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Original research

PREDICTION OF LARGE VESSEL OCCLUSION FOR ISCHAEMIC STROKE BY THE VAN SCALE

Huynh Quoc Toan[1], Hoang Trong Ai Quoc[2], Nguyen Viet Quy[3], Hoang Hai Phu[4], Nguyen Thi Nhan[5]

[1]Department of General medicine, the International Medical Center, Hue Central Hospital
[2]Department of General medicine, the International Medical Center, Hue Central Hospital
[3]Department of General medicine, the International Medical Center, Hue Central Hospital
[4]Department of General medicine, the International Medical Center, Hue Central Hospital
[5]Department of General medicine, the International Medical Center, Hue Central Hospital

ABSTRACT

Background: *Rapid and accurate detection of stroke by paramedics or emergency clinicians at the time of first contact is crucial for timely initiation of appropriate treatment. Several stroke recognition scales have been developed to support the initial triage Identification of emergent large vessel occlusion (ELVO) stroke has become increasingly important with the recent publications of favorable acute stroke thrombectomy trials. Multiple screening tools exist but the length of the examination and the false positive rate range from good to adequate. A screening tool was designed and tested in the emergency department using nurse responders without a scoring system.*

Methods: *Suspected stroke patients admitted by ambulance paramedics directly to an acute stroke unit through a rapid ambulance protocol were examined by a neurologist or admitting stroke physician. The vision, aphasia, and neglect (VAN) screening tool was designed to quickly assess functional neurovascular anatomy, which was used as an LVO screen for all stroke patients.*

Results: *There were 162 consecutive code stroke activations during the pilot study. 60 (37%) of the patients were VAN positive and 128 (79%) had a National Institutes of Health Stroke Scale (NIHSS) score of ≥ 6. NIHSS > 6 was more sensitive (100% vs 93% for VAN) but VAN was more specific (90% vs 74% for NIHSS ≥ 6). Similarly, VAN had 83% positive predictive value while NIHSS ≥ 6 had only a 42% positive predictive value. No patient that was NIHSS < 6 had an LVO (100% negative predictive value), there were 4 patients with VAN negative who had LVO (97% negative predictive value). However, VAN had 91% specificity versus 32% for NIHSS.*

Conclusions: *VAN assessment performed well in identifying patients with LVO.*

Keywords: *Stroke, VAN, NIHSS, Large vessel occlusion.*

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Corresponding author:
Huynh Quoc Toan
Email: drrambo871993@gmail.com
Phone: 0974128673

I. INTRODUCTION

Stroke was the third leading cause of death for patients after cancer and cardiovascular disease, but according to WHO statistics in 2012, it was the leading cause of death for patients [1]. According to Schutte - Altedorneburg G. et al, the mortality rate in patients with ischemic stroke due to basilar artery occlusion if without intravenous thrombolytic was 80 - 90% and decreases to 42 - 65% if receiving thrombolytic therapy [2]. Intravenous thrombolytic therapy also has limitations due to the short treatment window period combined with contraindications when using the therapy, so less than 10% of patients with ischemic stroke are treated even in settings with a well - established medical network. In particular, the rate of revascularization is low for large vessel occlusion (less than 40% for stroke patients due to intracranial large artery occlusion), leading to reduced ability to recover neurological function of patients with ischemic stroke due to large artery occlusion [3]. With the introduction of the techniques for mechanical thrombectomy in 2015 which is a turning point in stroke emergencies due to large vessel occlusion [2, 4, 5]. Clinically, when facing a patient with an acute cerebral infarction brain, the question is whether there is LVO or not? This is very important because it helps to choose the appropriate treatment to limit mortality, reduce complications as well as improve the prognosis for patients. To address this problem, we designed this study to improve the accuracy of predicting LVOS by using a scale called the VAN (vision, aphasia, neglect).

II. MATERIALS AND METHODS

2.1. Study population

Criteria for selection: All patients were evaluated by a stroke neurologist who met either of the following criteria: (1) Patients presenting with clinical suspicion of an acute stroke within 24 hours from symptom onset. (2) EVT was initiated within 24 h of symptom onset for the anterior circulation stroke and the basilar thrombosis.

The VAN assessment **(Table 1)** begins with a simple assessment of upper extremity weakness. If the patient exhibits weakness (minimum is any drift) they then proceed to vision, aphasia and neglect testing. If either vision, aphasia or neglect assessment is abnormal, the patient should be suspected of having a LVO. If there is no weakness, the patient is deemed to not have an LVO and the vision, aphasia and neglect pieces of the assessment are not carried out.

Table 1: Stroke VAN

How weak is the patient? Raise both arms up	☐ Mild (minor drift)
	☐ Moderate (severe drift - touches or nearly touches ground)
	☐ Severe (flaccid or no antigravity)
	☐ Patient shows no weakness. Patients are VAN negative (exceptions are confused or comatose patients with dizziness, focal findings, or no reason for their altered mental status then basilar artery thrombus must be considered; CTA is warranted)
Visual disturbance	☐ Field cut (which side) (4 quadrants)
	☐ Dubble vision (ask patient to look to right then left; evaluate for uneven eyes)
	☐ Blind new onset
	☐ None
Aphasia	☐ Expressive (inability to speak or paraphasic errrors); do not count slurring of words (repeat and name 2 objects)
	☐ Receptive (not understanding or following commands) (close eyes, make first)
	☐ Mixed
	☐ None

Neglect	☐ Forced gaze or inability to track to one side
	☐ Unable to feel both sides at the same time, or unable to identify own arm
	☐ Ignoring one side
	☐ None
Patients must have weakness plus one or all of the V, A, or N to be VAN positive.	

Exclusion criteria: Patients with stroke time onset > 24h; and a prestroke score on the mRS ≥ 2, which could affect the scale in evaluation process, were excluded from the analysis.

2.2. Study parameter

We performed a retrospective study of patients with acute ischemic stroke who underwent EVT between January 2018 and January 2021, at Stroke Center - Hue Central Hospital. 162 acute suspicion stroke patients were included in the analysis.

The VAN status of the patient was used to compare sensitivity, specificity, positive predictive value, negative predictive value, and accuracy to DSA confirmed LVO. The same analysis was done using the new guideline recommended (NIHSS of 6). LVO was defined as thromboembolic occlusion of an M1 segment of the middle cerebral artery (MCA), A1 segment of the anterior cerebral artery (ACA) internal carotid artery, basilar artery, or M2 segment for which embolectomy was considered [6].

2.3. Statistical analysis

The analysis was performed using Microsoft Excel 2010 and SPSS 25.0.

III. RESULTS

3.1. Population

Table 2: Participant's clinical characteristics and paraclinical information.

Characteristics		Result (N = 162)
Male: Female		2.2:1
Age, (mean ± SD)		66.87 ± 13.9
NIHSS (median, range)		12.07 (11; 2 - 30)
LVO	N	54 (33.3%)
	ICA	21
	M1	14
	M2	7
	A1	1
	VA, BA	14
VAN +		60 (37%)

One hundred sixty - two patients were included in this study, with the male: female is 2.2:1, a mean age of 66.87 ± 13.9, of which the youngest was 29 years old, the oldest was 96 years old. There were 54 LVO patients; the following embolic occlusions were identified on DSA: 21 ICA, 21 MCA (M1, M2), 1 A1 and 14 posterior circulation (VA, BA). The VAN scale positived in 60 of 162 patients (37%).

Table 3: Sensitivity, specificity, positive predictive value, negative predictive value, and accuracy of vision, aphasia, neglect and National Institutes of Health Stroke Scale for large vessel occlusion

	Large artery clot	**No large artery clot**	
VAN +	50	10	60 VAN +
VAN -	4	98	102 VAN -
	54 Large artery clot	108 No large artery clot	
	Large artery clot	No large artery clot	
NIHSS ≥ 6	54	74	128 NIHSS ≥ 6
NIHSS < 6	0	34	34 NIHSS < 6
	54 Large artery clot	108 No large artery clot	

NIHSS, National Institutes of Health Stroke Scale; VAN, vision, aphasia, and neglect.

Positive predictive value of VAN = 50/60 = 83%; sensitivity = 50/54 = 93%. Negative predictive value of VAN = 98/102 = 97%; specificity = 98/108 = 91%. Accuracy VAN = 148/162 = 92%. Positive predictive value of NIHSS = 50/60 = 42%; sensitivity = 54/54 = 100%. Negative predictive value of NIHSS = 34/34 = 100%; specificity = 34/108 = 32%. Accuracy NIHSS = 54.3%.

No patient that was NIHSS < 6 had an LVO (100% negative predictive value), there were 4 patients with VAN negative who had LVO (97% negative predictive value). However, VAN had 91% specificity versus 32% for NIHSS. The accuracy of VAN and NIHSS were 92% and 54.3%, respectively.

There were ten patients who were VAN positive without LVO (false positive): multiple distal MCA embolic stroke hysteria, seizure, complex migraine, meningitis.

IV. DISCUSSION

This study demonstrates that the VAN scale is a simple tool highly predictive of the presence of a large occlusion in patients with a suspicion of an acute stroke. The VAN scale shows a high sensitivity (93%) and specificity (91%) to identify LVO, that was quite similar to some studies, such as:

Mohamed S. [7] revealed that there were 62 consecutive code stroke activations during the pilot study. 19 (31%) of the patients were VAN positive and 24 (39%) had a National Institutes of Health Stroke Scale (NIHSS) score of ≥ 6. All 14 patients with ELVO were either VAN positive or assigned a NIHSS score ≥ 6. While both clinical severity thresholds had 100% sensitivity, VAN was more specific (90% vs 74% for NIHSS ≥ 6). Similarly, while VAN and NIHSS ≥ 6 had 100% negative predictive value, VAN had a 74% positive predictive value while NIHSS ≥ 6 had only a 58% positive predictive value.

Digvijaya Navalkele [8] revealed that the VAN scale was comparable in sensitivity (79% versus 80%) and NPV (88% versus 87%) to NIHSS greater than or equal to 6. It was superior in specificity (69% versus 57%), PPV (53% versus 46%) and accuracy to NIHSS greater than or equal to 6 (72% versus 64%) with significant receiver operating curve (.74 versus .69, P = .02). VAN also had comparable area under the curve when compared to RACE, FASTED, and CPSS however slightly lower accuracy (69% - 73%) compared to RACE (76%), FAST - ED (77%), and CPSS (75%). VAN had the highest NPV among all screening assessments (88%).

In common with the NIHSS, it may be both too cumbersome to administer in the field and have imperfect accuracy, VAN was easily taught and employed. The mnemonic triggers the examination steps and no calculations are required.

This study has some limitations, which it was a single center study as well as training the staff to use two scales may confound the ablity to access their utility independently - users may trix the test items.

Despite these limitations, this pilot study shows that VAN was easily taught and employed, while NIHSS score may be both too cumbersome to administer in the field and have imperfect accuracy. Besides, the VAN screen was prospectively applied to all stroke codes coming to our emergency room and was compared with a NIHSS threshold of ≥ 6 which has been suggested as the embolectomy candidacy threshold.

V. CONCLUSION

In conclusion, the VAN scale is a novel and simple tool for a prehospital use by medical emergency technicians that can accurately assess stroke severity and detect patients with acute stroke with large intracranial vessel occlusion. This tool may be useful to early detection of patients with acute stroke who should be transferred to a stroke center for endovascular treatment.

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