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REVIEW ARTICLE

Value of Los Angeles Motor Scale (LAMS) in the detection of large vessels occlusion in suspected stroke patients; a systematic review and meta-analysis

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Abstract: **Introduction**: Los Angeles Motor Scale (LAMS) is a validated prehospital scoring tool to identify stroke patients with large vessel occlusions (LVOs). While some studies have reported conflicting data in regards to the diagnostic value of LAMS, this systematic review and meta-analysis aims to provide a more concrete evidence for the value of this clinical decision tool in the diagnosis of LVO in suspected stroke patients. **Method**: Online databases of PubMed, Embase, Scopus, and Web of Science were searched until the end of October 2022, for studies evaluating the diagnostic performance of LAMS in the detection of LVOs in suspected stroke patients. **Results:** The results of our analysis demonstrated an AUC of 0.83 (95% CI: 0.79, 0.86), sensitivity of 0.65 (95% CI: 0.54, 0.74), and specificity of 0.83 (95% CI: 0.79, 0.86) for the diagnostic value of LAMS score with a cut-off value of ≥ 4. The diagnostic odds ratio of LAMS score was 8.81 (95% CI: 6.24, 12.45). Sensitivity analyses reveled that diagnostic performance of LAMS improves when utilized for detection of occlusion in the more proximal segments of large vessels, with a sensitivity of 0.75 and specificity of 0.83. **Conclusion:** A high level of evidence showed that LAMS scale does not have a promising diagnostic value in the identification of LVOs in suspected stroke patients. The sensitivity of 0.65 for this tool makes it obsolete as a proper triaging tool. As a suggestion, LAMS could be utilized in conjunction with other additional factors to increase its diagnostic performance.

Keywords: Stroke, Large vessel occlusion, LVO, clinical decision tool, Los Angeles Motor Scale, LAMS

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1. Introduction

Large vessel occlusion (LVO) strokes are a type of ischemic stroke that occurs when there is an obstruction of the large proximal cerebral arteries. These types of strokes often lead to functional and cognitive deficits. Statistics show that 30% of patients admitted to the hospital for strokes, have some degree of LVO (1). LVOs have been known to be resistant to thrombolytic drugs such as tPA. The treatment failure rate is higher when the proximal branches of large vessels are involved (2) and studies have shown that the mortality of stroke patients with LVO is almost twice as high as non-LVO patients (3).

Mechanical thrombectomy and alteplase administration are the recommended treatment options for patients with LVO within the first 24 hours of symptom onset. Thee interventions should be administered at the earliest time from the onset of symptoms since the effectiveness decreases as time elapses (4). The rapid diagnosis of LVO and transfer to stroke centers can reduce the stroke burden and adverse outcomes. There are multiple clinical decision tools that can be used for the quick identification of patients with strokes. In recent years, various tools have been proposed with varying sensi-

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tivity and specificity for the identification of LVOs (5). The Los Angeles Motor Scale (LAMS) is a three-item scoring tool that includes facial droop, arm drift, and grip strength (6). Several studies have shown that LAMS can identify LVO patients in a pre-hospital setting and accelerates management once in the hospital. However, there are significant disparities in the reported results. A meta-analysis performed in 2020, reported a sensitivity and specificity of 38% and 78% for LAMS by including 3 articles (7). In 2022, an umbrella review performed on the diagnostic value of LAMS for the prediction of LVOs, reviewed 6 articles, and reported sensitivity and specificity of 76% and 87% (5). These discrepancies have made it challenging to conclude on the diagnostic value of LAMS scale. This systematic review and meta-analysis aim to re-examine the diagnostic value of LAMS scale and address the discrepancies by increasing the number of included studies.

2. Method

2.1. Search strategy

The keywords related to large vessel occlusion and LAMS diagnostic value were extracted using MeSh and Emtree terms of Medline and Embase databases and review of the related articles. Applicable keywords and their synonyms were chosen with the help of an expert in the field. Systematic search of four online databases (Medline, via PubMed, Embase, Scopus and Web of Science) was performed using Boolean operators and respective standard tags until the end of October 2022. Additionally, a manual search of Google and Google Scholar search engines, citation tracking, and reference tracking was performed to retrieve any possibly missed articles. The search strategy utilized for this study can be reviewed in supplementary material 1.

2.2. Selection criteria

All original articles, evaluating the diagnostic value of LAMS scale for LVO were included in this review. Exclusion criteria were duplicates, not assessing the diagnostic value of LAMS for LVO, not reporting the required data, and reviews.

2.3. Data extraction

After the removal of duplicates from retrieved records, two reviewers independently screened the articles. The screening was performed in two stages of title and abstract, and full-text screening and relevant articles were included based on the inclusion and exclusion criteria. Information provided by the articles were summarized and extracted into a checklist designed according to PRISMA guidelines. The checklist contained article bibliographies (first author, publication year, country), study design, age and gender distribution of the patients, sample size, LVO definition, the interval between symptom onset and LAMS scale evaluation, number of patients with LVO, sensitivity, specificity, true and false positives, and true and false negatives.

2.4. Quality assessment

The quality assessment of the included articles was performed according to the guidelines provided by Quality Assessment of Diagnostic Accuracy Studies, version 2.0 (QUADAS-2) (8). This guideline includes two sections of risk of bias and applicability and evaluates the quality of the articles in the domains of patient selection, index test, reference standard, and flow and timing. Two reviewers independently appraised the studies, and any disagreements were resolved with the opinion of a third reviewer.

2.5. Certainty of evidence

Grading of Recommendation Assessment, Development, and Evaluation (GRADE) framework for comparative accuracy test was used for evaluation of the certainty of evidence (9). GRADE framework judges the level of evidence based on the risk of bias, inconsistency, indirectness, imprecision, publication bias, dose-response gradient, the magnitude of effect, and confounding factors. The table provided for the certainty of evidence was designed using GRADEpro online software (www.gradepro.org).

2.6. Statistical analysis

Analyses were performed in STATA 17.0 by utilizing “midas” package. This package uses an exact binomial rendition of the bivariate mixed-effects regression model to calculate the diagnostic value of a test. True positive (TP), true negative (TN), false positive (FP) and false negative (FN) values were entered in the statistical software for evaluation of the diagnostic value of LAMS score. In cases of only sensitivity and specificity being reported by the article, TP, TN, FP, and FN values were calculated according to the number of patients with and without LVOs. Studies had reported the performance of LAMS scale in different cut-off values. Cut-off point of greater and equal to 4 has been suggested as the optimum cut-off value by previous studies and this value was chosen as the cut-off for the current study.

Included articles had also evaluated posterior circulation LVOs (such as posterior cerebral artery occlusion), since occlusion in posterior cerebral circulation consequences in less severe motor complications, a sensitivity analysis was performed with evaluation of non-posterior circulation LVOs. Considering that proximal vessel occlusions in large cerebral vessels requires more aggressive and faster management, another sensitivity analysis was performed on the articles that defined LVO as occlusion of internal carotid artery (ICA), basilar cerebral artery (BCA) and proximal segment (M1) of middle cerebral artery (MCA).

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The findings are reported as pooled area under the curve (AUC), pooled sensitivity, pooled specificity, pooled positive and negative likelihood ratios and diagnostic odds ratio with 95% confidence intervals (95% CI). Publication bias was evaluated using Deek's Funnel asymmetry test.

3. Results

3.1. Study flow and characteristics of the included papers

The systematic search of online databases resulted in 311 records. After removal of duplicates, 192 records were screened and 37 articles were chosen for further evaluation. Five articles not assessing the diagnostic value of LAMS for LVO, 6 articles not reporting the required data, 8 review articles, one duplicate article and one article not evaluating LAMS as the index test were excluded. Finally, 17 articles were included in the current systematic review and meta-analysis (6, 10-25) (Figure 1). 9 articles were designed as prospective studies, and 8 articles were retrospective studies. Included articles comprise 14980 patients (52.67% male), 3809 of which (25.43) had developed LVO. The mean age of the study population ranged between 63 to 78 years old. All articles evaluated LAMS score in the first 24 hours of symptom onset. The reference standard was computed tomography (CT) angiography and magnetic resonance (MR) angiography in 16 and plain CT scan in one article. Table 1 represents the characteristics of the included studies.

3.2. Meta-analysis

The results of our analysis demonstrated an AUC of 0.83 (95% CI: 0.79, 0.86), sensitivity of 0.65 (95% CI: 0.54, 0.74), and specificity of 0.83 (95% CI: 0.79, 0.86) for the diagnostic value of LAMS score with a cut-off value of ≥ 4 (Figure 3). The diagnostic odds ratio of LAMS score for the detection of LVO with a cut-off value of ≥ 4 was 8.81 (95% CI: 6.24, 12.45) (Figure 4).

3.3. Sensitivity analysis

Sensitivity analysis was performed with the exclusion of two articles including posterior cerebral circulation arteries in the definition of LVO (6, 15). The AUC of LAMS score for the detection of non-posterior LVOs was 0.84 (95% CI: 0.80, 0.87). The sensitivity and specificity were calculated as 0.65 (95% CI: 0.52, 0.75) and 0.84 (95% CI: 0.79, 0.87), respectively. According to the results of our analysis, LAMS score performance is not affected by the inclusion of posterior cerebral arteries LVOs.

In another sensitivity analysis, the analyses were limited to the studies defining LVO as ICA, BA, and MCA (M1) occlusion. The AUC of LAMS score for the detection of said LVOs, was 0.87 (95% CI: 0.83, 0.89) with a sensitivity of 0.75 (95% CI: 0.53, 0.89) and specificity of 0.83 (95% CI: 0.76, 0.86). The performance of LAMS score seems to improve in the identification of ICA, BCA, and proximal segment (M1) of MCA arteries occlusion as opposed to other vessels (Table 2).

3.4. Publication bias

Dees' Funnel plot asymmetry test showed no evidence of publication bias (p = 0.051) in between the included articles (Figure 5).

3.5. Quality assessment

QUADAS risk of bias assessment tool was used to evaluate the quality of the included studies. 4 articles were rated as unclear in risk of bias in the domain of patient selection due to no mention of the sampling method, and one study was rated as high due to an inappropriate patient sampling method. Two studies were assessed as unclear in risk of bias in the domain of reference standard due to no mention of the outcome assessment method. Studies were evaluated to have low risk of bias of other domains. Overall, included studies were judged to have no serious risk of bias (Table 3).

3.6. Certainty of Evidence

The certainty of evidence of the included articles was evaluated using GRADE guidelines and GRADEpro online software. Articles were designed as cross-sectional and cohort-type accuracy studies and according to GRADE guidelines base level of evidence was set as high. Studies were not judged to have any serious risk of bias, indirectness, inconsistency, imprecision, and publication bias and no dose-response gradient, large magnitude of effect, and confounding factors were observed. Thus, the level of evidence for the results of the value of LAMS scale in the prediction of LVOs was rated as high (Table 4).

4. Discussion

The current review aimed to evaluate the diagnostic value of LAMS scale in the identification of LVOs. Our results demonstrated that LAMS scale does not have a promising degree for the diagnosis of LVOs. The sensitivity and specificity of LAMS scale in detection of LVOs were 0.65 and 0.83, respectively. The low sensitivity of this test is one of the limitations for its use as a screening tool to triage patients suspected with LVO strokes.

In a previous umbrella review, the researchers of the present study, obtained sensitivity and specificity of 0.76 and 0.87 by the inclusion of 6 articles (5). Although the specificity reported in the umbrella review matches the results of the present meta-analysis, the reported sensitivity was lower. In a meta-analysis, Ganti et al, analyzed three articles and reported a sensitivity of 0.38 and specificity of 0.78 for the value of LAMS in the detection of LVOs (7). These reviews were lim-

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ited by the scarce number of included articles and evidence of publication bias. Our review provides more concrete results with an increased number of included articles.

Our results demonstrated an increased sensitivity of 0.75 and specificity of 0.83 for LAMS scale in the detection of LVOs, defined as occlusion in ICA, BCA, and M1 segment of MCA and therefore it appears that the diagnostic value of LAMS scale increases in the detection of occlusion in larger arteries. The reason for this difference could be due to the fact that blockage in larger vessels such as ICA, BCA, and proximal segments of MCA causes more significant motor deficits, and the symptoms of such occlusions are identified faster as opposed to blockage in other vessels.

Clinical tools for the triage of suspected stroke and LVO patients are mainly based on clinical manifestations and observations and their sensitivity as a screening tool reportedly varies between 0.55 and 0.88, as even the better proposed tools have been reported to have false negative rates of about 12% (5, 26). Some studies have evaluated the value of adding further clinical signs and symptoms to the currently used scales. Aroor et al. introduced BE-FAST by the addition of balance and eye examination items to the Face, Arm, Speech, Time (FAST) scale, and demonstrated that utilization of BE-FAST reduces the number of missed strokes (27). Narwal et al. reported that the presence or absence of atrial fibrillation (AF) affects the diagnostic performance of LAMS score and their proposed scale of LAMS-AF increases this tools diagnostic performance (17). Therefore, future studies could investigate possible improvements in LAMS scale by proposing a modified LAMS with addition of other clinical variables.

A limitation of the present study was the variation in the definition of LVO among the included articles. Our sensitivity analysis revealed that this may cause a decrease in the performance of LAMS scale and therefore it is necessary to have a standard definition for LVO.

The reference standard utilized by the included studies varied between plain CT-scans, CT angiography and MR angiography. Although a difference in the reference standard used for each patient is considered as a possible source of bias based on the QUADAS-2 guidelines, large vessel occlusions cause distinct and clear abnormalities in all the imaging modalities used by the included studies and thus this difference does not have a significant impact on the results of our studies.

5. Conclusion

A high level of evidence showed that LAMS scale does not have a promising diagnostic value in the identification of LVOs in suspected stroke patients. The sensitivity of 0.65 for this tool makes it obsolete as a proper triage tool. As a suggestion, LAMS could be utilized in conjunction with other additional factors to increase its diagnostic performance.

6. Declarations

6.1. Acknowledgments

None.

6.2. Authors' contributions

Study design: MY, RM; Data gathering: KA, MA, EA, MS; Analysis: MY; Interpretation of the results: all authors; Drafting and revising: all authors.

6.3. Funding and supports

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6.4. Conflict of interest

The authors declare that they have no conflicts of interest.

6.5. Data availability

The gathered data can be shared at the request of qualified investigators with the purpose of replicating the procedures and results.

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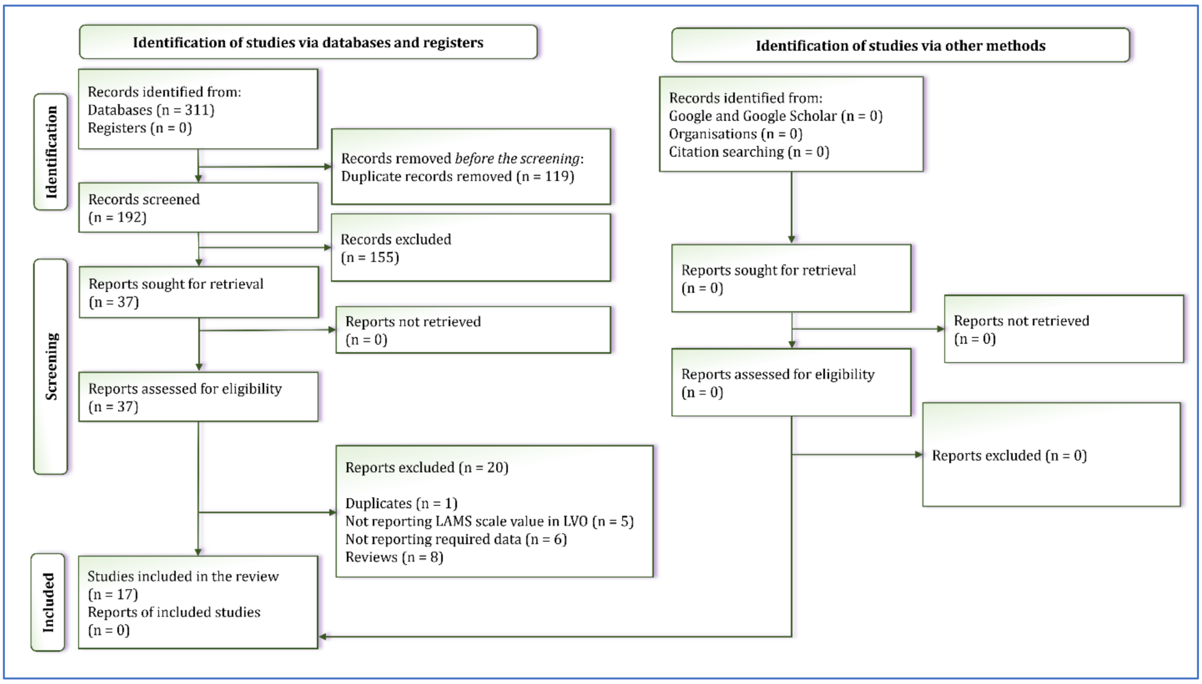

Figure 1: PRISMA flow diagram of the included studies. LAMS: Los Angeles Motor Scale; LVO: Large vessel occlusion.

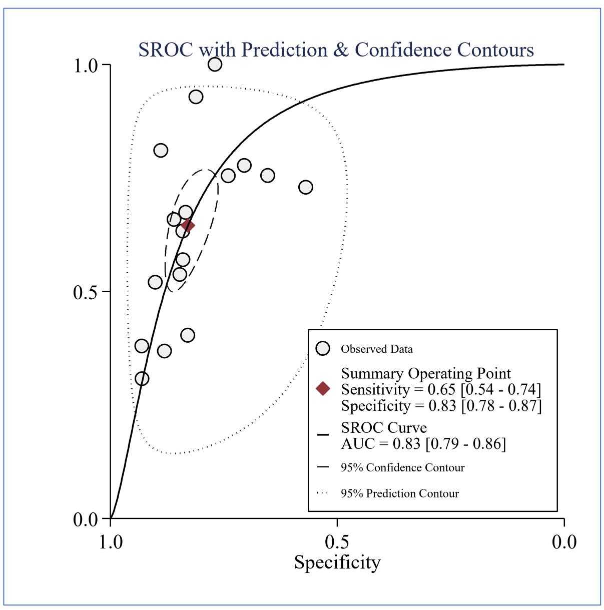

Figure 2: Area under the curve (AUC) of LAMS score in detection of large vessel occlusion.

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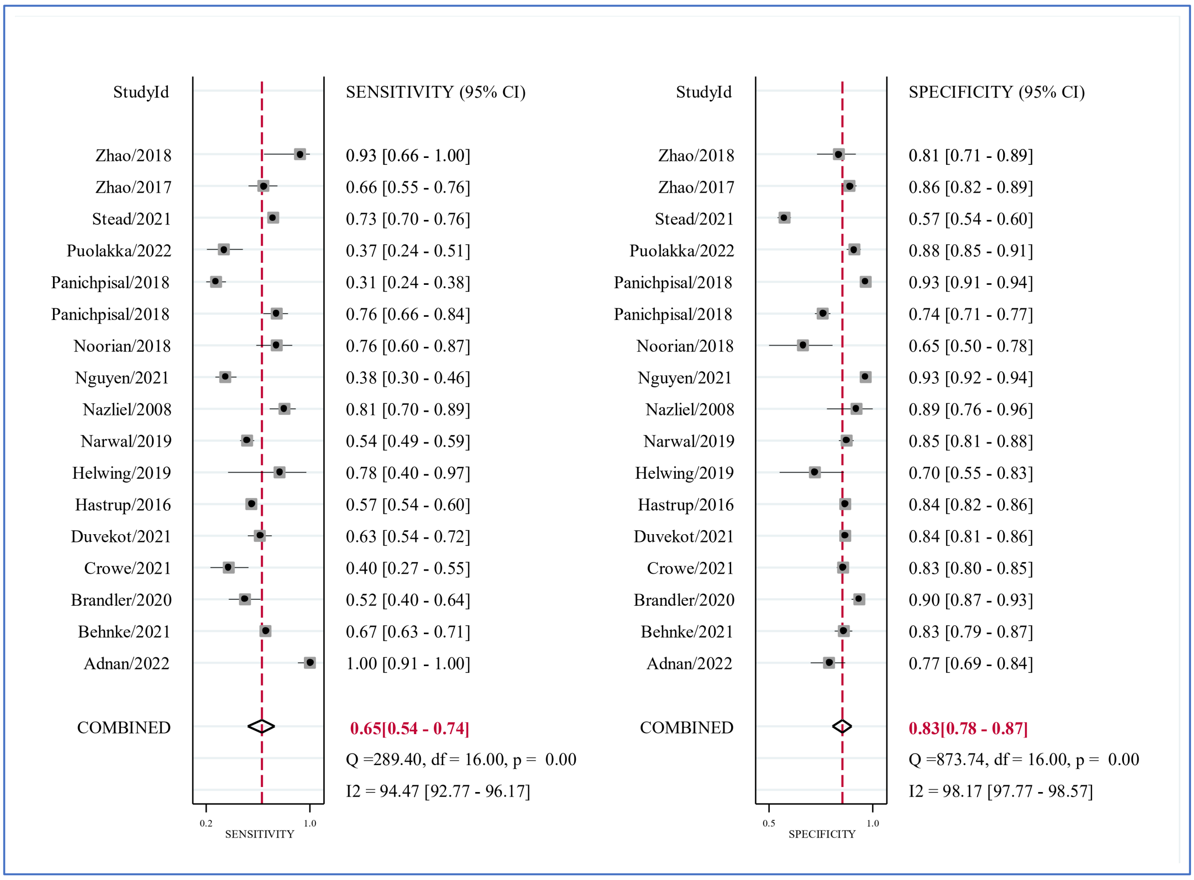

Figure 3: Sensitivity and specificity of LAMS score in detection of large vessel occlusion.

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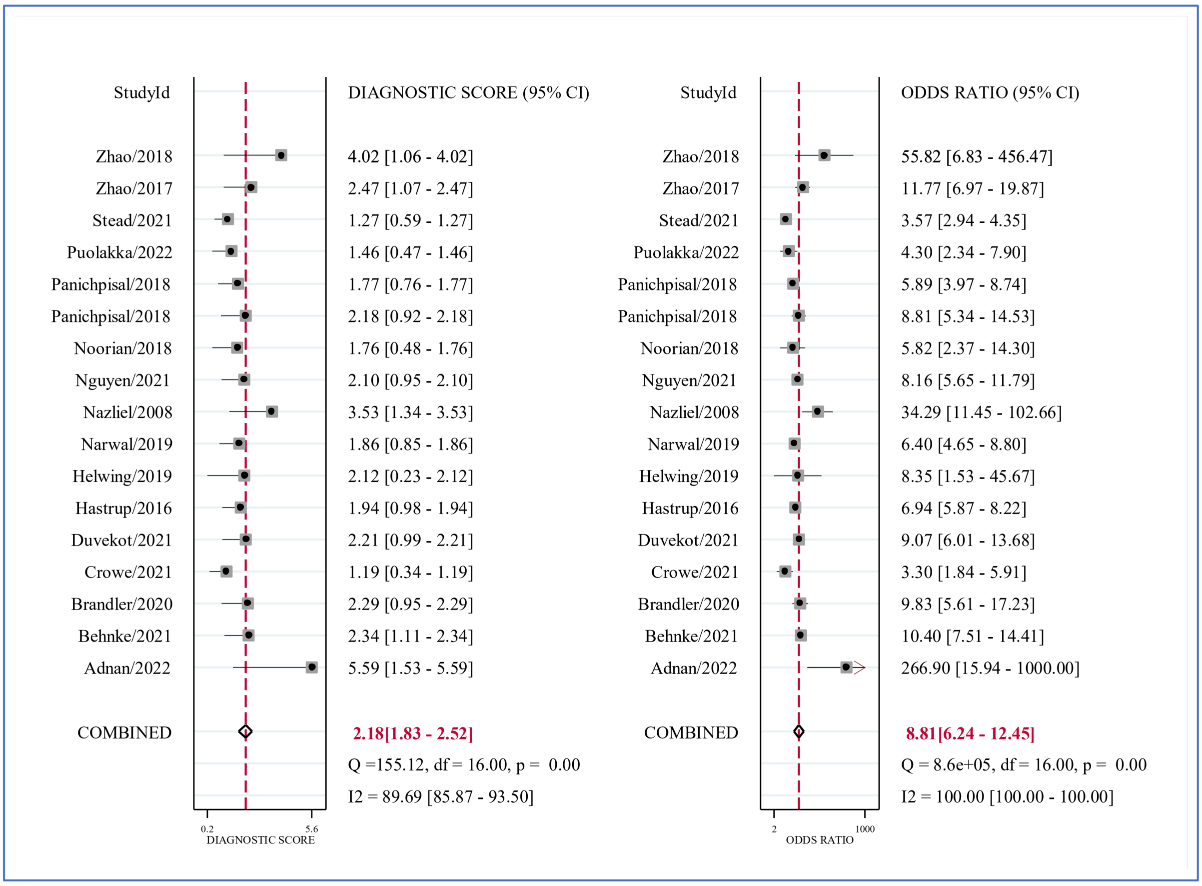

Figure 4: Diagnostic odds ratio of LAMS score in detection of large vessel occlusion.

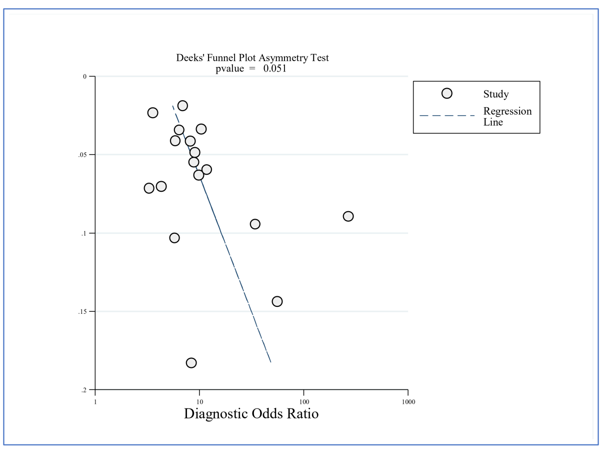

Figure 5: Publication bias of LAMS score in detection of large vessel occlusion.

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Table 1: Characteristics of the included studies

Study, year, country	Design	Sample size	Mean age (yr)	N male	LAMS timing (hrs)	Definition of LVO	Assessor	Reference	N LVO	N non-LVO
Adnan, 2022, Turkey	P-Cross	170	63	102	0	MCA (M1)	Neurologist	CT imaging	40	130
Behnke, 2021, Germany	PCS	920	78	565	8	ICA, BA, MCA (M1)	EMS/Paramedic	CTA	547	373
Brandler, 2020, USA	R-Cross	468	69	212	0	ICA, MCA (M1)	EMS/Paramedic	CTA	75	393
Crowe, 2021, USA	R-Cross	880	71	395	4.5	ICA, BA, MCA	EMS/Paramedic	CTA	52	828
Duvekot, 2021, Netherland	PCS	1039	72	560	6	ICA, MCA (M1 and M2), ACA (A1 and A2)	EMS/Paramedic	CTA	120	919
Hastrup, 2016, Denmark	RCS	3127	69	1876	0	ACA, PCA	Neurologist	CTA or MRA	1104	2023
Helwing, 2019, Germany	RCT	53	74	17	8	ICA, MA, MCA (M1) EM physician	CTA or MRA	9	44	
Narwal, 2019, USA	RCS	862	71.5	465	24	ICA, BA, MCA (M1 and M2)	Neurologist	CTA	374	488
Nazliel, 2008, USA	RCS	119	67	58	4	ICA, MCA (M1 to M4), ACA	EM physician CTA or MRA	74	45	
Nguyen, 2021, Netherlands	PCS	2007	71.1	1021	0	ICA, MCA (M1 and M2), ACA (A1 and A2)	EMS/Paramedic	CTA	158	1849
Noorian, 2018, USA	RCT	94	70	48	2	ICA, BA, MCA (M1 and M2), ACA (A1), PCA (P1), Vertebral	EMS/ Paramedic	MRA or CTA	45	49
Panichpisal, 2018a, USA	RCS	776	71	332	8	ICA, BA, MCA (M1)	Neurologist	MRA or CTA or cerebral angiogram	94	682
Panichpisal, 2018b, USA	RCS	1381	69.1	736	Within 24	ICA, BA, MCA (M1) Neurologist	MRA or CTA or cerebral angiogram	169	1212	
Puolakka, 2022, Finland	RCS	509	NR	NR	NR	ICA, BA, MCA (M1 and M2)	EM physician/ Neurologist	CTA	57	452
Stead, 2021, USA	PCS	1906	72	896	0	Not defined	EMS/Paramedic	CTA	795	1111
Zhao, 2017, Australia	PCS	565	75	288	0	Common carotid, ICA, MCA (M1 and M2)	Neurologist	CTA	82	483
Zhao, 2018, Australia	PCS	104	69	51	0	ICA, MCA (M1)	EMS/Paramedic	CTA	14	90

ACA: Anterior cerebral artery; BA: Basilar artery; CT: Computed tomography; CTA: CT angiography; EM: Emergency medicine; EMS: Emergency EMS: Emergency medical service technician; ICA: Internal carotid artery; LVO: Large vessel occlusion; MCA: Middle cerebral artery; MRA: Magnetic resonance angiography; NR: Not reported; PCS: Prospective cohort study; P-Cross: Prospective cross-sectional; PCA: Posterior cerebral artery; RCS: Retrospective cohort study; R-Cross: Retrospective cross-sectional; RCT: Randomized clinical trial.

Table 2: Sensitivity analysis for assessment of LAMS score performance in detection of LVO

	All LVOs (95% CI)	Non-posterior cerebral arteries LVOs (95% CI)	LVO of proximal segment of large vessels* (95% CI)
AUC	0.83 (0.79 - 0.86)	0.84 (0.80, 0.87)	0.87 (0.83, 0.89)
Sensitivity	0.65 (0.54, 0.74)	0.65 (0.52, 0.75)	0.75 (0.53, 0.89)
Specificity	0.83 (0.78, 0.87)	0.84 (0.79, 0.87)	0.83 (0.76, 0.88)
Positive LR	3.8 (3.1, 4.6)	3.9 (3.2, 4.9)	4.4 (3.4, 5.7)
Negative LR	0.42 (0.33, 0.55)	0.42 (0.31, 0.57)	0.30 (0.15, 0.61)
Diagnostic OR	8.81 (6.24, 12.45)	9.36 (6.18, 14.18)	14.79 (6.88, 31.82)

LR: Likelihood ratio; LVO: Large vessel occlusion; OR: Odds ratio

*, LVO in internal carotid, basilar and proximal (M1) segment of the MCA.

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Table 3: Risk of bias assessment of the included studies

Study, year	Risk of Bias				Applicability			Overall
	Patient selection	Index test	Reference standard	Flow and timing	Patient selection	Index test	Reference standard	
Adnan, 2022 Unclear	Low	Low	Low	Low	Low	Low	Some concern	
Behnke, 2021	Low	Low	Unclear	Low	Low	Low	Low	Some concern
Brandler, 2020	High	Low	Low	Low	Low	Low	Low	Some concern
Crowe, 2021	Low	Low	Low	Low	Low	Low	Low	Low
Duvekot, 2021	Unclear	Low	Low	Low	Low	Low	Low	Some concern
Hastrup, 2016	Low	Low	Low	Low	Low	Low	Low	Low
Helwig, 2019	Unclear	Low	Low	Low	Low	Low	Low	Some concern
Narwal, 2019	Low	Low	Low	Low	Low	Low	Low	Low
Nazliel, 2008	Low	Low	Low	Low	Low	Low	Low	Low
Nguyen, 2021	Low	Low	Low	Low	Low	Low	Low	Low
Noorian, 2018	Low	Low	Low	Low	Low	Low	Low	Low
Panichpisal, 2018a	Low	Low	Low	Low	Low	Low	Low	Low
Panichpisal, 2018b	Low	Low	Low	Low	Low	Low	Low	Low
Puolakka, 2022	Low	Low	Low	Low	Low	Low	Low	Low
Stead, 2021	Low	Low	Unclear	Low	Low	Low	Low	Some concern
Zhao, 2017	Low	Low	Low	Low	Low	Low	Low	Low
Zhao, 2018	Unclear	Low	Low	Low	Low	Low	Low	Some concern

Table 4: Certainty of evidence for performance of LAMS scale in detection of large vessel occlusion

Diagnostic values (N)	N of studies	Study design	Factors that may decrease certainty of evidence					Certainty of evidence
			Risk of bias	Indirectness	Inconsistency	Imprecision	Publication bias	
True positives (N=2327) False negatives (N=1482) True negatives (N=9310) False positives (N=1861)	17 studies 14980 patients	Cross-sectional and cohort type accuracy studies	Not serious	Not serious	Not serious	Not serious	None	⨁⨁⨁⨁ High

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Supplementary 1: search strategy

PubMed

1- “Stroke”[Mesh terms] OR “Ischemic Stroke”[Mesh terms] OR “Embolic Stroke”[Mesh terms] OR “Cerebral Infarction”[Mesh terms] OR “Infarction, middle cerebral artery”[Mesh terms] OR “Brain infarction”[Mesh terms] OR “Stroke, Lacunar”[Mesh terms] OR “Thrombotic Stroke”[Mesh terms] OR Stroke[Title/Abstract] OR Cerebral Infarction[Title/Abstract] OR Brain infarction[Title/Abstract] OR middle cerebral artery infarct*[Title/Abstract] OR middle cerebral artery occlusion[Title/Abstract] OR Cerebral Infarct*[Title/Abstract] OR Brain Infarct*[Title/Abstract] OR Stroke[Title/Abstract] OR Cerebrovascular Accident[Title/Abstract] OR Cerebrovascular Accident, [Title/Abstract] OR Apoplexy[Title/Abstract] OR Brain Vascular Accident*[Title/Abstract] OR Cryptogenic Embolism[Title/Abstract] OR Cerebral Infarct*[Title/Abstract] OR Subcortical Infarction[Title/Abstract] OR Choroidal Artery Infarction [Title/Abstract] OR MCA Infarction[Title/Abstract] OR Cerebral Artery Infarction[Title/Abstract] OR Cerebral Artery Embol*[Title/Abstract] OR Cerebral Artery Occlusion[Title/Abstract] OR Cerebral Artery Thromb*[Title/Abstract] OR Brain Venous Infarction[Title/Abstract] OR cerebral ischemia reperfusion injury[Title/Abstract] OR brain ischemi* reperfusion injury[Title/Abstract] OR brain ischemia/reperfusion[Title/Abstract] OR cerebral ischemia/reperfusion[Title/Abstract] OR cerebral reperfusion injury[Title/Abstract] OR reperfusion brain injury[Title/Abstract] OR acute cerebrovascular lesion[Title/Abstract] OR acute focal cerebral vasculopathy[Title/Abstract] OR brain vascular accident[Title/Abstract] OR cerebrovascular injury[Title/Abstract] OR cortical infarction[Title/Abstract] OR hemisphere infarct*[Title/Abstract] OR hemispheric infarct*[Title/Abstract] OR brain stem infarction*[Title/Abstract] OR brainstem infarction[Title/Abstract] OR cerebellar infarction[Title/Abstract] OR brain ischemia[Title/Abstract] OR brain ischaemic attack[Title/Abstract] OR brain ischemic attack[Title/Abstract]

2- "Los Angeles Motor Scale" OR "LAMS" OR “LAMS score”

3- #1 AND #2

Embase

1- ‘cerebral ischemia reperfusion injury’/exp OR ‘cerebrovascular accident’/exp OR ‘cardioembolic stroke’/exp OR ‘brain infarction’/exp OR ‘brain stem infarction’/exp OR ‘cerebellum infarction’/exp OR ‘brain ischemia’/exp OR ‘transient ischemic attack’/exp OR ‘Stroke’ OR ‘Cerebral Infarction’ OR ‘Brain infarction’ OR ‘middle cerebral artery infarct*’ OR ‘middle cerebral artery occlusion’ OR ‘Cerebral Infarct*’ OR ‘Brain Infarct*’ OR ‘Hemorrhagic Strokes’ OR ‘Stroke’ OR ‘Cerebrovascular Accident’ OR ‘Cerebrovascular Accident, ‘ OR ‘Apoplexy’ OR ‘Brain Vascular Accident*’ OR ‘Cryptogenic Embolism’ OR ‘Cerebral Infarct*’ OR ‘Subcortical Infarction’ OR ‘Choroidal Artery Infarction ‘ OR ‘MCA Infarction’ OR ‘Cerebral Artery Infarction’ OR ‘Cerebral Artery Embol*’ OR ‘Cerebral Artery Occlusion’ OR ‘Cerebral Artery Thromb*’ OR ‘Brain Venous Infarction’ OR ‘cerebral ischemia reperfusion injury’ OR ‘brain ischemi* reperfusion injury’ OR ‘brain ischemia/reperfusion’ OR ‘cerebral ischemia/reperfusion’ OR ‘cerebral reperfusion injury’ OR ‘reperfusion brain injury’ OR ‘acute cerebrovascular lesion’ OR ‘acute focal cerebral vasculopathy’ OR ‘brain vascular accident’ OR ‘cerebrovascular injury’ OR ‘cortical infarction’ OR ‘hemisphere infarct*’ OR ‘hemispheric infarct*’ OR ‘brain stem infarction*’ OR ‘brainstem infarction’ OR ‘cerebellar infarction’ OR ‘brain ischemia’ OR ‘brain ischaemic attack’ OR ‘brain ischemic attack’

2- "Los Angeles Motor Scale" OR "LAMS" OR "LAMS score"

3- #1 AND #2

Scopus

1- TITLE-ABS-KEY(“Stroke” OR “ Cerebral Infarction” OR “ Brain infarction” OR “ middle cerebral artery infarct*” OR “ middle cerebral artery occlusion” OR “ Cerebral Infarct*” OR “ Brain Infarct*” OR “ Hemorrhagic Strokes” OR “ Stroke” OR “ Cerebrovascular Accident” OR “ Cerebrovascular Accident, “ OR “ Apoplexy” OR “ Brain Vascular Accident*” OR “ Cryptogenic Embolism” OR “ Cerebral Infarct*” OR “ Subcortical Infarction” OR “ Choroidal Artery Infarction “ OR “ MCA Infarction” OR “ Cerebral Artery Infarction” OR “ Cerebral Artery Embol*” OR “ Cerebral Artery Occlusion” OR “ Cerebral Artery Thromb*” OR “ Brain Venous Infarction” OR “ cerebral ischemia reperfusion injury” OR “ brain ischemi* reperfusion injury” OR “ brain ischemia/reperfusion” OR “ cerebral ischemia/reperfusion” OR “ cerebral reperfusion injury” OR “ reperfusion brain injury” OR “ acute cerebrovascular lesion” OR “ acute focal cerebral vasculopathy” OR “ brain vascular accident” OR “ cerebrovascular injury” OR “ cortical infarction” OR “ hemisphere infarct*” OR “ hemispheric infarct*” OR “ brain stem infarction*” OR “ brainstem infarction” OR “ cerebellar infarction” OR “ brain ischemia” OR “ brain ischaemic attack” OR “ brain ischemic attack”)

2- TITLE-ABS-KEY("Los Angeles Motor Scale" OR "LAMS" OR "LAMS score")

3- #1 AND #2

Web of Science

1- TS=(“Stroke” OR “ Cerebral Infarction” OR “ Brain infarction” OR “ middle cerebral artery infarct*” OR “ middle cerebral artery occlusion” OR “ Cerebral Infarct*” OR “ Brain Infarct*” OR “ Hemorrhagic Strokes” OR “ Stroke” OR “ Cerebrovascular Accident” OR “ Cerebrovascular Accident, “ OR “ Apoplexy” OR “ Brain Vascular Accident*” OR “ Cryptogenic Embolism” OR “ Cerebral Infarct*” OR “ Subcortical Infarction” OR “ Choroidal Artery Infarction “ OR “ MCA Infarction” OR “ Cerebral Artery Infarction” OR “ Cerebral Artery Embol*” OR “ Cerebral Artery Occlusion” OR “ Cerebral Artery Thromb*” OR “ Brain Venous Infarction” OR “ cerebral ischemia reperfusion injury” OR “ brain ischemi* reperfusion injury” OR “ brain ischemia/reperfusion” OR “ cerebral ischemia/reperfusion” OR “ cerebral reperfusion injury” OR “ reperfusion brain injury” OR “ acute cerebrovascular lesion” OR “ acute focal cerebral vasculopathy” OR “ brain vascular accident” OR “ cerebrovascular injury” OR “ cortical infarction” OR “ hemisphere infarct*” OR “ hemispheric infarct*” OR “ brain stem infarction*” OR “ brainstem infarction” OR “ cerebellar infarction” OR “ brain ischemia” OR “ brain ischaemic attack” OR “ brain ischemic attack”)

2- "Los Angeles Motor Scale" OR "LAMS" OR "LAMS score"

3- #1 AND #2

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