

SVD score tool

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Purpose

Primary: continuous scale for grading SVD burden, for possible use in current as well as historical data.

Secondary: risk stratification of new stroke, dementia; correlation to life style factors.

 Only intended for research use currently

The following scoring system is not formally published and has not been through peer-review.

Scoring table

Table 1: SVD score table

MRI features	Raw score	Short score
Number of microbleeds ($T2^*/SWI$)		
0	0	0
1	1	1
2-4	2	1
5-10	3	1
>10	4	1
Location of microbleeds – no points ($T2^*/SWI$)		
Lobar, deep, or infratentorial (choose one or more)	L/D/I	-
Superficial siderose ($T2^*/SWI$)		
No siderosis	0	-
1 sulcus	1	-
>1 sulcus	2	-
Lacunes ($FLAIR$)		
0	0	0
1	1	1
2	2	1
3-5	3	1
>5	4	1
White matter hyperintensities – see Figure 1 ($FLAIR$)		
Absent	0	0
Punctate foci	1	0
Beginning confluence	2	1
Large confluent areas	3	1
Atrophy - see Figure 2 ($FLAIR/T1$)		
No	0	0
Mild	1	0
Moderate	2	1
Severe	3	1
Total SVD score	0-16	0-4

Setting

The scoring system is intended for use with acute MRI stroke scans. Scans are performed according to the acute stroke protocol at the given time of scan. Available sequences are DWI, ADC, 2D FLAIR, and $T2^*$ or SWI in our setting, but if available 3D FLAIR and T1 sequences should be used. Data capturing should reflect this, if data is later merged from different populations.

Scoring is performed independently by trained neurologists. Inter-rater-reliability-measures are performed to ensure validity.

Different suggested scores

Inspired by the scores from

Definitions on bio-markers

Definitions are mainly according to the STRIVE v1 criteria,(Joanna M. Wardlaw et al. 2013) with minor local specifications. The bio-markers included are within the suggestions from Markus et al. (2022) in the FINESSE framework.

Microbleeds

Sequence: T2*/SWI

Small (generally 2–5 mm in diameter, but sometimes up to 10 mm) areas of signal void with associated blooming seen on SWI-weighted MRI.

Different cut-offs are used in different trials.(Akoudad et al. 2016) We try to register in a way, so that our analysis can be made similarly to other studies and to provide enough resolution.

As discussions about the importance of location is ongoing,(Vernooij et al. 2008) we register if microbleeds are located lobar, deep, or infratentorial.

Superficial siderosis

Sequence: T2*/SWI

“Investigators should describe the location of siderosis (i.e., the number of sulci involved and in which lobes).”(Joanna M. Wardlaw et al. 2013, 828)

Lacunar infarcts

Sequence: 2D/3D FLAIR

“A round or ovoid, subcortical, fluid-filled cavity (signal similar to CSF) of between 3 mm and about 15 mm in diameter, consistent with a previous acute small subcortical infarct or haemorrhage in the territory of one perforating arteriole.”(Joanna M. Wardlaw et al. 2013, 825)

Additionally: “We identified asymptomatic lacunar infarcts as sharply demarcated hyperintense lesions <20 mm on T2-weighted images with corresponding hypointense lesions with a hyperintense rim on FLAIR. In lacunar stroke patients, the lesion could not be compatible with the clinical stroke.”(Huijts et al. 2013)

Based on the practice by Olama et al. (2020) and the 2021 ESO guidelines on covert small vessel disease, lacunes are counted 0, 1, 2, 3-5 and >5.(Joanna M. Wardlaw et al. 2021)

White matter hyperintensities

Sequence: 2D/3D FLAIR

The Fazekas subscale for deep white matter is used. The scale divides the white matter in periventricular and deep white matter, and each region is given a grade depending on the size and confluence of lesions.(Fazekas et al. 1987)

No regional differences is noted.(Groot et al. 2000) Scoring is performed with [visual reference](#) from [Radiopedia.org](#).

Atrophy

Sequence: 2D/3D FLAIR or T1

We follow definitions for the Global Cerebral Atrophy (GCA) score.(Harper et al. 2015)

A picture sample for reference is used.(Harper et al. 2015, fig. 1)

References

Akoudad, Saloua, Frank J. Wolters, Anand Viswanathan, Renée F. de Bruijn, Aad van der Lugt, Albert Hofman, Peter J. Koudstaal, M. Arfan Ikram, and Meike W. Vernooij. 2016. “Association of Cerebral Microbleeds With Cognitive Decline and Dementia.” *JAMA neurology* 73 (8): 934–43. <https://doi.org/10.1001/jamaneurol.2016.1017>.

- Fazekas, F, JB Chawluk, A Alavi, HI Hurtig, and RA Zimmerman. 1987. "MR Signal Abnormalities at 1.5 T in Alzheimer's Dementia and Normal Aging." *American Journal of Roentgenology* 149 (2): 351–56. <https://doi.org/10.2214/ajr.149.2.351>.
- Groot, J. C. de, F. E. de Leeuw, M. Oudkerk, J. van Gijn, A. Hofman, J. Jolles, and M. M. Breteler. 2000. "Cerebral white matter lesions and cognitive function: the Rotterdam Scan Study." *Annals of Neurology* 47 (2): 145–51. [https://doi.org/10.1002/1531-8249\(200002\)47:2%3C145::aid-ana3%3E3.3.co;2-g](https://doi.org/10.1002/1531-8249(200002)47:2%3C145::aid-ana3%3E3.3.co;2-g).
- Harper, Lorna, Frederik Barkhof, Nick C. Fox, and Jonathan M. Schott. 2015. "Using Visual Rating to Diagnose Dementia: A Critical Evaluation of MRI Atrophy Scales." *Journal of Neurology, Neurosurgery & Psychiatry* 86 (11): 1225–33. <https://doi.org/10.1136/jnnp-2014-310090>.
- Huijts, Marjolein, Annelien Duits, Robert J. van Oostenbrugge, Abraham A. Kroon, Peter W. de Leeuw, and Julie Staals. 2013. "Accumulation of MRI Markers of Cerebral Small Vessel Disease is Associated with Decreased Cognitive Function. A Study in First-Ever Lacunar Stroke and Hypertensive Patients." *Frontiers in Aging Neuroscience* 5: 72. <https://doi.org/10.3389/fnagi.2013.00072>.
- Markus, Hugh S., Wiesje M. van Der Flier, Eric E. Smith, Philip Bath, Geert Jan Biessels, Emily Briceno, Amy Brodtman, et al. 2022. "Framework for Clinical Trials in Cerebral Small Vessel Disease (FINESSE)." *JAMA Neurology* 79 (11): 1187. <https://doi.org/10.1001/jamaneurol.2022.2262>.
- Olama, Ali Amin Al, James M. S. Wason, Anil M. Tuladhar, Esther M. C. van Leijssen, Marisa Koini, Edith Hofer, Robin G. Morris, Reinhold Schmidt, Frank-Erik de Leeuw, and Hugh S. Markus. 2020. "Simple MRI Score Aids Prediction of Dementia in Cerebral Small Vessel Disease." *Neurology* 94 (12): e1294–1302. <https://doi.org/10.1212/WNL.0000000000009141>.
- Vernooij, M. W., A. van der Lugt, M. A. Ikram, P. A. Wielopolski, W. J. Niessen, A. Hofman, G. P. Krestin, and M. M. B. Breteler. 2008. "Prevalence and Risk Factors of Cerebral Microbleeds: The Rotterdam Scan Study." *Neurology* 70 (14): 1208–14. <https://doi.org/10.1212/01.wnl.0000307750.41970.d9>.
- Wardlaw, Joanna M, Stephanie Debette, Hanna Jokinen, Frank-Erik De Leeuw, Leonardo Pantoni, Hugues Chabriat, Julie Staals, et al. 2021. "ESO Guideline on Covert Cerebral Small Vessel Disease." *European Stroke Journal* 6 (2): CXI–CLXII. <https://doi.org/10.1177/23969873211012132>.
- Wardlaw, Joanna M., Eric E. Smith, Geert J. Biessels, Charlotte Cordonnier, Franz Fazekas, Richard Frayne, Richard I. Lindley, et al. 2013. "Neuroimaging Standards for Research into Small Vessel Disease and Its Contribution to Ageing and Neurodegeneration." *The Lancet Neurology* 12 (8): 822–38. [https://doi.org/10.1016/S1474-4422\(13\)70124-8](https://doi.org/10.1016/S1474-4422(13)70124-8).