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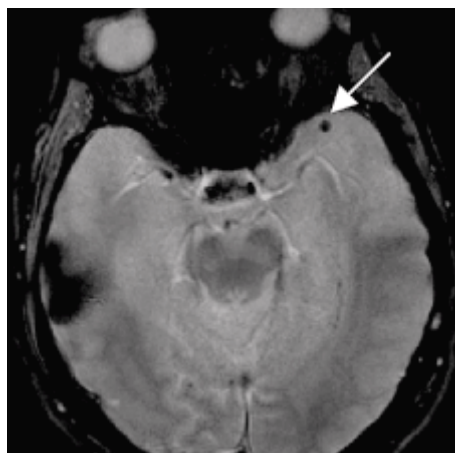


Figure 1A: Gradient Echo (GRE) image showing one renal cell metastasis.

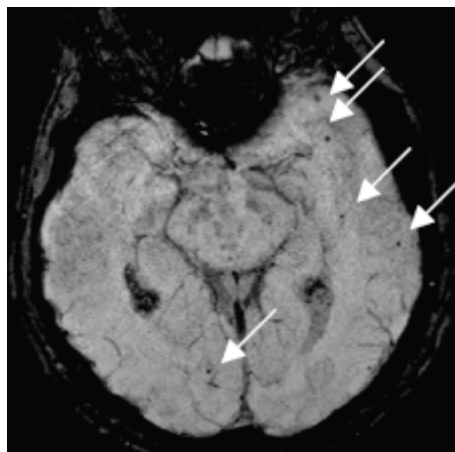


Figure 1B: SWI image showing multiple lesions in a case of renal cell metastases for Gamma knife. Courtesy of Edmond A. Knopp, MD, NYU School of Medicine.

SWI yields MR images that have enhanced contrast due to susceptibility differences between tissues; hence, SWI helps detect and evaluate hemorrhages and venous thrombosis. SWI sequence is a high resolution, 3D, full flow compensated gradient echo sequence. The magnitude image, phase mask image and combination of the two images acquired during the scan provide contrast sensitive to venous blood, hemorrhage and iron storage.

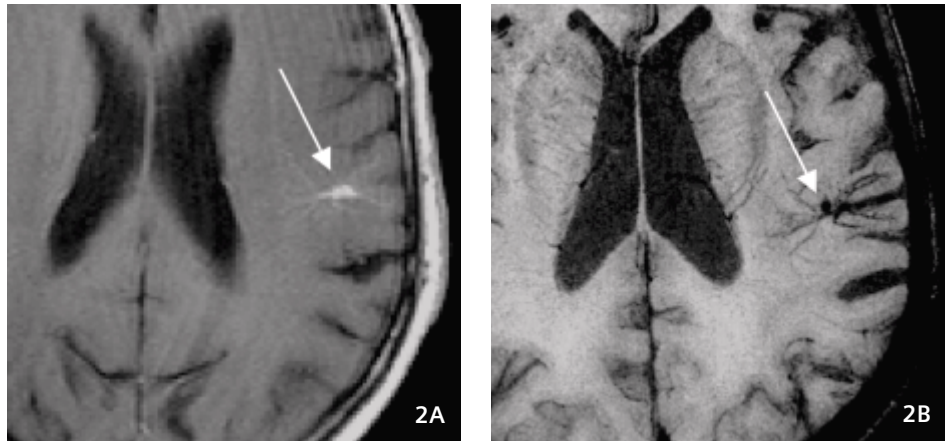
Clinical Role in Intracranial Metastatic Disease

SWI helps evaluate intracranial metastatic disease for multiplicity that would alter treatment plans. For example, a solitary metastasis would be surgically removed while multiple lesions would require whole brain radiation. SWI helps improve lesion detection. Metastatic disease is better seen on SWI as compared to GRE sequences, particularly very small 2–5 mm size lesions. Metastatic melanomas are seen well due to the higher susceptibility in these lesions. Figure 1A and 1B show a case of renal cell metastases where the SWI image shows multiple lesions (four additional lesions) as compared to a single lesion on the GRE sequence. SWI added valuable information in this case, impacting treatment planning for Gamma knife.

Occult Vascular Disease

SWI is useful in detecting occult vascular disease. In cases of venous angiomas and cavernomas, patient presents with bleed, but sometimes the lesion is not found on imaging. SWI is sensitive to venous blood and hemorrhage so lesion conspicuity is improved with SWI and has benefits in

Figure 2A: T1W post contrast showing enhancement.
Figure 2B: SWI image showing occult venous disease in great details.



clinical routine. Standard angiograms can be avoided in cases of suspected cavernomas, as the confidence to diagnose on SWI images is excellent. Post contrast T1W images do show these abnormalities, but very small lesions (2–5mm) and associated venous angiomas are better visualized with SWI (Figure 2).

Trauma

Diffuse Axonal Injury (DAI) caused by shearing stress injuries can be demonstrated by SWI. Presence of hemorrhage indicates poor prognosis. SWI is an added advantage as it allows better resolution and sensitivity to hemorrhage.

Shaken Baby Syndrome

SWI helps to demonstrate presence of microscopic hemorrhages and shearing injuries particularly in the direction perpendicular to the corpus callosum with confidence.

Stroke

Demonstrating presence of hemorrhage in stroke guides selection of treatment options. Non-contrast CT is the most common imaging modality for detecting hemorrhage in stroke and T1W images provide valuable information. However, for non-hemorrhagic strokes after starting anticoagulant therapy and having a baseline MRI for these patients, SWI is an excellent method to monitor and follow-up these patients 2–3 days later. SWI helps the physician detect early complications of the therapy like a massive bleed, as SWI is sensitive to hemorrhage and the management can be altered sooner. SWI is also valuable in venous

infarcts and venous infarcts tend to be hemorrhagic.

Dementia

Dementia is a major problem in the aging population. Dementia associated with Alzheimer's Disease is associated with the presence of amyloid plaques and has been demonstrated using SWI on ultra high field MR systems. In the vascular type of Dementia associated with amyloid angiopathy, SWI demonstrates micro-hemorrhages in the vessel wall. The possibility of these micro-hemorrhages to lead to Dementia is currently being correlated. Hence SWI can play a big role in neuroscience research including diseases like Alzheimer's, MS and Dementia.

Tumor Vasculature

When surgical approach in a case of tumor resection is planned, imaging plays an important role. SWI shows the venous drainage pattern and the micro-circulation with high resolution. This information helps the surgeon to plan the route of the surgery.

AVMs

SWI has an important role in the management of AVMs, particularly with Gamma knife, as signs of early hemorrhage are picked up by SWI and further complications can be avoided.

Epilepsy Follow-up

In the follow-up of intractable causes of Epilepsy, SWI plays an important role to identify very small lesions particularly calcified neurocysticercosis, cortical calcifications, calcified tuberculoma or a cavernoma.

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