Cerebral microbleeds on brain MRI in the general elderly population: prevalence and relation to small vessel disease.

M. W. Vernooij[1,2], A. van der Lugt[1], M. A. Ikram[2], P. A. Wielopolski[1], A. Hofman[2], G. P. Krestin[1], and M. M. Breteler[2]

[1]Radiology, Erasmus MC, Rotterdam, Netherlands, [2]Epidemiology & Biostatistics, Erasmus MC, Rotterdam, Netherlands

Background

Cerebral microbleeds (CMB) can be visualized with T2*-weighted gradient echo magnetic resonance imaging (T2*GRE MRI). In clinical studies, CMBs indicate an increased risk of stroke, both ischemic and hemorrhagic. Little is known on the prevalence of CMBs in the general population. Available data are based on conventional T2*GRE sequences, rather than on more sensitive susceptibility weighted imaging (SWI) [1, 2].

Objective

We conducted an MRI study in elderly persons, using high-resolution 3D SWI, to assess the prevalence of CMBs and their relation to small vessel disease.

Methods

The study is based on 895 participants (mean age 67.4; age range 61 to 92 years) from the Rotterdam Study, a population-based cohort study [3]. We performed a custom-designed 3D T2*GRE susceptibility-weighted MR-sequence (TR/TE 45/31ms; FA 13; matrix 320*224; slices 1.6mm; acquisition time 5:50 mins), with higher T2* weighting and smaller voxel size than commonly used 2D T2*GRE sequences, to increase the conspicuity of CMBs. 862 scans were of sufficient quality to analyze. Two raters scored the presence, location and number of CMBs. Intra-rater and inter-rater reliabilities were good to excellent. Brain infarcts were rated on a FLAIR sequence. White matter lesion (WML) volume was quantified using automated tissue classification [4]. Associations between small vessel disease and CMBs were assessed by logistic regression, adjusted for age and sex.

Results

One or more CMBs were seen in 179 (20.8%) persons, of whom 66 (37%) had multiple microbleeds. Figure 1 shows a typical example of the depiction of CMBs. Of participants with microbleeds, 78% had CMBs located in cortical grey and subcortical white matter, 25% in deep grey matter, and 23% infratentorial. The prevalence of CMBs increased with age (OR per year 1.06; 95% confidence interval (CI) 1.03-1.09). Persons 70 years of age or older had a prevalence of CMBs of 31.1% compared with 17.8% in those younger than 70. There was no gender difference for the prevalence of CMBs. Persons with lacunar infarcts were more likely to have CMBs than those without (age and sex-adjusted prevalence OR= 2.60; 95% CI 1.48-4.58). Also, persons who had a higher WML load more often had CMBs.

Conclusion

We found a high prevalence (20.8%) of CMBs in a general elderly population. This is three- to fourfold higher than was previously reported [1, 2]. The prevalence of CMBs increased with age. Persons with lacunar infarcts or a high WML load were more likely to have CMBs.

References

1.   Roob, G., et al., Neurology, 1999. **52**(5): p. 991-4.
2.   Jeerakathil, T., et al., Stroke, 2004. **35**(8): p. 1831-5.
3.   Ott, A., et al., Am J Epidemiol, 1998. **147**(6): p. 574-80.
4.   Vrooman, H.A., et al., in Proc. SPIE. Medical Imaging: Image process. 2006.

Figure 1.

a   b   c
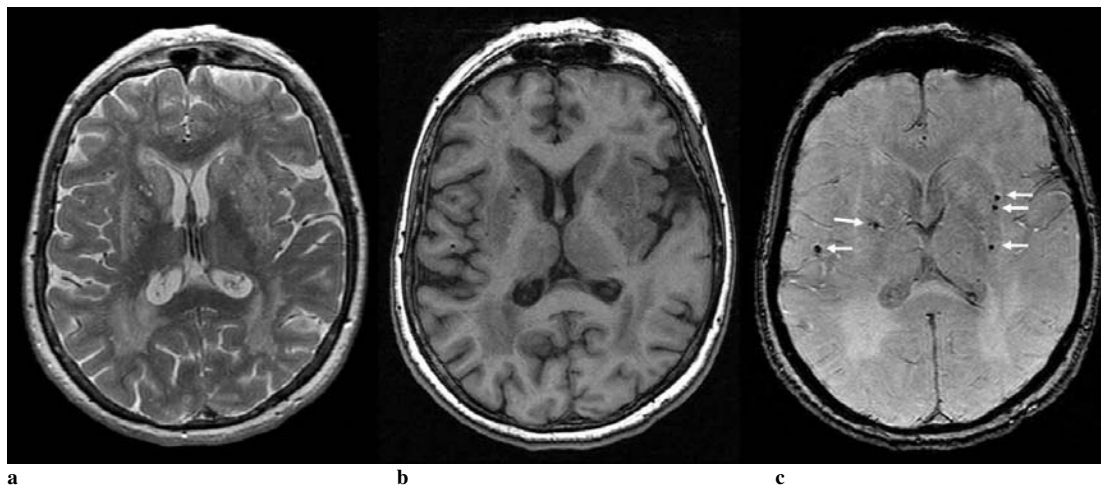
Proton density-weighted (a), T1-weighted (b) and 3D susceptibility-weighted imaging (SWI) (c) axial MRI images of a person with multiple cerebral microbleeds (white arrows). The cerebral microbleeds visible on the 3D SWI scan are not or barely visible on the proton density-weighted and T1-weighted scans.