**Abstract**

**Purpose:**
To investigate the sensitivity of a CBV-based MR technique, vascular space occupancy (VASO) imaging, in the detection of vasodilatation during different durations of breath holding (BH) and its clinical feasibility as compared with BOLD MRI.

**Method and Materials:**
Experiments were performed on a 1.5T Siemens MRI scanner. For VASO, a non-slice-selective IR-GE-EPI was used with TR/TE/TI = 2000/9.3/665 ms, SW = 6 mm and in-plane resolution = 3 mm. For BOLD, a GE-EPI was used with TR/TE = 2000/60 ms. Two normal volunteers each performed 4 experimental runs, including two-cycle 30-s and 15-s BH each for BOLD and VASO. CNRs of were determined from ROIs drawn within the thalamus. A similar protocol was also carried out in a patient with right frontal anaplastic astrocytoma to review clinical feasibility.

**Results:**
Positive BOLD signal changes were noted during 30-s and 15-s BH (4.9 and 2.2 %), and the CNRs were 4.0 and 2.5. VASO method was able to detect CBV related negative signal changes (-3.1 and -1.8%, for 30-s and 15-s BH), and the CNRs were 2.3 and 1.8. Initial analysis of the patient data set revealed negative intra-tumoral BOLD signal changes. While the global pattern of the VASO map agreed well with BOLD, the extent of intra-tumoral changes was smaller. The BOLD map was then re-thresholded to a lower p-value which demonstrated intra-tumoral changes similar to those with VASO.

**Conclusions:**
CNRs of VASO were lower than those from BOLD. However, they were closer to BOLD (58 and 72% for 30-s and 15-s BH) than previously published results from visual stimulation (~ 30%). Discrepancies between two techniques in the clinical case were likely resulted from the differences in sensitivity. However, given that CBV-based signal change is more directly related with the vasomotor response, it could potentially be more clinically relevant.