Detection of cerebral microbleeds with dual echo T2*-weighted MR imaging at 7.0 Tesla

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Introduction

Increasing interest in microbleeds had led to an increasing number of studies addressing its prevalence and clinical relevance. Prevalence estimates differ substantially between studies, due to differences in image protocols and field strengths. This study assessed the visualization of cerebral microbleeds with dual echo T2*-weighted imaging at 7.0 Tesla magnetic resonance imaging (MRI).

Methods

Ten consecutive participants (8 men, 2 women, mean age 54 ± 12 years) with vascular disease or vascular risk factors from the Second Manifestations of ARTerial disease (SMART) study were included. Dual echo T2*-weighted scans (echo time: 2.5/15.0 ms) were made for all participants at 7.0 Tesla MRI. The number of visible microbleeds and the diameter of the microbleeds were recorded for both echo times. Microbleeds were evaluated on minimal intensity projection (minIP) images of both echoes. By combining the maximum intensity projection (MIP) with the minIP of the first echo image only, a perfect match could be obtained of an image displaying arteries and microbleeds in a single scan.

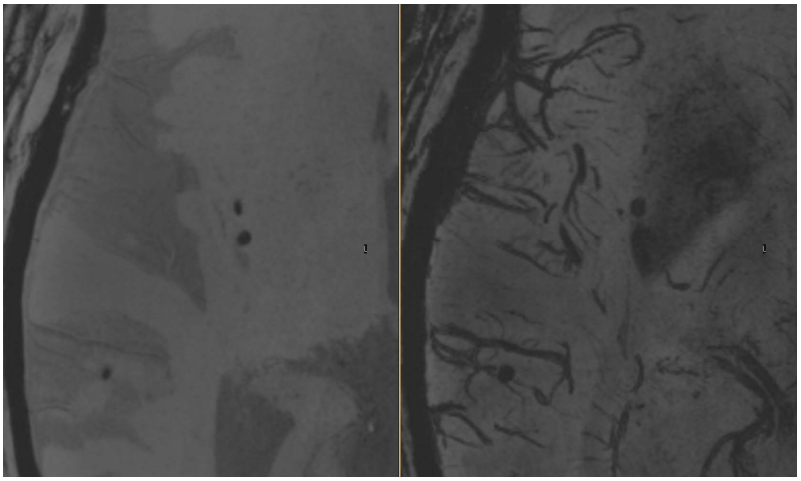

Figure 1
The first echo image (left) shows a large contrast between the microbleeds and the surrounding tissue. The microbleed is clearly visible on the first echo image, but it is hardly detectable on the second echo image (right).

Results

The first echo image shows dark microbleeds against a homogeneous, more hyperintense signal of the brain tissue including veins and basal ganglia (figure 1). On the combined images (MIP and minIP) of the first echo, the relation between the arteries and the microbleeds can be shown (figure 2). In 8 patients microbleeds were observed, with a total of 104 microbleeds. Of these, 88 (84.6%) were visible on the first and 102 (98.0%) on the second echo image. The mean diameter of the microbleeds was 1.24 mm for the first echo and 2.34 mm for the second echo (figure 3).

Conclusion

T2*-weighted imaging at two echo times combines the large contrast between the microbleeds and the surrounding tissue at the first echo time and the larger size of the microbleeds at the second echo time for the visualization of microbleeds at 7.0 Tesla MRI. Furthermore, additional information about the relation between both arteries and microbleeds can be obtained from this scan. Visualization of microbleeds and information about their relation with arteries and veins may be relevant for a better understanding of cerebral microbleeds.

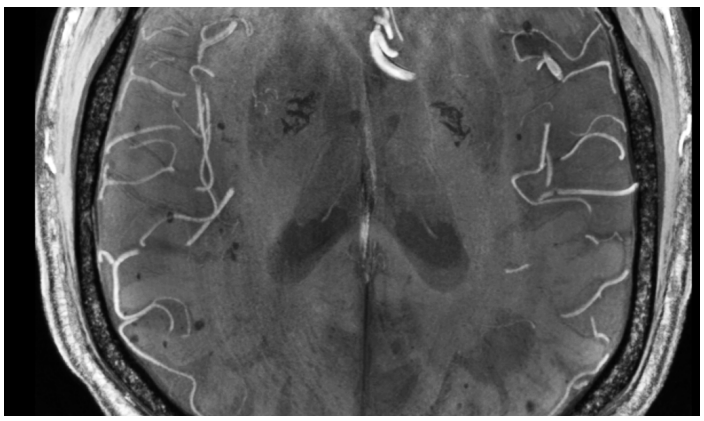

Figure 2
The combination of the MIP and minIP of the first echo shows the relation between arteries and microbleeds (arrows)

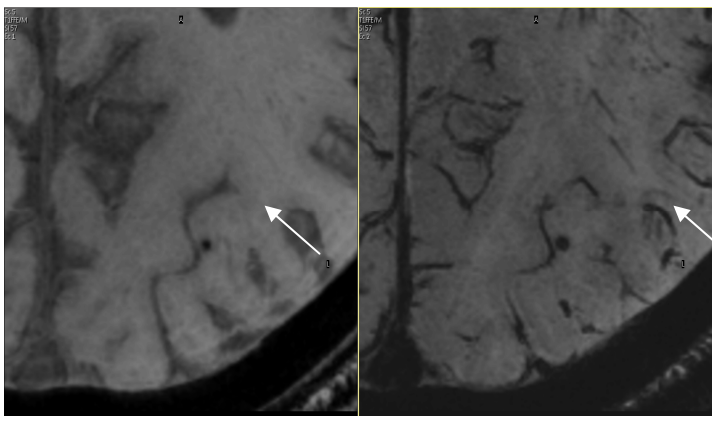

Figure 3
The minimal intensity projection (minIP) of the first echo on the left shows a smaller microbleed than the minIP of the second echo on the right (arrows).