AbstractID: 12848 Title: A quantitative approach to extracting magnetic susceptibilities of small cylindrical objects in MRI

Purpose: Changes of venous blood oxygenation level lead to direct changes in the magnetic susceptibility of veins. The oxygenation level reflects the physiological state of a given vein. Therefore, susceptibility quantification of veins has been a strong interest in MRI [1]. Here we will demonstrate a general approach to extracting magnetic susceptibilities of narrow cylindrical objects and veins at arbitrary orientations from only two or three echoes of a standard 3D gradient echo sequence. **Method and Materials:** Our previous work [2] has accurately quantified effective magnetic moments of given cylindrical objects. If an object has no MR signal, its volume and susceptibility can be further determined [2]. When an object of interest (e.g., vein) has an MR signal, the susceptibility of the object and its volume may be uniquely quantified from our CISSCO method applied on images acquired with three different echo times. Simulations and phantoms of Gd-DTPA doped gel cylinders with diameters less than 5 pixels at arbitrary orientations were imaged at 1.5T. Several small isolated human cerebral veins were also measured from MR images. The uncertainties of magnetic susceptibilities were quantified by the error propagation method. **Results:** Differences of measured susceptibilities in simulations at echo time (TE) 14ms are within 15% of the input susceptibility (1 ppm). These differences agree very well with the uncertainties estimated from the error propagation method. The measured susceptibilities of diluted Gadolinium cylinders from echo time 14 ms images have uncertainties less than 15% estimated from the error propagation method. The measured susceptibilities of veins agree with the textbook value [3] within 16%. **Conclusion:** Simulations, phantom studies, and *in-vivo* measurements demonstrate our approach can be used to accurately quantify the magnetic susceptibility of a given narrow and long cylindrical object. Ref:[1]Sedlacik et.al, MRM,2007,pp.1035-44.[2]Cheng et.al, PMB, 2009,pp.7025-7044.[3]Haacke et.al, MRI, 1999.