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MR demonstration of falx ossification: recognition and differential diagnosis.

J A Tobias, K P Solla, J J Sheldon and R Shapiro

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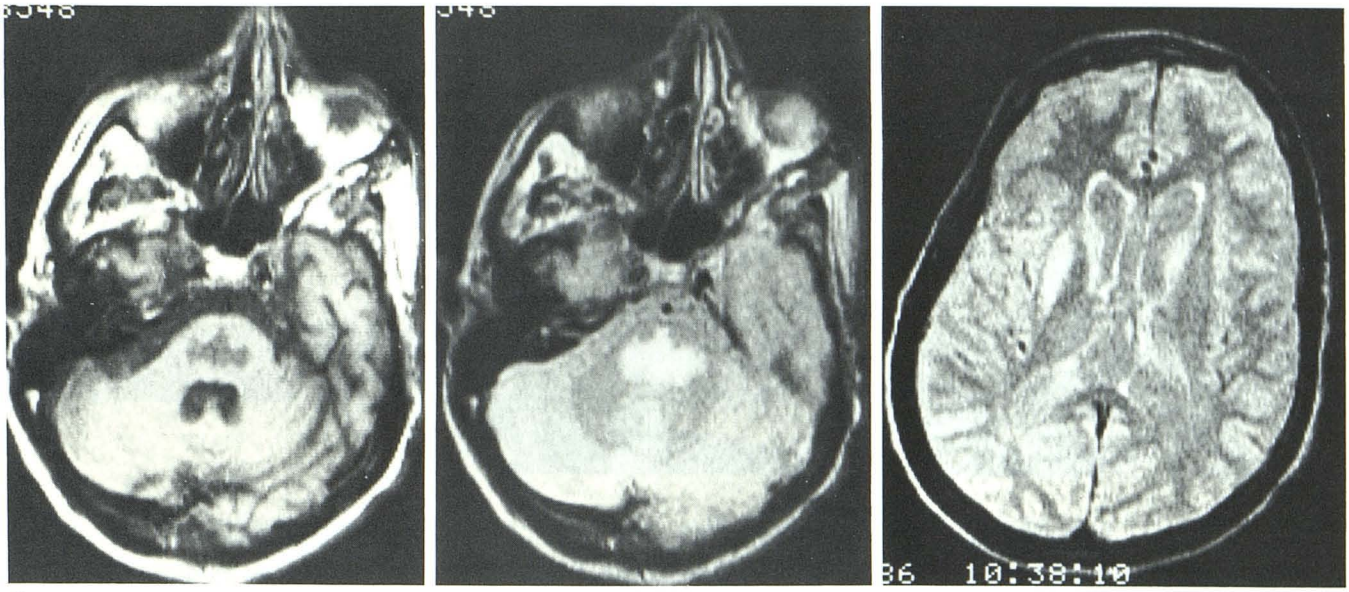

Fig. 2.—*A*, T1-weighted MR image at same level as Fig. 1. Trident-shaped hypointense area in pons. Ventrolateral sparing is in location of corticospinal and corticobulbar tracts.
***B*, T2-weighted image at same level as part *A*.**
***C*, T2-weighted image shows abnormal signal in right putamen. Similar involvement on left not seen on this slice because of head tilt.**

MR Demonstration of Falx Ossification: Recognition and Differential Diagnosis

An area of high signal has been observed as an incidental finding on routine T1-weighted sequences of the brain. Correlation with CT scans and/or plain skull films revealed the source to be within areas of ossification of the falx cerebri. The marrow within this ossification may led to high signal, such as is seen within the diploic space of the calvaria and other marrow spaces of the body. Appreciation of this finding should prevent confusion with intracerebral hemorrhage and other cerebral diseases (i.e., lipomatous lesions) that may also present with bright signal on T1-weighted sagittal images.

Case Report

A 64-year-old woman with a history of colonic carcinoma and radiation therapy for a pontine mass has been followed by MR since 1984. The sagittal T1-weighted image has persistently shown a high frontal area of increased signal (Fig. 1A, on next page), which becomes isointense on the T2-weighted sequence (Fig. 1B, on next page). Correlation with CT has shown a densely mineralized falx in this area, which has not changed in appearance on sequential studies.

Discussion and Differential Diagnosis

It has previously been demonstrated, histologically, that mineralization of the falx cerebri in humans is caused by ossification and not just calcification. These areas of membranous bone formation are complete with marrow elements that may also be subject to metastatic or leukemic infiltrates [1]. It is expected, therefore, that marrow and fat elements within areas of dural ossification have high signal on T1-weighted sequences similar to that demonstrated within the diploic space. A similar high T1-signal phenomenon has been observed within a densely mineralized osteoma that abutted the inner table. The lesion, which was hyperdense on CT, appeared very bright on T1-weighted sequences and essentially isointense to brain on T2-weighted images. The high signal on T1-weighted spin-echo sequences is again likely to be related to marrow and/or fat elements. Osteomas, while commonly appearing very dense on CT, may consist of highly vascular, fatty, or hematopoetic elements pathologically. If the falx cerebri were calcified or ossified with compact bone, without marrow elements, one could predict a relative absence of signal on all MR sequences because of the paucity of mobile protons.

It is necessary to distinguish between clinically significant lesions that may be confused with physiologic falcial marrow. A clinical example is demonstrated by a 68-year-old woman outpatient who had a long clinical history of definite multiple sclerosis and a recent fall due to ataxia. The MR study in this patient (Fig. 2, on next page) revealed a subacute interhemispheric subdural collection of blood, which was clinically unsuspected and could have mimicked falx ossification if both T1 and T2 images were not evaluated. The initial T1-weighted parasagittal image shows an area of high signal similar to that emanating from fatty marrow within falcial ossification (Fig. 2A). This lesion (hemorrhage) differs from falcial ossification because it has increased signal on the second echo of the T2-weighted sequences and is distinctly separate from the linear low signal of the falx, which is medial to the blood (Fig. 2B).

While both interhemispheric subdural blood and falcial ossification are bright on T1-weighted images, they can be distinguished from each other. In falcial marrow and ossification, the area of bright signal will often appear to straddle the falx or cross the midline on the T1-weighted coronal images. The spin-density coronal images show low signal peripherally, within the ossified cortex, and isointensity to brain centrally, within the marrow elements. The area of bright signal within the falx on T1-weighted sequences tends to become isointense with brain on the T2-weighted sequences, and may no longer appear visible (Fig. 1B). Fatty marrow has short T1 values and its T2 values, while relatively long, will be shorter than blood [2]. Marrow within falx ossification looks bright on T1-weighted sequences, but will not be brighter than adjacent normal brain on the T2-weighted sequences. Coronal images will show that the marrow signal mirrors that of normal marrow in the diploic space.

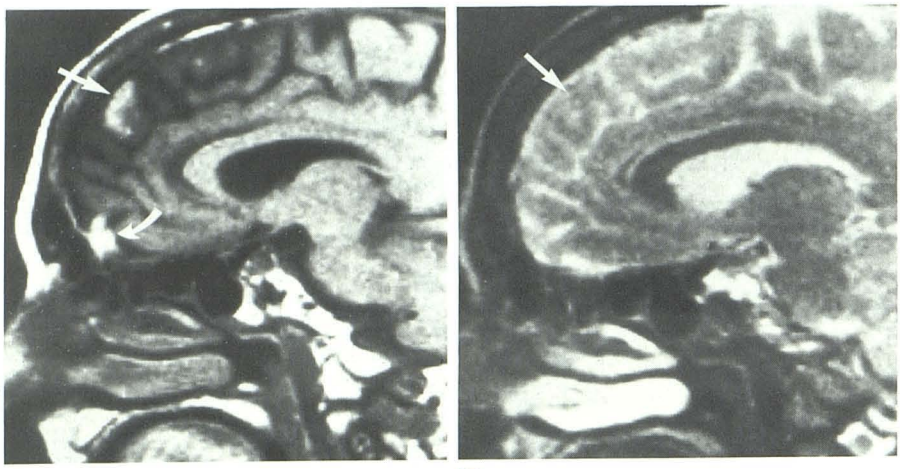

Fig. 1.—Falx ossification.

***A*, High signal emanates from marrow within ossification of anterior falx (*straight arrow*) on this T1-weighted SE sagittal sequence (TR = 300 msec, TE = 30 msec). High signal is also arising from marrow within crista galli (*curved arrow*).**

***B*, T2-weighted SE sagittal image (TR = 1500 msec, TE = 70 msec). Falcial ossification has become isointense with brain and is no longer visible.**

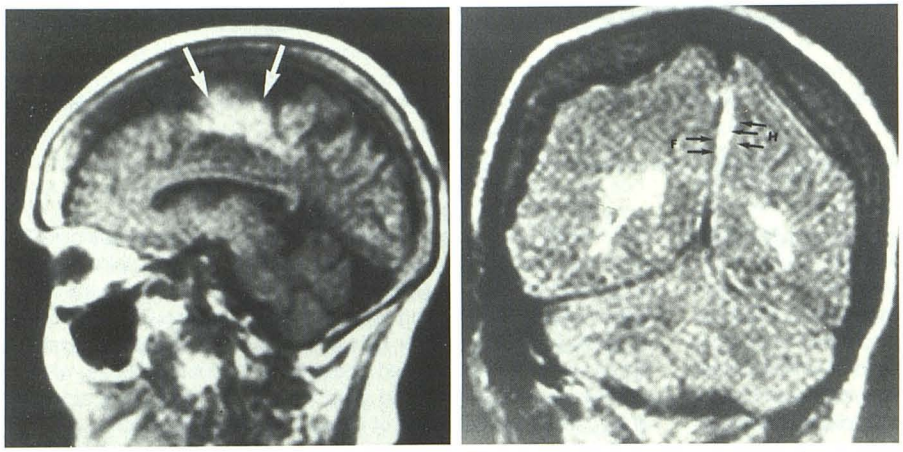

Fig. 2.—Subacute interhemispheric subdural hematoma.

***A*, T1-weighted parasagittal image (TR = 300 msec, TE = 30 msec) also has high-signal area above falx (*arrows*). Differential diagnosis of interhemispheric subdural hematoma vs falcial ossification may be difficult on the basis of this single projection and sequence. Severe atrophy of the corpus callosum and cerebral cortex is due to long-standing multiple sclerosis.**

***B*, T2-weighted coronal sequence (TR = 1500 msec, TE = 70 msec) shows parafalcine high signal (H) due to prolonged T2 values within subacute subdural hematoma, which is brighter than normal brain or adjacent diploic marrow. Low signal, linear falx (F) is seen separate and medial to blood.**

The signal from subacute interhemispheric subdural blood, however, gets brighter on the T2-weighted sequence because of its long T2 values and is easily separated on all spin-echo sequences from the low signal, linear falx, which forms its medial border (Fig. 2B). Because the subacute collection of hemorrhage has a relatively long T2-relaxation time and short T1 values, it appears bright on both T1-weighted and T2-weighted sequences. The bright signal of subdural blood will not cross the midline on the coronal images.

While ossification of the falx is a normal finding, the presence of high signal on one study followed by its disappearance on subsequent MR studies should suggest the possibility of pathologic replacement of marrow elements, most likely by a primary or metastatic hematologic process. Marrow replacement by leukemic infiltrates, metastatic breast and prostate carcinoma, have been demonstrated pathologically and radiologically within falx ossification on conventional radiographs of the skull [1]. Case reports have also demonstrated the possibility of primary sarcomas of the falx cerebri [3, 4]. Although we have yet to document a case involving metastasis to the marrow within the falx, it is well known that MR is sensitive to pathologic marrow replacement in other parts of the body, such as the lumbar spine [5].

In conclusion, the recognition of normal causes of unexpected signal alteration on MR will lead to more accurate interpretation and diagnosis. The presence of high signal on T1-weighted sequences in the region of the falx cerebri or inner table may be caused by marrow elements within areas of intracranial physiologic ossification. Characterization with T2-weighted sequences and/or CT can assist in the differential diagnosis and prevent confusion with hemorrhage or lipomatous lesions.

Jeffrey A. Tobias
Kalevi P. Solla
Jerome J. Sheldon
Mount Sinai Medical Center
Miami Beach, FL 33140
Robert Shapiro
University of Miami School of Medicine
Miami, FL 33101

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