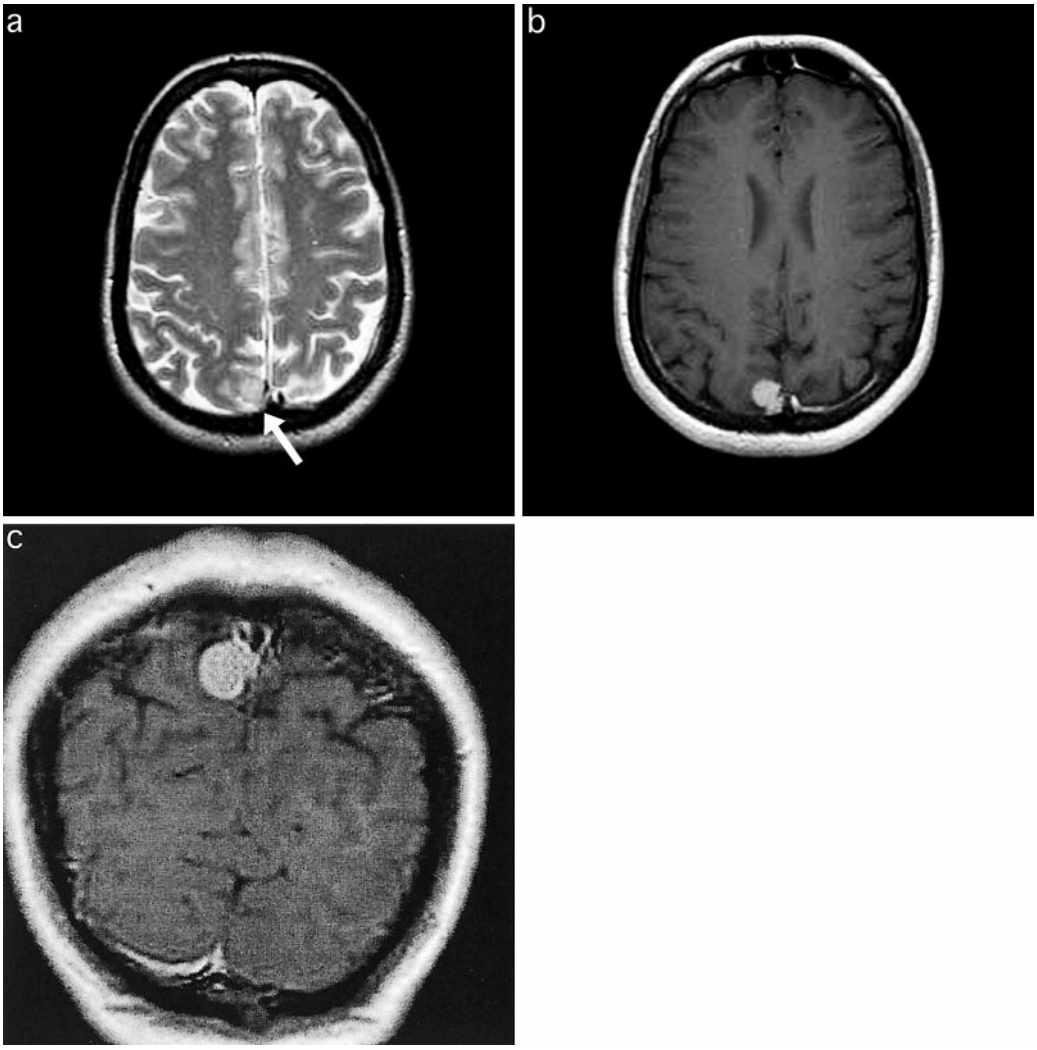

Figure 1. *Meningioma. A: There is a rounded area of decreased signal intensity in the right parietal parasagittal region that is faintly visible on the T2W images (arrow). B and C: Following the infusion of contrast material axial and coronal T1W images reveal dense homogeneous enhancement of the meningioma that arises from the falx cerebri in the right parasagittal region. There is slight mass effect upon the adjacent cortex.*

rier and exhibit dense, usually homogeneous enhancement following contrast administration. Any meningioma must be evaluated and followed-up.

ANEURYSM

Berry aneurysms (Figure 2) may occasionally be seen as an incidental finding. They are usually seen in the region of the circle of Willis and are well evaluated by MR angiography. CT angiography may also be used when the multi-slice scanners are available prior to treatment. Standard x-ray catheter angiography is almost always necessary for complete evaluation prior to treatment. In addition, aneurysms are multiple in approximately 20% of cases. Evaluation, treatment, and/or follow-up are mandatory. Long-term follow-up is also necessary.

CHIARI MALFORMATION

There are 3 recognized types of Chiari malformation (Figures 3 and 4). The Chiari malformation is typically seen as an incidental finding. The adult patient with Chiari I malformation may be asymptomatic or may have a wide variety of symptoms including headache, nystagmus, Lhermitte's Sign and other

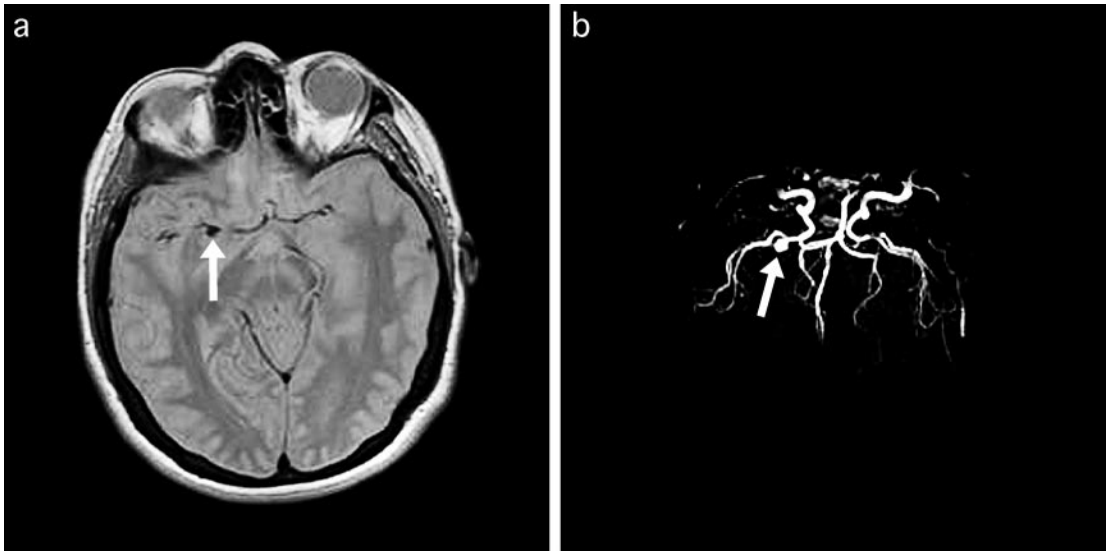

Figure 2. *Middle cerebral artery aneurysm. A: Routine proton density MR image reveals an area of abnormal flow void along the horizontal portion of the right middle cerebral artery (arrow). B: Subsequent MR angiography reveals an approximately 7 mm aneurysm of the middle cerebral artery (arrow).*

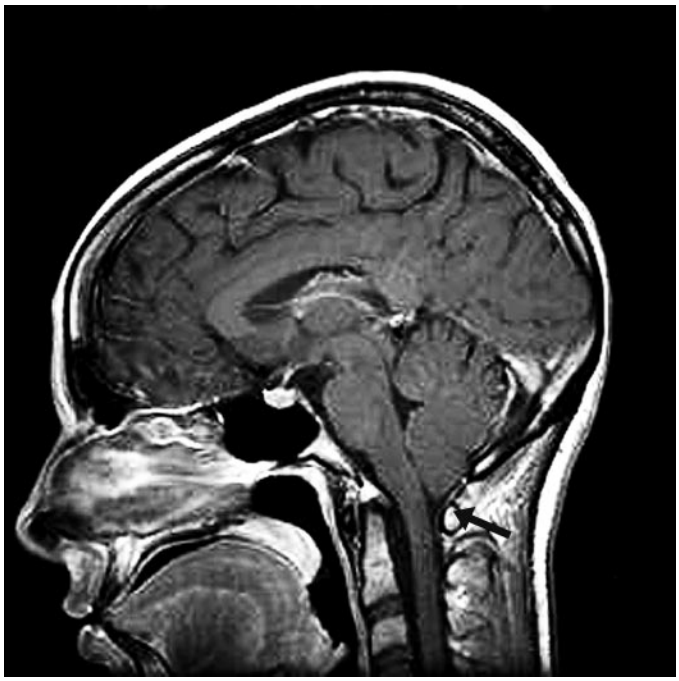

Figure 3. *Chiari malformation. The cerebellar tonsils are (arrow) displaced below the foramen magnum and are pointed in appearance. The posterior fossa is "crowded" and the pre pontine and pericerebellar cisterns are compressed.*

vague neurologic complaints. Generally asymptomatic, additional work-up and follow-up are based upon the patient's clinical signs and symptoms. Surgery with compression of the cerebellar tonsils may be necessary in some cases.

EMPTY SELLA

Empty sella is defined as a sella turcica larger than 14 mm × 17 mm in size, with the pituitary gland compressed in the floor of the sella and the pituitary stalk displaced posteriorly in the sella turcica (Figure 5). Empty

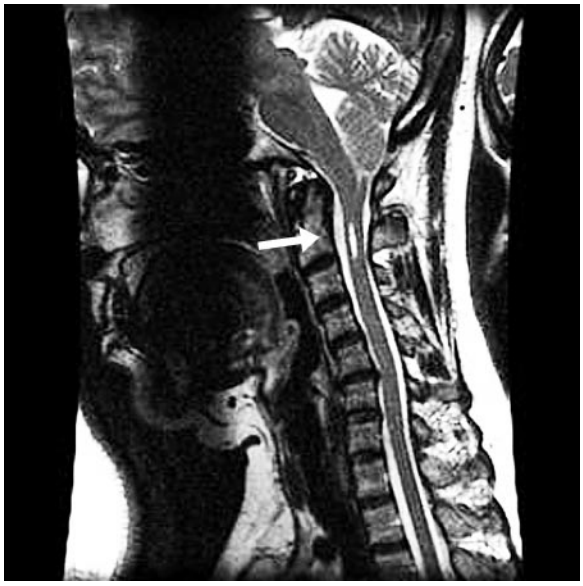

Figure 4. *Chiari malformation. There is a Chiari I malformation and a small syrinx cavity at the level of C2-3 (arrow). In addition, there is a herniated disc at the level of C5-6.*

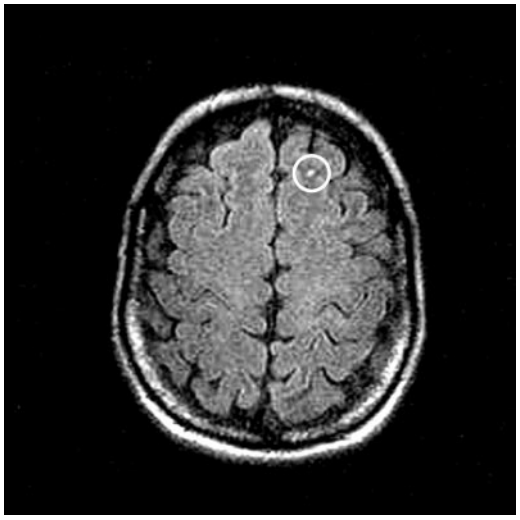

Figure 6. *Sjögren syndrome. FLAIR imaging reveals a small area of increased signal intensity in the left frontal region (circled).*

sella is seen more frequently in females than males. The cause is theorized to be related to swelling and shrinking of the gland with menstruation and pregnancy. In most cases, no treatment or follow-up is required.

AREAS OF INCREASED SIGNAL INTENSITY

There are multiple causes of areas of increased signal intensity. A list of potential causes is seen in Table 2. These areas of increased signal intensity should be evaluated in the clinical setting of the patient's illness. In the older-age group, multiple areas of increased signal intensity are common with end artery infarcts. In younger individuals, diseases such as cerebral autosomal dominant arteriopathy with subcortical infarcts and leukoencephalopathy (CADASIL) are a consideration. This requires additional workup and additional follow-up studies.

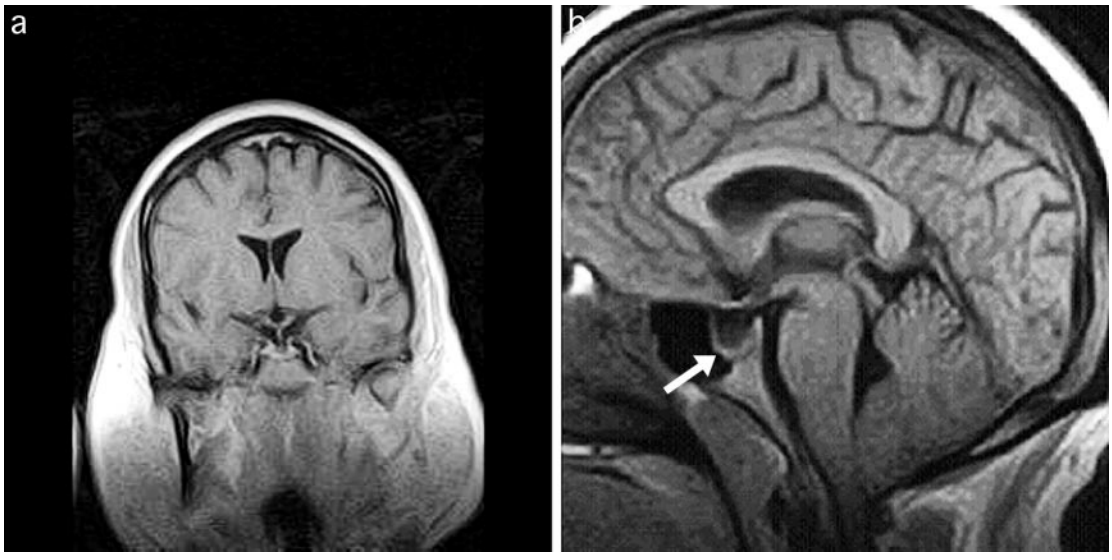

Figure 5. *Empty Sella. Coronal (A) and lateral views (B) of the sella turcica reveal enlargement of the sella turcica. The pituitary gland is compressed into the floor of the sella (arrow). Note that the optic chiasm is also depressed slightly into the sella. Visual symptoms may result from this.*

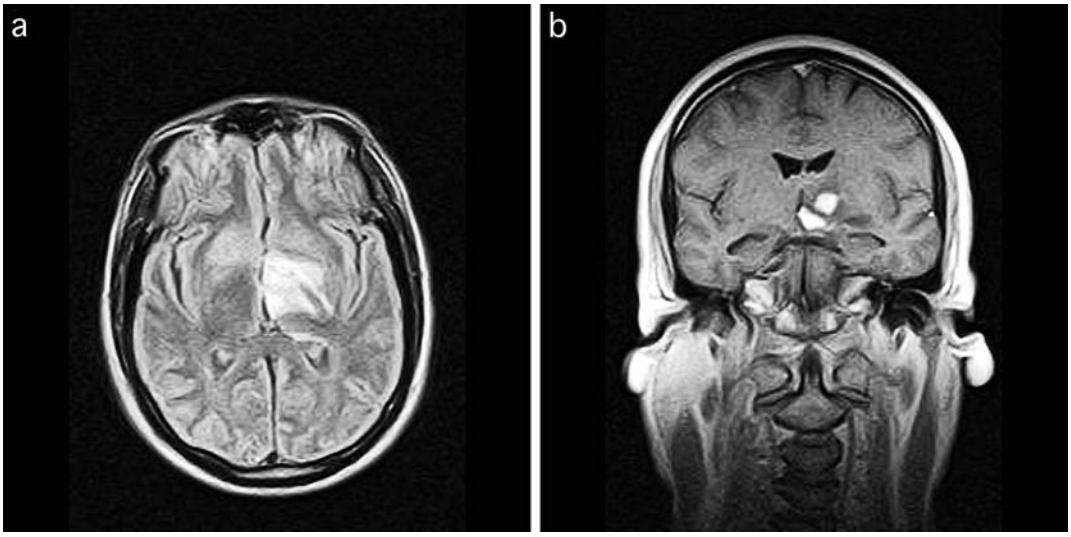

Figure 7. *Metastatic disease, unknown primary. The patient is a 57-year-old male with headaches and mild right-sided weakness. A: T2WI reveals a slightly irregularly marginated area of increased signal intensity in the left basal ganglia. There is slight compression of the third ventricle. B: Following the infusion of contrast material, coronal T1WI reveals a dense enhancement of a bilobed mass in the left basal ganglia. There is compression of the third ventricle. Findings are consistent with hematogenous spread of metastatic disease with two adjacent Metastatic deposits. Primary source is not yet identified.*

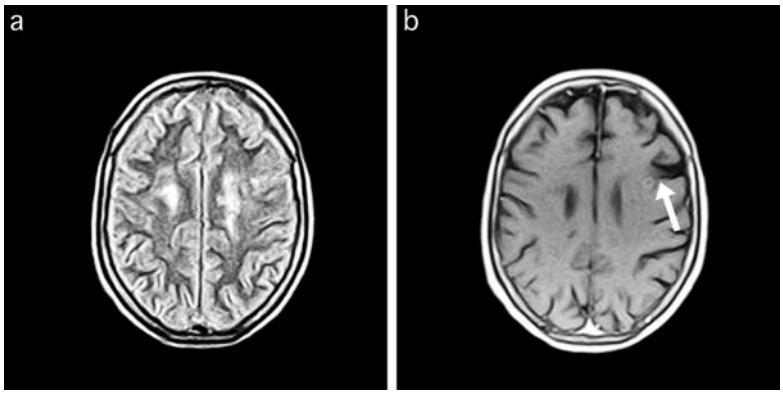

Figure 8. *Metastatic disease. A: Reveals multiple small areas of increased signal intensity which are non-space occupying. These are unchanged since a previous study. B: However, after the infusion of contrast material, there is a small ring of enhancement deep in the left frontal lobe in the region of one of the areas of increased signal intensity (arrow). This finding is consistent with a new metastasis.*

Multiple sclerosis typically results in multiple areas of increased signal intensity; however, in rare occasions, only a solitary lesion will be seen.

There are also rare diseases such as Sjögren syndrome, which may also result in areas of increased signal intensity (Figure 6). In these cases, the changes are most likely related to an associated vasculopathy with vessel stenosis and resulting infarcts. Most patients with Sjögren syndrome will require additional imaging as well as long-term follow-up.

NEOPLASTIC PROCESSES

In general, any space-occupying mass must be evaluated with a post contrast study and surgical or medical treatment with follow-up is absolutely necessary (Figures 7 and 8).

PINEAL CYSTS

Typically, the pineal gland should be smaller than 10 mm; however, occasionally a benign cystic pineal may be as large as 15 mm (Figure 9). If there is no pathologic en-

Table 2. Causes of Small Areas of Increased Signal Intensity

- Small strokes/infarcts
- Multiple infarcts
- Binswanger disease
- CADASIL
- Epstein-Barr virus
- ADEM-Acute disseminated encephalomyelitis, an autoimmune process
- Multiple sclerosis
- Craniocerebral trauma
- AIDS Encephalomalacia
- Old Encephalitis
- Tuberculosis
- Sarcoidosis
- Lyme-tick disease
- West Nile Virus
- Progress multifocal leukoencephalopathy (PML)
- Vasculopathy (previously called vasculitis)
- Post-dramatic shearing injury
- Sickle-cell disease with resulting infarcts
- Sjögren syndrome

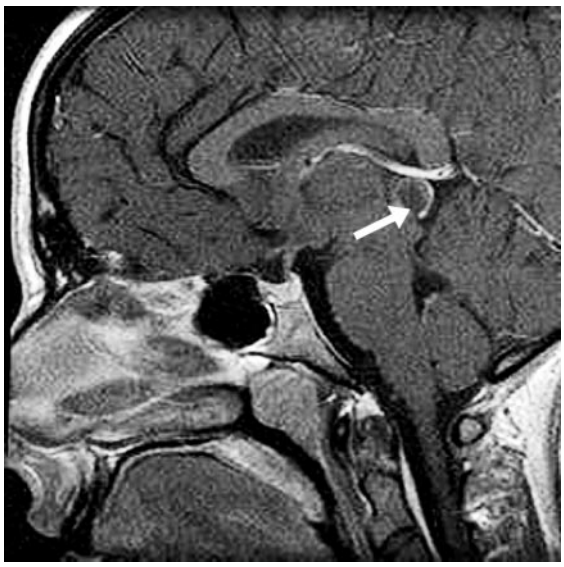

Figure 9. *The pineal gland measures 11 mm in greatest dimension and exhibits a small peripheral ring of enhancement (arrow). The appearance was unchanged over one year, and there is no obstructive hydrocephalus.*

hancement or obstructive hydrocephalus, no follow-up is needed.

LIPOMA OF CORPUS CALLOSUM

Lipoma of the corpus is associated with varying degrees of agenesis of the corpus callosum, depending upon the size of the lipoma (Figure 10). The patient's symptoms are variable, depending upon the degree of agenesis. Complete agenesis of the corpus callosum is more ominous than a small lipoma with partial agenesis of the corpus callosum.

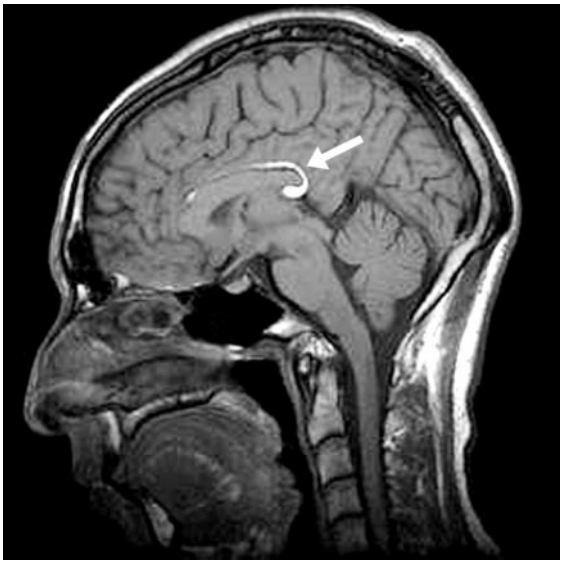

Figure 10. *Small lipoma of the corpus callosum. There is a curvilinear area of increased signal intensity along the superior margin of the corpus callosum that extends around the posterior margin of the corpus callosum at the level of the splenium of the corpus callosum (arrow). There is partial agenesis of the splenium of the corpus callosum. The brain is otherwise normal. No additional follow-up is needed, and no additional studies are needed.*

SUMMARY

Incidental findings may or may not be significant. A broad knowledge of normal and abnormal findings is necessary to evaluate these changes. Broad generalizations include the fact that if a process is space occupying, or exhibits enhancement following the infusion of contrast material, which reflects the presence of breakdown of the blood brain barrier, this patient will require additional follow-up. The follow-up will likely also include multiple additional studies.

It should be noted that while there is a desire to make a definitive diagnosis at the time of first imaging study additional evaluation with contrast or another type of follow-up examination such as CT scanning might be necessary. The type of abnormality and the patient's clinical symptoms dictates the period of time between follow-up studies. It is axiomatic that any and all findings must be viewed in the clinical setting and correlated

with other physical findings and laboratory tests. Additional incidental MR findings in the central nervous system will be illustrated in Part 2, in a future issue.

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