DEVELOPMENT OF A NEW TOOL TO IDENTIFY LARGE VESSEL OCCLUSION

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Background and Aims: Prediction tools have been proposed to identify patients with large vessel occlusion (LVO), but no tool can achieve both high sensitivity and high specificity. The aims of our study were to develop a new tool to identify patients with LVO and to compare it with other existing prediction tools.

Methods: We used the stroke registry of a comprehensive stroke center to develop the prediction tool. We included patients with ischemic stroke who arrived at the emergency department within 6 hours of symptom onset. We excluded patients whose National Institutes of Health Stroke Scales, which were evaluated by the neurologists, were not available and those who did not received computed tomographic angiography or magnetic resonance angiography of brain before intravenous thrombolysis or endovascular thrombectomy was performed. Receiver operating curve (ROC), sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) of the new tool were analyzed.

Results: LVO was detected in 419 of 1231 patients (34.0%). The new 6-item tool, which contained items of level of consciousness, horizontal eye movement, visual field test, facial palsy, leg motor asymmetry and speech test, had good capacity to identify patients with LVO (area under ROC 0.83). The area under ROC of other 9 existing prediction tools ranged from 0.77 to 0.83. A score of the new tool ≥7 had sensitivity 0.78, specificity 0.79, PPV 0.66, and NPV 0.87 for identifying patients with LVO.

Conclusions: The new 6-item tool has good accuracy to identify patients with LVO. Prospective validation is required.

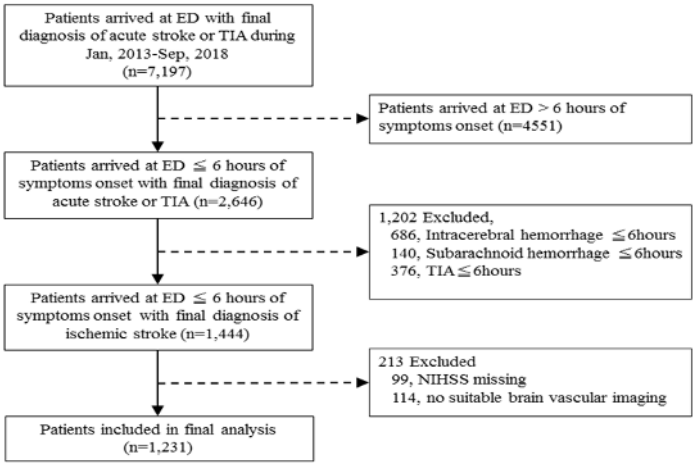

Figure 1: Flowchart of patients included in our study. Abbreviation: ED: emergency department; TIA: transient ischemic attack; NIHSS: National Institute of Health Stroke Scale.

Table1. Characteristics of study participants (N=1231).

Characteristics	LVO	Non-LVO	Total
Age (year), mean (SD)	73.10 (13.24)	69.17 (13.66)	70.51 (13.64)
Male gender, n (%)	215 (51.31%)	489 (60.22%)	704 (57.19%)
Arrival by EMS, n (%)	268 (63.96%)	315 (38.79%)	584 (47.44%)
Diabetes mellitus, n (%)	120 (28.64%)	289 (35.59%)	409 (33.23%)
Hypertension, n (%)	288 (68.74%)	575 (70.81%)	863 (70.11%)
Prior stroke, n (%)	99 (23.63%)	184 (22.66%)	283 (22.99%)
Atrial fibrillation, n (%)	188 (44.87%)	171 (21.06%)	359 (29.16%)
CAD, n (%)	83 (19.81%)	141 (17.36%)	224 (18.2%)
CHF, n (%)	44 (10.5%)	53 (6.53%)	97 (7.88%)
Carotid stenosis, n (%)	16 (3.82%)	30 (3.69%)	46 (3.74%)
Prosthetic valve, n (%)	34 (8.11%)	39 (4.8%)	73 (5.93%)
Hyperlipidemia, n (%)	137 (32.7%)	288 (35.47%)	425 (34.52%)
Smoking, n (%)	72 (17.18%)	141 (17.36%)	213 (17.3%)
NIHSS socre, mean (SD), median (q1, q3)	17.20 (8.80) 17 (10, 24)	6.66 (6.92) 4 (2, 9)	10.25 (9.10), 7 (3, 17)
rt-PA treatment, n (%)	153 (36.6%)	154 (19.15%)	307 (25.12%)
IA thrombectomy, n (%)	142 (33.89%)	1 (0.12%)	143 (11.62%)

LVO: large vessel occlusion; SD: standard deviation; EMS: emergency medical service; CAD: coronary arterial disease; CHF: congestive heart failure; NIHSS: National Institute of Health Stroke Scale; IA thrombectomy: intra-arterial thrombectomy.

Table 2. New 6-item tool

Variable	Level	Score	p-value
1A: Level of consciousness	1	2	0.0031
1A: Level of consciousness	≧2	3	0.0057
Horizontal eye movement	≧1	2	0.0020
Visual field test	≧1	4	<.0001
Facial palsy	≧1	2	0.0068
Leg motor asymmetry	Motor 6A ≠Motor 6B	1	0.019
Speech test	≧1	2	0.0047

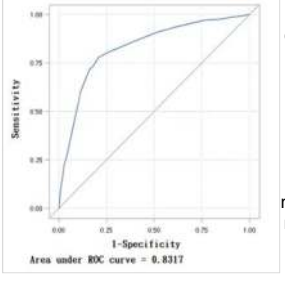

Figure 2. ROC curve in derivation cohort.

AUC, area under the curve; CP, cut point (optimal); LR+, positive likelihood ratio; LR-, negative likelihood ratio; NPV, negative predictive value and PPV, positive predictive value.*Overall accuracy. †Accuracy at cut point.

Table 3. Accuracy of existing tools for identifying large vessel occlusion in all included patients and the new 6-item tool in derivation cohort, validation cohort and all included patients.

Scales	AUC*	CP	Sensitivity	Specificity	AUC†	PPV	NPV	LR+	LR-
New 6-item tool in derivation cohort (95% CI)	0.83	≧7	0.78 (0.73-0.83)	0.79 (0.76-0.83)	0.79 (0.75-0.82)	0.66 (0.61-0.71)	0.87 (0.84-0.90)	3.77 (3.16-4.49)	0.28 (0.22-0.35)
New 6-item tool in validation cohort (95% CI)	0.83	≧7	0.78 (0.71-0.85)	0.79 (0.74-0.83)	0.78 (0.74-0.82)	0.65 (0.58-0.72)	0.87 (0.83-0.91)	3.62 (2.83-4.62)	0.28 (0.21-0.39)
New 6-item tool in all patients (95% CI)	0.83	≧7	0.78 (0.74-0.82)	0.79 (0.76-0.82)	0.78 (0.76-0.81)	0.66 (0.62-0.70)	0.87 (0.85-0.90)	3.72 (3.22-4.29)	0.28 (0.23-0.34)
G-FAST (95% CI)	0.80	≧3	0.82 (0.78-0.85)	0.65 (0.62-0.69)	0.74 (0.71-0.76)	0.55 (0.51-0.59)	0.87 (0.85-0.90)	2.36 (2.12-2.62)	0.28 (0.23-0.35)
3-ISS (95% CI)	0.80	≧4	0.43 (0.38-0.47)	0.93 (0.92-0.95)	0.68 (0.66-0.71)	0.77 (0.72-0.83)	0.76 0.73-0.79)	6.55 (4.93-8.69)	0.61 (0.56-0.67)
CPSSS (95% CI)	0.81	≧2	0.74 (0.70-0.78)	0.78 (0.75-0.81)	0.76 (0.73-0.79)	0.64 (0.59-0.68)	0.85 (0.83-0.88)	3.40 (2.95-3.92)	0.34 (0.28-0.40)
VAN (95% CI)	0.77	-	0.81 (0.77-0.84)	0.73 (0.70-0.76)	0.77 (0.74-0.79)	0.60 (0.56-0.64)	0.88 (0.85-0.90)	2.95 (2.61-3.33)	0.27 (0.22-0.32)
PASS (95% CI)	0.80	≧2	0.77 (0.73-0.81)	0.75 (0.72-0.78)	0.76 (0.73-0.78)	0.61 (0.57-0.65)	0.86 (0.84-0.89)	3.06 (2.69-3.49)	0.31 (0.26-0.37)
FAST-ED (95% CI)	0.83	≧4	0.72 (0.68-0.77)	0.84 (0.82-0.87)	0.78 (0.76-0.81)	0.70 (0.66-0.74)	0.85 (0.83-0.88)	4.55 (3.84-5.39)	0.33 (0.28-0.39)
RACE (95% CI)	0.81	≧5	0.70 (0.66-0.75)	0.82 (0.79-0.85)	0.76 (0.74-0.79)	0.67 (0.62-0.71)	0.84 (0.82-0.87)	3.90 (3.33-4.58)	0.36 (0.31-0.42)
EMSA (95% CI)	0.79	≧3	0.92 (0.89-0.94)	0.43 (0.39-0.46)	0.67 (0.65-0.69)	0.45 (0.42-0.49)	0.91 (0.88-0.94)	1.60 (1.50-1.71)	0.20 (0.14-0.27)
FPSS (95% CI)	0.82	≧5	0.66 (0.61-0.70)	0.82 (0.79-0.85)	0.74 (0.71-0.76)	0.65 (0.61-0.70)	0.82 (0.80-0.85)	3.63 (3.08-4.26)	0.42 (0.37-0.48)