Cerebral microbleed diagnosis

The diagnosis of cerebral microbleeds (CMBs) often involves advanced imaging techniques, as these tiny bleeds may not be visible on standard CT (computed tomography) or traditional MRI (magnetic resonance imaging) scans. The two primary imaging methods used for detecting cerebral microbleeds are:

Gradient Echo Imaging (GRE): Also known as susceptibility weighted imaging (SWI), GRE is a specific MRI sequence that is highly sensitive to paramagnetic substances such as hemosiderin, a byproduct of blood breakdown. Cerebral microbleeds appear as small, round or ovoid hypointense (dark) lesions on GRE images.

T2-Weighted MRI:* Similar to GRE, T2*-weighted imaging is another MRI sequence that can be used to detect microbleeds. The dark signal on these images indicates the presence of blood products.

These imaging techniques are particularly useful in detecting small hemorrhages in the brain, including microbleeds. It's important to note that the clinical significance of microbleeds depends on various factors, including their location, number, and the underlying cause. Some common conditions associated with cerebral microbleeds include cerebral amyloid angiopathy (CAA), hypertensive vasculopathy, and other vascular disorders.

The ability to accurately assess the degree of bleeding in an SAH model is crucial for understanding the brain-damage mechanisms and developing therapeutic strategies. However, current methods are unable to monitor microbleeding owing to their limited sensitivities. Herein, a new bleeding assessment system using a bioprobe TTVP with aggregation-induced emission (AIE) characteristics is demonstrated. TTVP is a water-soluble, small-molecule probe that specifically interacts with blood. Taking advantage of its AIE characteristics, cell membranes affinity, and albumin-targeting ability, TTVP fluoresces in bleeding areas and detects the presence of blood with a high signal-to-noise (S/N) ratio. The degree of SAH bleeding in an endovascular perforation model is clearly evaluated based on the intensity of the fluorescence observed in the brain, which enables the ultrasensitive detection of mirco-bleeding in the SAH model in a manner that outperforms the current imaging strategies. This method serves as a promising tool for the sensitive analysis of the degree of bleeding in SAHs and other hemorrhagic diseases [1)]

They appear as small, hypointense lesions on T2-weighted images.

When cerebral microhemorrhages are diagnosed on MRI, conclusions regarding their significance and associated risks should be made based on the population examined. Further studies to characterize the associated risks of cerebral microhemorrhages in different stroke populations are needed to use this new imaging marker in therapeutic decisions [2)].

Cerebral microbleed (CMB) detection impacts disease diagnosis and management. Susceptibility-weighted imaging (SWI) MRI depictions of CMBs are used with phase images (SWIP) to distinguish blood from calcification, via qualitative intensity evaluation (bright/dark). However, the intensities

depicted for a single lesion can vary within and across consecutive SWIP image planes, impairing the classification of findings as a CMB.

Quantitative susceptibility mapping (QSM) MRI, which maps tissue susceptibility, demonstrates less in- and through-plane intensity variation, improving the clinician's ability to categorize a finding as a CMB. QSM more consistently demonstrates interpretable lesion intensity compared to SWIP as used for distinguishing CMBs from calcification [3].

1)
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2)
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3)
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