Cerebral microbleed

Epidemiology

The prevalence of cerebral microbleeds is high.

Etiology

Cerebral Microbleed Etiology.

Traumatic brain injury-induced cerebral microbleeds

Diagnosis

Cerebral microbleed diagnosis.

Complications

Emerging evidence from both clinical and preclinical studies underscores the role of aging in potentiating the detrimental effects of hypertension on cerebral microhemorrhages (CMHs, or cerebral microbleeds). CMHs progressively impair neuronal function and contribute to the development of vascular cognitive impairment and dementia. There is growing evidence showing accumulation of senescent cells within the cerebral microvasculature during aging, which detrimentally affects cerebromicrovascular function and overall brain health. Faakye et al. postulated that this build-up of senescent cells renders the aged cerebral microvasculature more vulnerable, and consequently, more susceptible to CMHs. To investigate the role of cellular senescence in CMHs' pathogenesis, they subjected aged mice, both with and without pre-treatment with the senolytic agent ABT263/Navitoclax, and young control mice to hypertension via angiotensin-II and L-NAME administration. The aged cohort exhibited a markedly earlier onset, heightened incidence, and exacerbated neurological consequences of CMHs compared to their younger counterparts. This was evidenced through neurological examinations, gait analysis, and histological assessments of CMHs in brain sections. Notably, the senolytic pre-treatment wielded considerable cerebromicrovascular protection, effectively delaying the onset, mitigating the incidence, and diminishing the severity of CMHs. These findings hint at the potential of senolytic interventions as a viable therapeutic avenue to preempt or alleviate the consequences of CMHs linked to aging, by counteracting the deleterious effects of senescence on brain microvasculature [1)]

Cerebral microbleed complications

Systematic review

Cordonnier et al., reviewed and critically appraised the published literature according to QUADAS, STARD and Cochrane principles. The selection criteria were met by 54 studies of 53 case series involving 9073 participants, 4432 of whom were people with cerebrovascular diseases. There were significant biases in many of the studies: variation in MRI magnet strength, flip angle, slice gap and slice thickness; inconsistent definitions of BMB size (23% did not define size at all, and of those that did 44% chose a diameter of < or =5 mm); only 30% included participants who were representative of the disease under study; and only 53% mentioned that BMB evaluation was blinded to other factors of interest. By pooling data from similar studies, we found that the prevalence of BMBs was 5% [95% confidence interval (CI) 4-6] in healthy adults, 34% (95% CI 31-36) in people with ischaemic stroke, and 60% (95% CI 57-64) in people with non-traumatic Intracerebral hemorrhage (ICH). In the studies where a distinction could be made, BMBs were more prevalent among recurrent strokes than first-ever strokes: they affected 23% (95% CI 18-29) with first-ever ischaemic stroke but 44% (95% CI 34-54) with recurrent ischaemic stroke, and 52% (95% CI 47-56) with first-ever ICH but 83% (95% CI 71-90) with recurrent ICH. By pooling data that could be extracted from similar studies, it appears that BMBs are associated with hypertension (OR 3.9, 95% CI 2.4-6.4) and diabetes mellitus (OR 2.2, 95% CI 1.2-4.2) in otherwise healthy adults, and that they are associated with hypertension (OR 2.3, 95% CI 1.7-3.0) in adults with cerebrovascular diseases. The association with hypertension was robust in sensitivity analyses. There is a pressing need for better designed studies to assess the diagnostic utility of BMBs, disentangle the many likely influences on their occurrence, and determine their prognostic utility and whether they should influence treatment. They conclude by proposing criteria for ideal study design and reporting [2)].

Case series

A total of 1847 patients with unruptured and ruptured intracranial aneurysm from January 2010 to November 2017 were included in this cross-sectional study. Their clinical records and images, including the preoperative presence of CMBs identified by T2-weighted gradient-recalled-echo sequence on magnetic resonance imaging (MRI) were evaluated. Univariate analysis and multivariate logistic regression were done to determine which parameters are independent factors for aneurysm rupture. The incubation period of CMBs related intracranial aneurysm rupture was also evaluated.

CMBs confirmed by MRI were present in 142 patients, with 7.7% incidence rate (142/1847). Of the total 142 patients with CMBs, 56 patients (including 17 ruptured anrueysms) received endovascular treatment, and other 86 consecutive patients who did not receive emobilization or surgery due to various reasons were followed for 3-49 months. The incidence of CMBs related intracranial aneurysm rupture was 27.9% (24/86) during the follow-up. The incubation period of CMBs related intracranial aneurysm rupture varies from 3 to 27 months (median month, 9.5 months). Multivariate analyses showed CMBs is significantly correlated with the intracranial aneurysm rupture (OR 1.6, 95%C.I. 1.1 to 2.4, P=0.010).

CMBs is independently associated with the intracranial aneurysm rupture. Patient with CMBs has the increased 60% risk of aneurysm rupture than those without [3)].

1)
Faakye J, Nyúl-Tóth Á, Muranyi M, Gulej R, Csik B, Shanmugarama S, Tarantini S, Negri S, Prodan C, Mukli P, Yabluchanskiy A, Conley S, Toth P, Csiszar A, Ungvari Z. Preventing spontaneous cerebral microhemorrhages in aging mice: a novel approach targeting cellular senescence with ABT263/navitoclax. Geroscience. 2023 Dec 4. doi: 10.1007/s11357-023-01024-9. Epub ahead of print. PMID: 38044400.
2)

Cordonnier C, Al-Shahi Salman R, Wardlaw J. Spontaneous brain microbleeds: systematic review, subgroup analyses and standards for study design and reporting. Brain. 2007 Aug;130(Pt 8):1988-2003. Review. PubMed PMID: 17322562.
3)
Zhang X, Yao ZQ, Karuna T, Duan CZ, Wang XM, Li XF, Yin JH, He XY, Guo SQ, Chen YC, Liu WC. Cerebral Microbleeds Could be Independently Associated with the Intracranial Aneurysm Rupture: A Cross-Sectional Population-Based Study. World Neurosurg. 2018 Apr 11. pii: S1878-8750(18)30734-4. doi: 10.1016/j.wneu.2018.04.018. [Epub ahead of print] PubMed PMID: 29654957.