



Supplementary Figure 2. Ex vivo blood relaxation times. The two blood samples shown were taken from a patient with sickle cell anemia (left) and from a healthy control volunteer (right). Both samples (4 mL) were obtained via venipuncture, combined with anticoagulant, inserted into a 37 Celsius semi-solid suspension for coil loading and susceptibility artifact mitigation, and scanned within one hour. Temperature was maintained at near-physiological temperature using a warm water pump (temperature=36±2 Celsius). Blood measurements were recorded immediately before the approximately 15 minute scan (VetScan i-STAT 1 Handheld Analyzer, Abaxis, Union City, CA, USA) and HbS fraction was determined separately at the Vanderbilt Hematology Laboratory. Oxygenation and hematocrit values were near identical, with only the percentage of hemoglobin S significantly different. Localized volume shimming was performed over the samples. For T1 measurement (field-of-view = 80x80x3 millimeters; spatial resolution=1.25x1.25x3 millimeters), an inversion recovery sequence with eight inversion times (0.01-5 seconds) with constant recovery time = 8 seconds was used. For T2 determination (field-of-view=80x80x2 millimeters; spatial resolution = 1.25x1.25x2 millimeters), the same four effective echo times and T2-relaxation-under-spin-tagging protocol as described in the text were used, with only the field-of-view reduced and spatial resolution increased. (A) Cross-sectional T1 maps, (B) T1 recovery curves, and (C) T2 decay curves. Both T1 and T2 were similar, indicating that HbS itself may exhibit only a moderate influence on blood water relaxation times. Note that a difference in blood T1 of nearly half a second would be required to account for the discrepancy in cerebral blood flow between patients and controls observed in our study. These values are also within error of what has been reported for healthy blood for similar hematocrit and oxygenation levels. However, additional work is necessary to discern small differences in hemoglobin, oxygenation, and T2 relationships over a larger range of values, and also possibly in vivo where velocity could influence these parameters.