

Stroke imaging at 8 Tesla MRI

V. Novak¹, A. M. Abduljalil², P. Novak³, D. Chakeres²

¹Beth Israel Deaconess Medical Center, Harvard Medical School, Boston, Massachusetts, United States, ²Ohio State University, Columbus, Ohio, United States, ³Dept. of Neurology, Boston University, Boston, Massachusetts, United States

Summary:

High field MRI at 8T offers increased resolution for visualization of infarct site and stroke diagnosis. Fourteen patients with the first ischemic stroke or transient ischemic attack (TIA) were studied using 8T and 1.5T MRI. Gradient echo images (GE) at 8T revealed infarct as a high signal area, often surrounded by a low signal area suggestive of iron deposits. In addition, infarct was found in 2 TIA patients with normal 1.5T MRI. Additional white matter lesions and incidental angiomas were observed. High resolution MRI at 8T may increase sensitivity for infarct visualization and reveal features underlying pathophysiology of stroke.

Introduction:

Stroke is the leading cause of death in the US and the leading cause of disability.

Hypertension, age and sex are known risk factors that may predispose cerebral circulation for stroke. TIAs are common with hypertension and often hallmark stroke.

Subjects and Methods:

We studied 14 patients with the first ischemic stroke (N=9) or TIA (N=5) (mean age 50.9 ± 7.5 years aged 35-65 years with minimal neurological deficit, >2 months after acute onset, (Rankin score <4). 1). Imaging was performed using 8 Tesla MR instrument. Gradient echo (GE) and RARE images were acquired. The GE images were acquired with the following parameters: slice thickness = 5 mm, TR=528.3 ms, TE=7ms, matrix 512x340. The RARE images parameters are: slice thickness 5 mm, N=16, TR = 5000ms, TE=18 ms matrix 1024x024, 512x512 and 256x256. T1 and T2 weighted FSE and FLAIR images at 1.5 were repeated in 10 patients within 1 week of the acquisitions of the 8T images.

Results:

The scans at 8T revealed infarct as a sharply demarcated area of high signal with size and location similar to the 1.5 T images (Figure 1). A low signal area surrounding the lesion and extending beyond the infarct site that was suggestive of iron deposits. Microvascular supply and revascularization of the infarct site was also visualized. Left temporal infarcts were found in 2 TIA patients with normal 1.5T MRI (48 yr old and 63 yr old F) presenting transient symptoms of right sided weakness that resolved prior to admission. Several periventricular and cortical areas of abnormal signal were also visualized in the 8T images that were not apparent at 1.5T. High resolution at 8T also enabled visualization of a cascade of minute white matter changes, suggestive of embolic origin in another patient. Small penetrating vessel and MCA branches appeared to have an asymmetric pattern compared to normal volunteers.

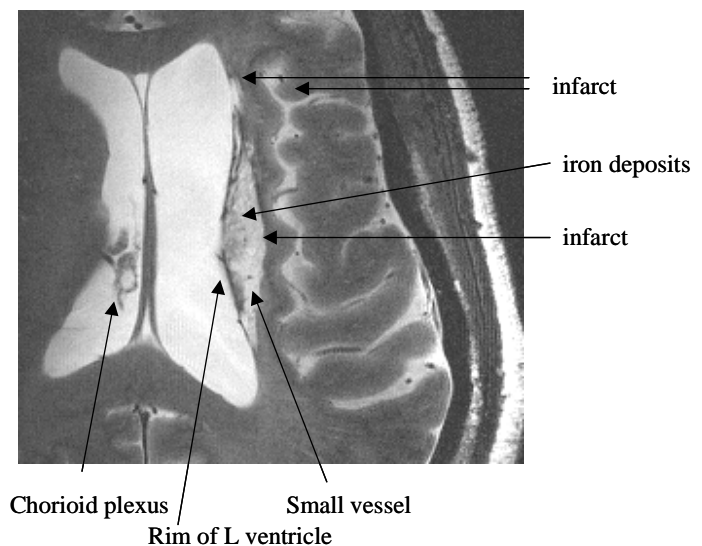


Figure 1. RARE image acquired at 8T with slice thickness of 2 mm.

Conclusion:

This study shows that 8 T MRI study may reveal the pathologies in a different fashion and reveal abnormalities that are not apparent at the lower magnetic field.