

SVD score tool

2024-01-02


Table of contents

Purpose	1
Scoring	1
Setting	2
Definitions on biomarkers	3
Microbleeds	3
Superficial siderosis	3
Lacunar infarcts	3
White matter hyperintensities	4
Atrophy	4
References	4

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 1: SVD score table

MRI features	Raw SVD score value
Number of microbleeds ($T2^*/SWI$)	
0	0
1	1
2-4	2
5-10	3
>10	4
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
1-2	1
3-5	2
>5	3
White matter hyperintensities – see Figure 1 ($FLAIR$)	
Absent	0
Punctate foci	1
Beginning confluence	2
Large confluent areas	3
Atrophy - see Figure 2 ($FLAIR/T1$)	
No	0
Mild	1
Moderate	2
Severe	3
Total SVD score	0-15

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.

Definitions on biomarkers

Definitions are mainly according to the STRIVE v1 criteria,(Wardlaw et al. 2013) with minor local specifications.

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).”(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.”(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)

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>.
- 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., 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).