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Appraisal

Clinimetrics: The Scandinavian Stroke Scale

Summary

The Scandinavian Stroke Scale (SSS) is a clinical measure of functional impairment and activity limitations in patients with acute stroke. It was first presented by the Copenhagen Stroke Study Group in 1985.[1] The SSS consists of nine items measuring *consciousness, eye movement, arm motor power, hand motor power, leg motor power, orientation, speech, facial palsy* and *gait*.[1] Each item is scored on an ordinal scale with two to five categories, with item scores ranging from 2 to 12. In the original scale, unconscious patients could not be scored, as the lowest category in this item read: *reacts to verbal command, but is not fully conscious* (score 2).[1] However, a scale revision added the category *unconscious* (score 0).[2] Thus, sum scores range from 0 to 58 in the edited version, with 0 indicating severe neurological deficits and 58 indicating no neurological deficits. The SSS includes items that are of functional significance to the patients and are easy to assess.[1] Therefore, items such as dysarthria, visual field, sensation, and reflexes were omitted during scale development.[1] The SSS can be administered in < 5 minutes by non-specialists (ie, physiotherapists and nurses).[3] It is used worldwide and is available in multiple languages, including English,[1] Danish[4] and Portuguese.[5]

Reliability and validity: The internal consistency of items in the SSS is high (Cronbach's α: 0.91).[6] The interrater reliability of items is also good to excellent, with weighted Kappa coefficients ranging from 0.608 to 0.912.[7] The items with the strongest agreement are *gait* (κ: 0.912) and *speech* (κ: 0.860), while the items with the poorest agreement are *leg motor power* (κ: 0.688) and *facial palsy* (κ: 0.608). It is also possible to obtain reliable SSS scores based on information from medical records when compared with face-to-face assessment, with excellent agreement ($\kappa > 0.75$) except for *consciousness* (κ: 0.71) and *eye movements* (κ: 0.58).[8] The positive predictive value for the speech item is 0.55 (95% CI 0.23 to 0.83) when assessed by trained nurses compared to comprehensive assessments by speech and language therapists.[9]

Ninety-day SSS scores correlate with the National Institute of Health Stroke Scale (NIHSS) (r^2 = 81.2%), Barthel Index (r^2 = 72.3%) and modified Rankin Scale (r^2 = 76.9%).[10] However, interconversion models for SSS to NIHSS, accounting for age and gender, demonstrate that the relationship between SSS and NIHSS depends on the timing of measurement. In the acute phase, the adjusted r^2 = 0.60 whereas 90 days after stroke the adjusted r^2 = 0.80.[11] The SSS predicts 1-week mortality[3] and 3-month disability[12] with the same accuracy as the NIHSS scale. The area under the ROC curve is 0.76 for 1-week mortality[3] and 0.769 for 3-month disability.[12] Using a cut-off score of 36, the SSS predicts 1-week mortality with a sensitivity of 0.83 and specificity of 0.63[3] and using a cut-off score > 42 predicts 3-month disability with a sensitivity of 69.5% and specificity of 82.2%.[12]

Commentary

The SSS is a common measure of stroke impairment in acute care settings (eg, in Denmark it is mandatory to administer the SSS to all hospitalised patients with acute stroke or transient ischaemic attack), and is used in clinical trials and observational studies as a measure of neurological deficit. To our knowledge, the SSS did not undergo testing of its clinimetric properties during its development. However, subsequent studies have provided some information on the reliability, validity and internal consistency. Although the SSS has some predictive validity, the values are likely to be optimistic, as the predictions were not externally validated.

In comparison with other commonly used scales such as NIHSS, the SSS assesses gait but does not include items measuring ataxia, neglect or sensation. This facilitates ease of use and administration by non-specialists but could miss useful information that may assist in determining appropriate management and potential prognosis. Low inter-rater reliability has been reported in the item *facial palsy*,[7] likely due to the simplicity/ambiguity of the item, with categorisation as either *present facial palsy* or *none/dubious facial palsy*.[1] Furthermore, the speech item in the SSS has low positive predictive value, resulting in patients without aphasia being scored as having aphasia.[13]

The SSS is an easy-to-use measure of functional limitations in patients with stroke, which may be useful for clinical and research purposes. Further research investigating the clinimetric and prognostic properties of the SSS is warranted.

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