Cerebral microbleeds on MRI: comparison between 1.5 and 7 Tesla

M. M. Conijn[1], M. I. Geerlings[2], G-J. Biessels[2], T. Takahara[2], T. D. Witkamp[2], J. J. Zwanenburg[2], P. R. Luijten[2], and J. Hendrikse[2]
[1]Radiology, University Medical Center Utrecht, Utrecht, Netherlands, [2]University Medical Center Utrecht

Introduction

Increasing interest in microbleeds has resulted in an increasing number of studies addressing its prevalence and clinical relevance. Prevalence estimates differ substantially between studies, which in part may be explained by differences in image protocols and field strengths. At ultra-high field strengths, such as 7T, the susceptibility effect will increase as will the signal to noise ratio (SNR). This increase in SNR can be used for higher spatial resolution with increased conspicuity of small haemosiderin deposits that may be obscured by partial volume effects at lower field strengths operating at lower spatial resolution. The purpose of this study was to compare the visualization of microbleeds with T2*-weighted imaging on 1.5T with dual echo T2*-weighted imaging at 7T and assess the reliability of the detection of microbleeds with the two field strengths.

Methods

Thirty-four patients (29 male, mean age 58 ± 12 years) with vascular risk factors or vascular disease from the Second Manifestations of ARTerial disease (SMART) study were included. 3D T2*-weighted imaging at 1.5T (TR 25ms, TE 35ms, resolution 0.8x0.8x0.8mm^3, matrix 276x226, 125 slices) and 3D dual echo T2*-weighted imaging at 7T (TR 20ms, TE 2.5/15ms, resolution 0.35x0.4x0.6 mm^3, matrix 508x399, 167 slices) were done in all patients. Presence and number of definite microbleeds were scored on minimal intensity projections by two observers. Inter- and intra-observer reliability were assessed with the intraclass correlation coefficient (ICC). The difference in presence and number of microbleeds was tested with McNemar's test and Wilcoxon signed rank test.

Results

The inter-observer ICC for number of microbleeds at 7T was 0.61 and the intra-observer ICC was 0.94, whereas at 1.5T the inter-observer ICC was 0.50 and the intra-observer ICC 0.59. Microbleeds were detected in significantly more patients on 7T (50%) than on 1.5T scans (21%) (p=0.001). The number of microbleeds was also higher at 7T (median 0.5, range 0-5) than on 1.5T (median 0.0, range 0-6) (p=0.002). Figures 1 and 2 show examples of microbleeds that were scored at 7T, but not at 1.5T.

Conclusion

3D dual echo T2*-weighted imaging at 7T results in detection of microbleeds in more patients, detection of a higher number of microbleeds better and more reliable detection of microbleeds compared to 3D T2*-weighted imaging at 1.5T.

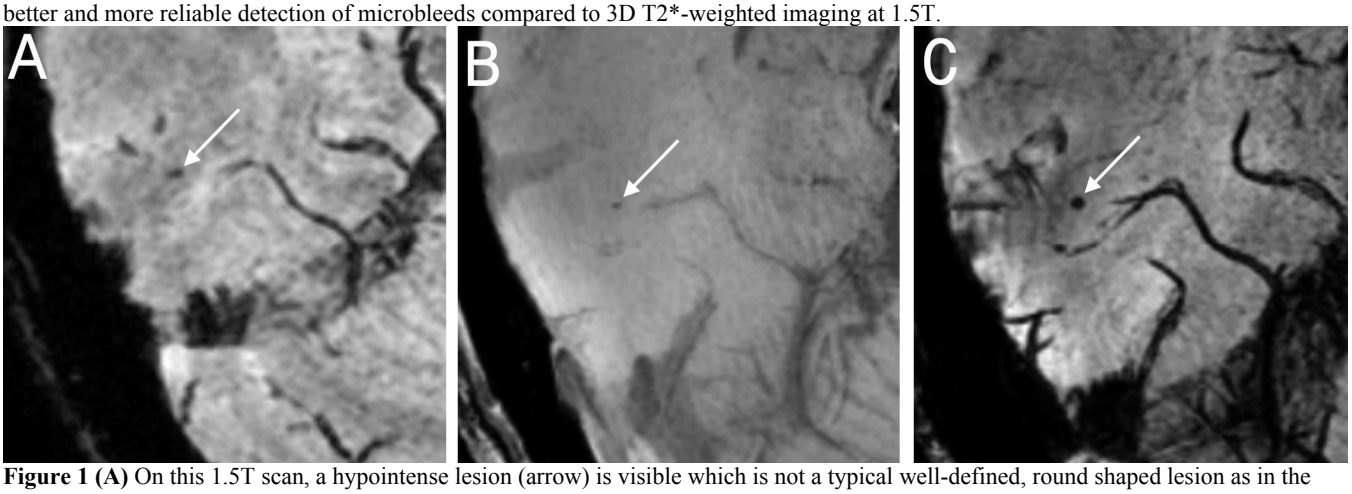

Figure 1 (A) On this 1.5T scan, a hypointense lesion (arrow) is visible which is not a typical well-defined, round shaped lesion as in the definition of a microbleed. This lesion was not scored as a microbleed on the 1.5T scan by the observers. In **B** and **C** this same lesion is visible on the 7T scan. On the first echo image **(B)** is it is visible as a faint round hypointensity and on the second echo **(C)** as a clearly visible round hypointensity (arrow).

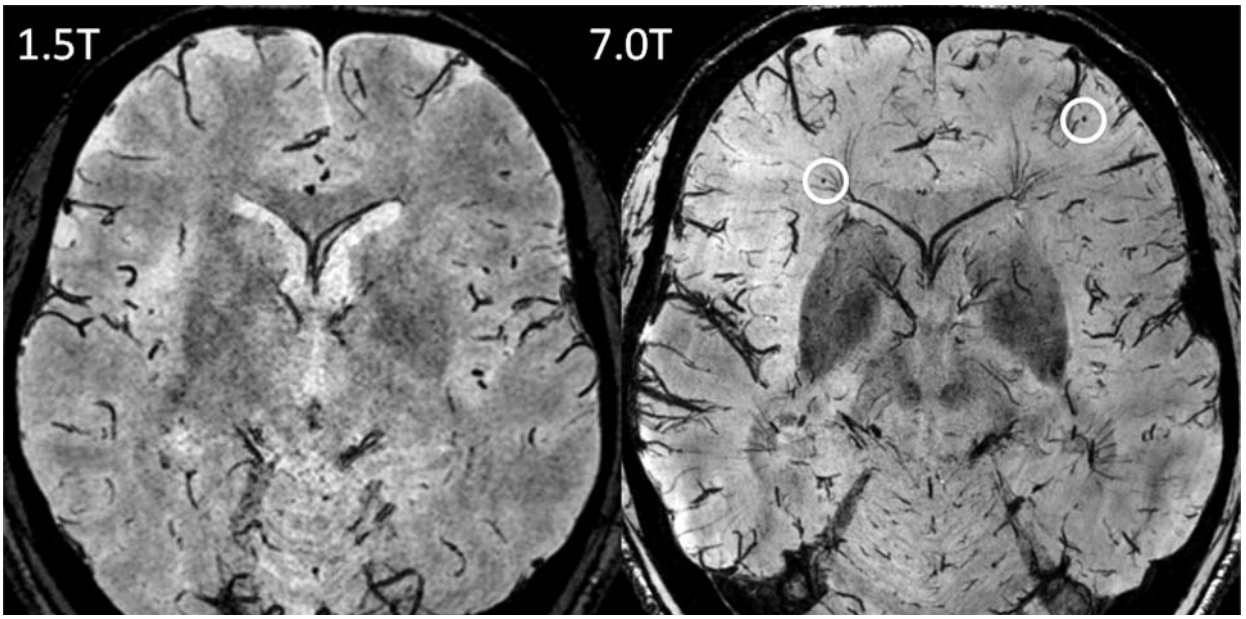

Figure 2 On the 7T scan on the right, two microbleeds can be seen (circles), which are not visible on the 1.5T scan.