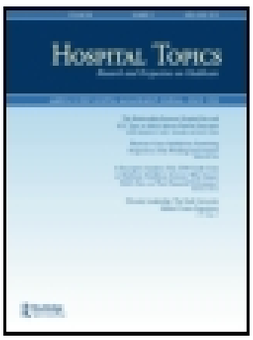

Hospital Topics

ISSN: 0018-5868 (Print) 1939-9278 (Online) Journal homepage: http://www.tandfonline.com/loi/vhos20

The National Institutes of Health Stroke Scale: Its Role in Patients with Posterior Circulation Stroke

Antonio Siniscalchi, Roman Sztajzel, Giovanni Malferrari & Luca Gallelli

To cite this article: Antonio Siniscalchi, Roman Sztajzel, Giovanni Malferrari & Luca Gallelli (2017): The National Institutes of Health Stroke Scale: Its Role in Patients with Posterior Circulation Stroke, Hospital Topics, DOI: 10.1080/00185868.2017.1322888

To link to this article: http://dx.doi.org/10.1080/00185868.2017.1322888

Published online: 23 May 2017.

HOSPITAL TOPICS
2017, VOL. 0, NO. 0, 1–3
https://doi.org/10.1080/00185868.2017.1322888

Taylor & Francis
Taylor & Francis Group

The National Institutes of Health Stroke Scale: Its Role in Patients with Posterior Circulation Stroke

Antonio Siniscalchi[a], Roman Sztajzel[b], Giovanni Malferrari[c], and Luca Gallelli[d]

[a]Department of Neurology, "Annunziata" Hospital, Cosenza, Italy; [b]Department of Neurology, University Hospital of Geneva, Geneva, Switzerland; [c]Stroke Unit, Department of Neurology, Santa Maria Nuova Hospital, Reggio Emilia, Italy; [d]Department of Health Science, School of Medicine, University of Catanzaro, Clinical Pharmacology and Pharmacovigilance Unit, Mater Domini University Hospital, Catanzaro, Italy

ABSTRACT
The National Institutes of Health Stroke Scale (NIHSS) is indispensable for both prognosis and treatment in patients with acute ischemic stroke. However, there is subtype of acute ischemic stroke (i.e., posterior circulation stroke) that is difficult to diagnose using the NIHSS. The authors report the limits of NIHSS in this stroke subtype, suggesting thereby the need to modify and render it more appropriate for the evaluation of the neurological signs occurring in posterior circulation stroke.

KEYWORDS
Acute ischemic stroke; NIHSS; posterior circulation; scale evaluation

Introduction

The National Institutes of Health Stroke Scale (NIHSS) is an impairment scale that may be administered quickly by physicians to evaluate the stroke severity before and after each treatment (Nouh, Remke, and Ruland 2014). However, it underestimates the clinical severity during a posterior circulation (PC) stroke (Nouh, Remke, and Ruland 2014).

A PC stroke is classically defined by infarction occurring within the vascular territory supplied by the vertebrobasilar arterial system. The vertebral arteries arise from the right and left subclavian arteries and travel cranially through the transverse foramina of the cervical vertebrae. When reaching the foramen magnum, they pierce the dura mater to start their intracranial course. Both vertebral arteries join at the pontomedullary junction forming the basilar artery. The most common etiologies of PC stroke are atherosclerosis, cardioembolism, and cervical artery dissections (Nouh, Remke, and Ruland 2014; Schulz and Fischer 2017), although other conditions (i.e., subclavian steal syndrome, giant cell arteritis, vertebrobasilar dolichoectasia, and Fabry disease) can be also involved (Nouh, Remke, and Ruland 2014; Siniscalchi 2016).

Mitochondrial encephalopathy, lactic acidosis, and stroke-like episodes; migraines; and posterior reversible encephalopathy syndrome also have a predilection for the PC (Nouh, Remke, and Ruland 2014; Markus, van der Worp, and Rothwell 2013; Siniscalchi 2016). Classical symptoms of PC stroke include vertigo, imbalance, unilateral or bilateral limb weakness, dysarthria, diplopia, headache, nausea, and vomiting. However, patients may also show signs and symptoms of multifocal PC strokes. Clinical findings include unilateral or bilateral limb weakness, gait ataxia, limb ataxia, dysarthria, and nystagmus. Infarcts involving the proximal PC territory usually cause dysphagia due to pharyngeal weakness, nausea, vomiting, and Horner's syndrome. Infarcts involving the middle territory are often associated with limb weakness, horizontal or vertical gaze palsy, and nuclear facial palsy. More distal territory infarctions are commonly associated with sensory loss, lethargy, and visual field defects (Schulz and Fischer 2017; Searls et al. 2012). Even if asterixis has been reported in patients with ipsilateral cerebellar infarction, it is not yet considered a neurological sign of cerebellum infarction (Siniscalchi et al. 2012). Patients typically have more than one finding and rarely have an isolated symptom or sign of PC ischemia (Savitz and Caplan 2005). The severity of clinical presentation is related to the site of occlusion; the most devastating location is the midbasilar occlusion that induces a bilateral pontine ischemia. These patients appear comatose but they can be fully

CONTACT Antonio Siniscalchi anto.siniscalchi@libero.it Department of Neurology, Annunziata Hospital, Via F. Migliori, 1, 87100 Cosenza, Italy.

conscious and paralyzed with only limited vertical eye movements (Siniscalchi et al. 2017). Acute treatment options for PC stroke include intravenous recombinant tissue plasminogen activator, intra-arterial fibrinolysis, and endovascular thrombectomy (Nouh, Remke, and Ruland 2014). The management of acute ischemic stroke is primarily governed by time from last known moment of good health and comorbidity. Within the therapeutic treatment window, stroke severity score based on NIHSS plays an important role. The NIHSS is the most commonly used scoring system for quantification of neurologic deficits after acute stroke (Meyer et al. 2002; Pezzella et al. 2013) and it is an indispensable tool for the determination of acute stroke prognosis and decision making (Pezzella et al. 2013). Patients with PC strokes often present lower NIHSS scores, which may also result in the withholding of thrombolytic treatment from these patients (Inoa et al. 2014). However, whether these lower initial NIHSS scores predict better long-term prognoses is uncertain. To clarify this point Inoa et al. (2014) performed a retrospective study to assess the predictive value of the NIHSS in anterior circulation (AC) versus PC strokes on the functional outcome at three months (Inoa et al. 2014). The authors enrolled 1,197 patients with AC stroke and 372 with PC stroke with a median initial NIHSS score of 7 for patients with AC strokes and 2 for patients with PC strokes (i.e., the median NIHSS score on admission was five points lower in patients with PC strokes). In this study, about 71% of patients with PC stroke have baseline NIHSS scores ≤ 4, and 15% of these patients have a poor outcome at three months. To determine whether the accuracy of the NIHSS for predicting outcomes differed depending on the location of the infarction a receiver-operating characteristic curves for the two stroke distributions were constructed and the area under the curve was calculated. This receiver-operating characteristic curve analysis identified that the optimal NIHSS cutoff for outcome prediction was eight for AC stroke and 4 for PC stroke. To achieve $>80\%$ sensitivity for detecting patients with a subsequent poor outcome, the NIHSS cutoff for AC stroke was 4 whereas for PC stroke it was 2.

Conclusion

The NIHSS cutoff that predicts outcomes is 4 points higher in AC compared with PC infarctions. There is potential for poor outcomes in patients with PC strokes and low NIHSS scores, suggesting that in these patients thrombolytic treatment should not be withheld considering solely the NIHSS.

Previous studies reported that NIHSS has a good correlation with the middle cerebral artery territory size infarct but underestimates clinical severity in PC stroke (Gur et al. 2007). In fact, symptoms such as limb ataxia and cranial nerve palsies receive fewer points, whereas other PC findings (e.g., truncal ataxia and nystagmus) are not measured in PC strokes (Nouh, Remke, and Ruland 2014; Schulz and Fischer 2017). Sato et al. (2008) reported that the cutoff score of the baseline NIHSS for a favorable chronic outcome was relatively low in patients with PC stroke compared with patients with AC stroke. Patients with PC strokes may have an unfavorable three-month outcome despite relatively low NIHSS scores (Sato et al. 2008). Although some items related to the vertebrobasilar system can be scored, other elements receive no score (e.g., diplopia, dysphagia, gait instability, hearing, nystagmus). A specific scale for PC (Israeli Vertebrobasilar Stroke Scale; Gur et al. 2007), a scale for the emergency triage (Emergency Triage Stroke Scale; Lyden et al. 1999), or the modified NIHSS derived from the NIHSS by deleting redundant items have been proposed (Whelley-Wilson and Newman 2004). Recently, Olivato et al. (2016) reported that the expanded NHISS could improve the sensitivity of NIHSS in PC stroke and could have an impact on clinical trials as well as on outcomes. A limitation of this study is the fact that it is a pilot study limited by a small number of patients who lack long-term disability follow-up. PC infarcts represent a heterogeneous group of strokes with various clinical presentations, which cannot be captured as deficits on the NIHSS. In an emergency department from an academic and community hospital, 103 of 465 ischemic stroke patients were misdiagnosed. Of these, 33% revealed a PC stroke compared with only 16% of AC strokes. The authors reported that atypical symptoms, such as nausea or vomiting as well as dizziness, associated with PC strokes may lead to misdiagnoses (Arch et al. 2016). Furthermore, the presence of a neurology resident improves the accuracy of stroke diagnosis, in particular for PC strokes, as not all PC stroke presentations are classic. Also increased utilization of thrombolytic therapy could result (Mohamed, Bhattacharya, and Chaturvedi 2013; Moradiya et al. 2013).

In conclusion, NIHSS is only poorly representative of the clinical deficit in PC stroke. In fact some important clinical features receive no score at all (e.g.,

diplopia, dysphagia, gait instability, hearing, and nystagmus). Physicians must consider that patients presenting on emergency department with a low NIHSS may develop a PC stroke. Diagnosis of PC stroke may often be delayed, because many patients present with an important variety of signs and symptoms. An accurate neurological examination in the emergency department may help to identify the clinical features of PC strokes.

The commonly used NIHSS cutoffs to select patients for thrombolytic treatment should be viewed with caution in suspected PC strokes. Further studies are needed in order to modify the current NIHSS score and to render it more appropriate for the evaluation of PC strokes.

Acknowledgments

Antonio Siniscalchi serves as the regional delegate for the Italian National Society of Neurovascular Disease.

References

Arch, A. E., D. C. Weisman, S. Coca, K. V. Nystrom, C. R. Wira III, and J. L. Schindler. 2016. Missed ischemic stroke diagnosis in the emergency department by emergency medicine and neurology services. *Stroke* 47:668–73.

Gur, A. Y., Y. Lampl, B. Gross, V. Royter, L. Shopin, and N. M. Bornstein. 2007. A new scale for assessing patients with vertebrobasilar stroke-the Israeli Vertebrobasilar Stroke Scale (IVBSS): inter-rater reliability and concurrent validity. *Clinical Neurology and Neurosurgery* 109:317–22.

Inoa, V., A. W. Aron, I. Staff, G. Fortunato, and L. H. Sansing. 2014. Lower NIH stroke scale scores are required to accurately predict a good prognosis in posterior circulation stroke. *Cerebrovascular Diseases* 37:251–5.

Lyden, P., M. Lu, C. Jackson, J. Marler, R. Kothari, T. Brott, and J. Zivin. 1999. Underlying structure of the National Institutes of Health Stroke Scale: results of a factor analysis. NINDS tPA Stroke Trial Investigators. *Stroke* 30:2347–54.

Markus, H. S., H. B. van der Worp, and P. M. Rothwell. 2013. Posterior circulation ischaemic stroke and transient ischaemic attack: diagnosis, investigation, and secondary prevention. *The Lancet: Neurology* 12:989–98.

Meyer, B. C., T. M. Hemmen, C. M. Jackson, and P. D. Lyden. 2002. Modified National Institutes of Health Stroke Scale for use in stroke clinical trials: prospective reliability and validity. *Stroke* 33:1261–6.

Mohamed, W., P. Bhattacharya, and S. Chaturvedi. 2013. Early access to a neurologist reduces the rate of missed diagnosis in young strokes. *Journal of Stroke and Cerebrovascular Diseases* 22:e332–7.

Moradiya, Y., H. Crystal, H. Valsamis, and S. R. Levine. 2013. Thrombolytic utilization for ischemic stroke in US hospitals with neurology residency program. *Neurology* 81:1986–95.

Nouh, A., J. Remke, and S. Ruland. 2014. Ischemic posterior circulation stroke: a review of anatomy, clinical presentations, diagnosis, and current management. *Frontiers in Neurology* 5:30.

Olivato, S., S. Nizzoli, M. Cavazzuti, F. Casoni, P. F. Nichelli, and A. Zini. 2016. e-NIHSS: an expanded National Institutes of Health Stroke Scale weighted for anterior and posterior circulation strokes. *Journal of Stroke and Cerebrovascular Diseases* 25:2953–7.

Pezzella, F. R., C. Pozzessere, A. Siniscalchi, L. Gallelli, and S. Anticoli. 2013. The cloud stroke unit: 24-hour acute stroke expertise-on-demand. *Hospital Topics* 91:81–6.

Sato, S., K. Toyoda, T. Uehara, N. Toratani, C. Yokota, H. Moriwaki, H. Naritomi, and K. Minematsu. 2008. Baseline NIH Stroke Scale Score predicting outcome in anterior and posterior circulation strokes. *Neurology* 70:2371–7.

Savitz, S. I., and L. R. Caplan. 2005. Vertebrobasilar disease. *New England Journal of Medicine* 352:2618–26.

Schulz, U. G., and U. Fischer. 2017. Posterior circulation cerebrovascular syndromes: diagnosis and management. *Journal of Neurology, Neurosurgery, and Psychiatry* 88:45–53.

Searls, D. E., L. Pazdera, E. Korbel, O. Vysata, and L. R. Caplan. 2012. Symptoms and signs of posterior circulation ischemia in the new England Medical Center posterior circulation registry. *Archives of Neurology* 69:346–51.

Siniscalchi, A. 2016. DWI-MRI and Fabry disease: what can we learn? *European Journal of Neurology* 23:1143–4.

Siniscalchi, A., L. Gallelli, O. Di Benedetto, and G. De Sarro. 2012. Asterixis as a presentation of cerebellar ischemic stroke. *Western Journal of Emergency Medicine* 13:507–8.

Siniscalchi, A., R. Sztajzel, G. Malferrari, G. De Sarro, A. Saletti, and L. Gallelli. 2017. Cocaine and acute basilar artery occlusion: what we know to date? *Current Vascular Pharmacology* 15:3–4.

Whelley-Wilson, C. M., and G. C. Newman. 2004. A stroke scale for emergency triage. *Journal of Stroke and Cerebrovascular Diseases* 13:247–53.