Session: “Everything you wanted to know about magnetic susceptibility and why it is important”

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Highlights: SWI is changing clinical medicine, and is no longer considered a “research tool”!

Talk title: Yes, It is Exciting but Where are the “Killer Apps”?

Target audience – those interested in using susceptibility-weighted imaging in clinical practice

Outcome/objectives – to identify clinical areas that benefit from the SWI technique, in order to have the most significant impact.

Discussion:

Susceptibility weighted imaging (SWI) has proven to be superior to conventional MRI in the evaluation of many neurological conditions:

• This is especially true for detection of hemorrhages in many disorders. Often the hemorrhages may only be visible on SWI, and diagnoses would not have been made correctly without this technique:
  o SWI better demonstrates the extent of traumatic brain parenchymal injury in the acute clinical setting.
  o SWI better demonstrates acute parenchymal hemorrhage in many conditions including coagulopathy, leukemia, hemorrhagic encephalitis, vasculitis.
  o SWI better demonstrates chronic microhemorrhages, which may be the only supporting evidence of some diseases (short of autopsy), such as amyloid angiopathy, but also in chronic hypertension, Alzheimer disease, post-radiation therapy, post-cardiac bypass.
  o SWI can even be used to detect hemorrhage in acute cervical spinal cord injury.
• SWI has also provides greater clinical information regarding stroke, even without the presence of hemorrhage.
  o SWI can show the location and extent of arterial thrombus in the setting of acute infarct, even without or possibly better than MRA.
  o SWI can show increased oxygen extraction in the setting of acute or chronic ischemia, or hypoxia; and can imply penumbra even without PWI.
  o SWI can show the location and extent of cortical venous thrombus, even possibly better than MRV.
  o SWI can help guide the management of stroke patients, whether for excluding patients from thrombolytic therapy, or for determining whether antiplatelet therapy may be required after thrombolytic treatment.
• SWI has been established as a superior technique for detecting and monitoring venous anomalies and vascular malformations of all types, including telangiectasias, cavernomas, Sturge-Weber syndrome, AVM or AVF.
• SWI has also been shown to improve the grading of gliomas and potentially distinguish between different types of brain tumors such as glioblastoma versus primary CNS lymphoma.
• SWI has dramatically improved the ability to diagnose neurodegenerative disorders, often associated with iron deposition or mineralization of the brain.

• SWI phase images can be used to clarify the etiology of hypointense foci that can be due to calcifications, microhemorrhages, iron deposition, or air.
• SWI can potentially be used to diagnose brain death and help guide issues of end-of-life care.

**SWI has also been shown to be useful in the evaluation of non-neurological disorders, elsewhere in the body.**
• To evaluate malignancies in the body including prostate cancer, hepatocellular carcinoma, renal cell carcinoma.
• To evaluate gynecological pathology such as endometriosis.
• To evaluate other abdominal pathology, such as splenic lesions associated with cirrhosis, portal hypertension or esophageal varices.

**The next stage of SWI is here, using Quantitative Susceptibility Mapping (QSM)**
• QSM has improved the understanding of anatomy and physiology of the brain, as well as other parts of the body.
• More “killer apps” will keep coming!

**References**


de Souza JM, Domingues RC, Cruz LC Jr, Domingues FS, Iasbeck T, Gasparetto EL. Susceptibility-weighted imaging for the evaluation of patients with familial cerebral cavernous malformations: a comparison with T2-weighted fast spin-echo and gradient-echo sequences. AJNR Am J Neuroradiol. 2008 Jan;29(1):154-8


