La richiesta di competenza neurologica nel prossimo futuro

Sesta edizione

Fortuna Resort, Chianciano Terme (Siena)

13-15 maggio 2022

SIN SOCIETÀ ITALIANA DI NEUROLOGIA

SIN

SIGN SEZIONE ITALIANA GIOVANI NEUROLOGI

Sabato 14 maggio 2022

SECONDA SESSIONE

STROKE

Moderatore senior: **V. Caso**, *Perugia*

Moderatore young: **M. Romoli**, *Cesena*

9.00 Nuove linee guida ISO-Stroke
M. Cappellari, *Verona*

9.25 Organizzazione pre-ospedaliera: scale, telemedicina e codice ictus
P. Cerrato, *Torino*

9.40 Mind the tissue
E. Scola, *Firenze*

10.00 Mind the vessel
F. Diana, *Salerno*

10.20 Neurosonologia
R. Tassi, *Siena*

Alcune premesse

- Nonostante la comprovata efficacia della trombolisi endovenosa (iv) nei pazienti con ictus acuto, gli esiti rimangono scarsi in quei pazienti con occlusione di grandi arterie intracraniche prossimali. [1]
- L'efficacia della trombolisi endovenosa in termini di ricanalizzazione arteriosa nelle prime ore diminuisce progressivamente all'aumentare del carico del coagulo occlusivo. [2]
- Mentre il tasso di ricanalizzazione di un'occlusione M2 è di circa il 70%, i tassi di ricanalizzazione delle occlusioni ICA ed M1 o terminali scendono rispettivamente al 30% e al 10%.
- Nei pazienti con occlusione prossimale di grandi vasi (LVO), il vantaggio principale del trattamento per trombolisi endovenosa è che il trattamento è prontamente disponibile e può essere prontamente istituito anche in centri privi di un'infrastruttura sofisticata.

- La trombolisi IA ha dimostrato di essere un trattamento potente nei pazienti con ictus LVO, indipendentemente dal fatto che siano pre-trattati o meno con tr EV perché i tassi di riperfusione efficaci osservati con questa procedura sono nell'intervallo dell'80%.

- sono necessari un alto livello di risorse tecnologiche e medici specializzati, limitando la disponibilità di questo trattamento a centri ictus di 2 livello

E utile centralizzare i pz piu gravi con sospetto ictus cerebrale?

- Improved cost-effectiveness and outcomes for ischemic stroke, intracerebral hemorrhage, and subarachnoid hemorrhage at CSCs compared with non-CSCs.[2–12]

Comparison of 30-Day Mortality Models for Profiling Hospital Performance in Acute Ischemic Stroke With vs Without Adjustment for Stroke Severity

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Wenqin Pan, PhD
Jeffrey L. Saver, MD
Eric E. Smith, MD, MPH
Mathew J. Reeves, PhD
Joseph P. Broderick, MD
Dawn O. Kleindorfer, MD
Ralph L. Sacco, MD
DaiWai M. Olson, PhD
Adrian F. Hernandez, MD, MHS
Eric D. Peterson, MD, MPH
Lee H. Schwamm, MD

Context There is increasing interest in reporting risk-standardized outcomes for Medicare beneficiaries hospitalized with acute ischemic stroke, but whether it is necessary to include adjustment for initial stroke severity has not been well studied.

Objective To evaluate the degree to which hospital outcome ratings and potential eligibility for financial incentives are altered after including initial stroke severity in a claims-based risk model for hospital 30-day mortality for acute ischemic stroke.

Design, Setting, and Patients Data were analyzed from 782 Get With The Guidelines–Stroke participating hospitals on 127 950 fee-for-service Medicare beneficiaries with ischemic stroke who had a score documented for the National Institutes of Health Stroke Scale (NIHSS, a 15-item neurological examination scale with scores from 0 to 42, with higher scores indicating more severe stroke) between April 2003 and December 2009. Performance of claims-based hospital mortality risk models with and without inclusion of NIHSS scores for 30-day mortality was evaluated and hospital rankings from both models were compared.

Main Outcomes Measures Model discrimination, hospital 30-day mortality outcome rankings, and value-based purchasing financial incentive categories.

Results Across the study population, the mean (SD) NIHSS score was 8.23 (8.11) (median, 5; interquartile range, 2-12). There were 18 186 deaths (14.5%) within the first 30 days, including 7430 deaths (5.8%) during the index hospitalization. The hospital mortality model with NIHSS scores had significantly better discrimination than the model without (*C* statistic, 0.864; 95% CI, 0.861-0.867, vs 0.772; 95% CI, 0.769-0.776; $P<.001$). Among hospitals ranked in the top 20% or bottom 20% of performers by the claims model without NIHSS scores, 26.3% were ranked differently by the model with NIHSS scores. Of hospitals initially classified as having "worse than expected" mortality, 57.7% were reclassified to "as expected" by the model with NIHSS scores. The net reclassification improvement (93.1%; 95% CI, 91.6%-94.6%; $P<.001$) and integrated discrimination improvement (15.0%; 95% CI, 14.6%-15.3%; $P<.001$) indexes both demonstrated significant enhancement of model performance after the addition of NIHSS. Explained variance and model calibration was also improved with the addition of NIHSS scores.

Conclusion Adding stroke severity as measured by the NIHSS to a hospital 30-day risk model based on claims data for Medicare beneficiaries with acute ischemic stroke was associated with considerably improved model discrimination and change in mortality performance rankings for a substantial portion of hospitals.

JAMA. 2012;308(3):257-264 www.jama.com

INCREASING ATTENTION HAS BEEN given to defining the quality and value of health care through reporting of process and outcome measures.[1,2] National quality profiling efforts have begun to report hospital-level performance for Medicare beneficiaries, including 30-day mortality rates, for common medical conditions, including acute myocardial infarction, heart failure, and community-acquired pneumonia.[3-5] These outcome measures have been adopted by accreditation organizations, the Centers for Medicare & Medicaid Services (CMS), and other payers, and rewards based on risk-adjusted outcomes have

-Large volume stroke centers provide faster treatment and improve the use of thrombolysis for patients with acute ischemic stroke (AIS).

Bigger, Faster?

Associations Between Hospital Thrombolysis Volume and Speed of Thrombolysis Administration in Acute Ischemic Stroke

Benjamin D. Bray, MRCP; James Campbell, LLB; Geoffrey C. Cloud, FRCP;
Alex Hoffman, MSc; Pippa J. Tyrrell, FRCP; Charles D.A. Wolfe, FFPHM;
Anthony G. Rudd, FRCP; on behalf of the Intercollegiate Stroke Working Party Group

Background and Purpose—There is evidence that high-volume hospitals may produce better patient outcomes. We aimed to identify whether there were any associations between hospital thrombolysis volume and speed of thrombolysis (tissue-type plasminogen activator [tPA]) administration in patients with ischemic stroke.

Methods—Data were drawn from 2 national clinical audits in England: the Stroke Improvement National Audit Program and the 2012 Sentinel Stroke Audit. Hospitals were categorized into 3 groups based on the annualized volume of thrombolysis: 0 to 24, 25 to 49, and ≥50 cases per annum. Arrival-brain scan, onset-tPA, and arrival-tPA times were compared across groups and stratified by onset-arrival time. Multilevel logistic models were used to estimate the odds of receiving tPA within 60 minutes of arrival.

Results—Of the 42 024 patients with acute ischemic stroke admitted to 80 hospitals, 4347 received tPA (10.3%). Patients admitted to hospitals with an annual thrombolysis volume of ≥50 cases per annum had median arrival-tPA times that were 28 and 22 minutes shorter than patients admitted to hospitals with volumes of 0 to 24 and 25 to 49, respectively. Onset-tPA times were shorter by 24 to 32 minutes across strata of onset-arrival times. In multivariable analysis, patients admitted to hospitals with a volume of ≥50 cases per annum had 4.33 (2.21–8.50; $P<0.0001$) the odds of receiving tPA within 60 minutes of arrival. No differences in safety outcomes were observed, with similar 30-day mortality and complication rates across the groups.

Conclusions—Hospitals with higher volumes of thrombolysis activity achieve statistically and clinically significant shorter delays in administering tPA to patients after arrival in hospital. (***Stroke*. 2013;44:3129-3135.**)

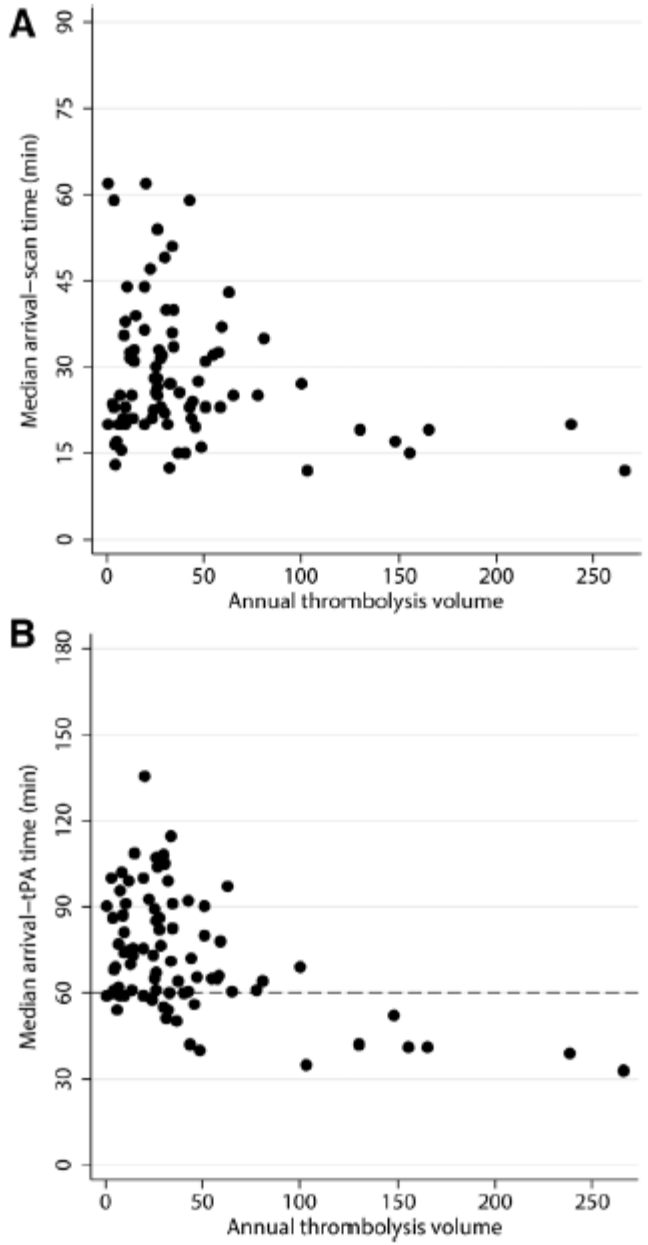

Figure 2. Median arrival-scan (**A**) and arrival-tissue-type plasminogen activator times (**B**) by hospital annual thrombolysis volume.

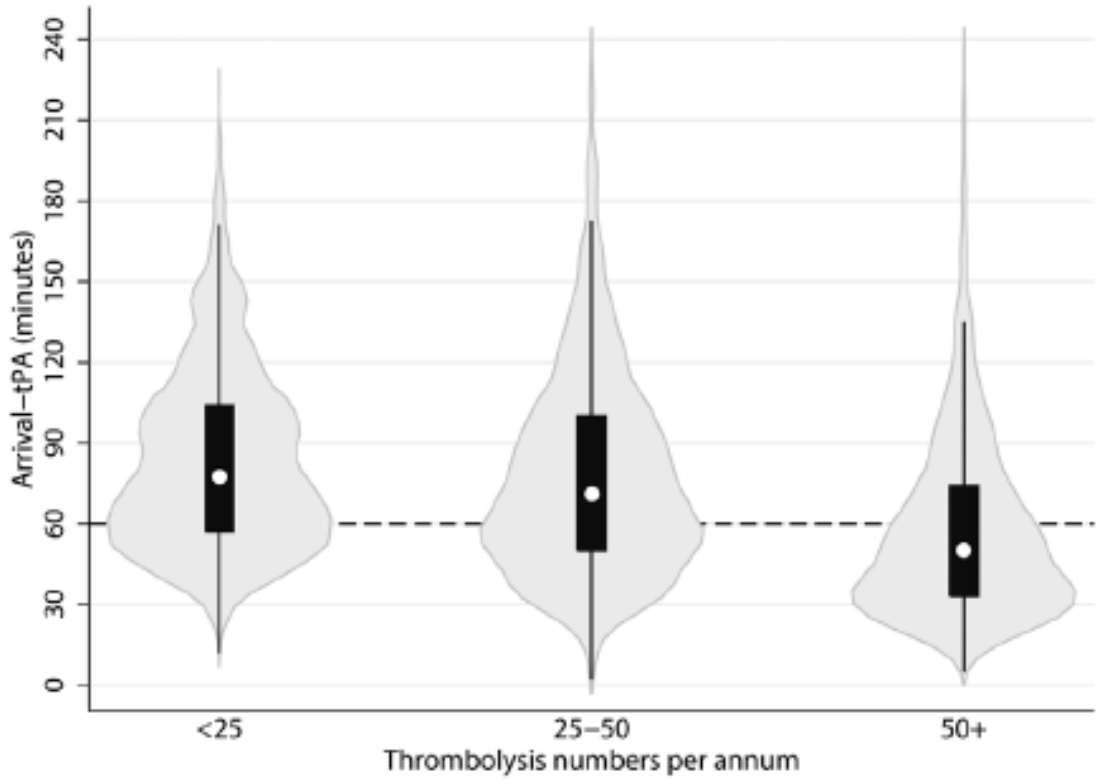

Figure 3. Violin plot of arrival-tissue-type plasminogen activator (tPA) times by thrombolysis volume. The black bars are the interquartile range, the white marks the median, the whiskers delineate the upper and lower adjacent values, and the shaded area is the kernel density.

QUALE MODELLO ORGANIZZATIVO

- TUTTI AL CENTRO DI 2 LIVELLO (TROMBECTOMIA, NCH)?

- Prima al centro che fa trombolisi EV e poi invio i casi selezionati al centro di 2 livello per trombectomia?

Direct to angiography suite approaches for the triage of suspected acute stroke patients: a systematic review and meta-analysis

Ther Adv Neurol Disord

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Alex Brehm, Ioannis Tsogkas, Johanna M. Ospel, Christian Appenzeller-Herzog, Junya Aoki, Kazumi Kimura, Johannes A.R. Pfaff, Markus A. Möhlenbruch, Manuel Requena, Marc J. Ribo, Amrou Sarraj, Alejandro M. Spiotta, Peter Sporns and Marios-Nikos Psychogios

Conclusion: DTAS approaches for the triage of suspected LVO patients led to a significant reduction in door-to-groin and door-to-reperfusion times but an effect on functional outcome was not detected. The subgroup analysis showed similar results for transfer and mothership patients.

La selezione si fa sul territorio (nelle periferie)!!

Che tipo di scale e fatte da chi

- Scale opedaliere→medici (es NIHSS e varianti)

- Scale pre-ospedaliere→fatte da personale 118→centralizzare il pz in centri che fanno trombectomia

Scala pre-ospedaliera di Cincinnati

- Deficit eloquio
- Deficit faciale
- Deficit stenico arto superiore

Identifying Stroke in the Field

Prospective Validation of the Los Angeles Prehospital Stroke Screen (LAPSS)

Chelsea S. Kidwell, MD; Sidney Starkman, MD; Marc Eckstein, MD;
Kimberly Weems, RN; Jeffrey L. Saver, MD

Background and Purpose—Reliable identification of stroke patients in the field by prehospital personnel could expedite delivery of acute stroke therapy. The Los Angeles Prehospital Stroke Screen (LAPSS) is a 1-page instrument designed to allow prehospital personnel to rapidly identify acute stroke patients in the field. We performed a prospective, in-the-field validation study of the LAPSS.

Methods—Paramedics assigned to 3 University of California at Los Angeles–based advanced life support units were trained and certified in use of the LAPSS. Over 7 months, paramedics completed the LAPSS on noncomatose, nontrauma patients with complaints suggestive of neurological disease. LAPSS form stroke identification results were compared with emergency department and final hospital discharge diagnoses. Sensitivity, specificity, positive predictive value, negative predictive value, accuracy, and likelihood ratios were calculated for LAPSS identification of ischemic stroke, currently symptomatic transient ischemic attack, and intracerebral hemorrhage.

Results—Of a total of 1298 runs, 34% were for nontraumatic, noncomatose neurologically relevant complaints. Thirty-six of these patients (3% of all transports) had a final diagnosis of acute symptomatic cerebrovascular disease (21 ischemic strokes, 7 transient ischemic attacks, and 8 intracerebral hemorrhages). LAPSS forms were completed on 206 patients. Paramedic performance when completing the LAPSS demonstrated sensitivity of 91% (95% CI, 76% to 98%), specificity of 97% (95% CI, 93% to 99%), positive predictive value of 86% (95% CI, 70% to 95%), and negative predictive value of 98% (95% CI, 95% to 99%). With correction for the 4 documentation errors, positive predictive value increased to 97% (95% CI, 84% to 99%).

Conclusions—The LAPSS allows prehospital personnel to identify patients with acute cerebral ischemia and intracerebral hemorrhage with a high degree of sensitivity and specificity. **(*Stroke*. 2000;31:71-76.)**

Los Angeles Prehospital Stroke Screen (LAPSS)

1. Patient Name: _____ (*Last*) _____ (*First*)
2. Information/History from:
   [ ] Patient
   [ ] Family Member
   [ ] Other
   _____ (*Name*) Phone: _____
3. Last known time patient was at baseline or deficit free and awake: *Military Time:* _____ *Date:* _____

SCREENING CRITERIA:

	Yes	Unknown	No
4. Age > 45	[ ]	[ ]	[ ]
5. History of seizures or epilepsy **absent**	[ ]	[ ]	[ ]
6. Symptom duration **less than** 24 hours	[ ]	[ ]	[ ]
7. At baseline, patient is **not** wheelchair bound or bedridden	[ ]	[ ]	[ ]

	Yes	No
8. Blood glucose between 60 and 400:	[ ]	[ ]

9. Exam: **LOOK FOR OBVIOUS ASYMMETRY**

	Normal	Right	Left
Facial Smile/Grimace:	☐	☐ Droop	☐ Droop
Grip:	☐	☐ Weak Grip ☐ No Grip	☐ Weak Grip ☐ No Grip
Arm Strength:	☐	☐ Drifts Down ☐ Falls Rapidly	☐ Drifts Down ☐ Falls Rapidly

	Yes	No
Based on exam, patient has **only unilateral** (and not bilateral) weakness:	[ ]	[ ]

	Yes	No
10. ***Items 4,5,6,7,8,9 all YES's (or unknown) → LAPSS screening criteria met:***	[ ]	[ ]

11. If LAPSS criteria for stroke met, call receiving hospital with a "code stroke", if not then return to the appropriate treatment protocol. (Note: the patient may still be experiencing a stroke even if LAPSS criteria are not met.)

TABLE 1. LAPSS Rater Performance Characteristics for LAPSS Form Completed Runs and All Runs

LAPSS Form Completed Runs (n=206)			All Runs (n=1298)		
TP	FP	PPV	TP	FP	PPV
31	5	86% (70–95)	31	5	86% (70–95)
FN	TN	NPV	FN	TN	NPV
3	167	98% (95–99)	5	1257	99% (99–100)
Sensitivity	Specificity	Accuracy	Sensitivity	Specificity	Accuracy
91% (76–98)	97% (93–99)	96% (92–98)	86% (70–95)	99% (99–100)	99% (99–100)

Values in parentheses are 95% CI. TP indicates true-positives; FP, false-positives; FN, false-negatives; TN, true-negatives; PPV, positive predictive value; and NPV, negative predictive value.

Quali scale per identificare pz con occlusione grossi vasi intracranici ossia ICA-T, M1 (m2, (basilare) eligibili per trombectomia?

- A European consensus statement suggested that if baseline arterial imaging is not available, an NIHSS score ≥9 points (within 3 hours of stroke onset) or ≥7 points (within 6 hours) may indicate LAO,

Wahlgren N, Moreira T, Michel P, Steiner T, Jansen O, Cognard C, et al; for ESO-KSU, ESO, ESMINT, ESNR and EAN. Mechanical thrombectomy in acute ischemic stroke: consensus statement by ESO-Karolinska Stroke Update 2014/2015, supported by ESO, ESMINT, ESNR and EAN. Int J Stroke. 2016;11:134–147

Two current US and Canadian guidelines do not state a clinical score as useful to predict LAO.

Powers WJ, Derdeyn CP, Biller J, Coffey CS, Hoh BL, Jauch EC, et al; American Heart Association Stroke Council. 2015 American Heart Association/American Stroke Association Focused Update of the 2013 Guidelines for the Early Management of Patients With Acute Ischemic Stroke Regarding Endovascular Treatment: a Guideline for Healthcare Professionals From the American Heart Association/American Stroke Association. Stroke. 2015;46:3020–3035

Casaubon LK, Boulanger JM, Blacquiere D, Boucher S, Brown K, Goddard T, et al; Heart and Stroke Foundation of Canada Canadian Stroke Best Practices Advisory Committee. Canadian Stroke Best Practice Recommendations: Hyperacute Stroke Care Guidelines, Update 2015. Int J Stroke. 2015;10:924–940.

Quante scale abbiamo?

Table 4. Comparison of Various Published Clinical Scales With the 4I-SS to Predict LVOS in the Validation Cohort

Scale	Cutoff	AUC (95%CI)	Youden index	Sensitivity	Specificity	PPV	NPV	Accuracy	*P* value*
4I-SS	≥4	0.800 (0.789–0.811)	0.494	0.657	0.837	0.600	0.868	0.788	<0.001
NIHSS	≥6	0.797 (0.787–0.806)	0.445	0.834	0.611	0.444	0.908	0.672	<0.001
s-NIHSS-8	≥6	0.794 (0.785–0.803)	0.479	0.699	0.780	0.541	0.874	0.758	<0.001
RACE	≥5	0.791 (0.781–0.800)	0.473	0.672	0.801	0.557	0.868	0.766	<0.001
mNIHSS	≥7	0.790 (0.781–0.800)	0.482	0.716	0.766	0.533	0.879	0.753	<0.001
s-NIHSS-EMS	≥6	0.790 (0.780–0.799)	0.451	0.816	0.635	0.455	0.903	0.684	<0.001
CG-FAST	≥4	0.790 (0.780–0.799)	0.424	0.538	0.886	0.638	0.837	0.792	<0.001
FAST-ED	≥4	0.788 (0.779–0.798)	0.471	0.715	0.756	0.521	0.877	0.744	<0.001
s-NIHSS-5	≥4	0.784 (0.774–0.793)	0.474	0.699	0.775	0.536	0.873	0.754	<0.001
CPSSS	≥2	0.780 (0.771–0.790)	0.452	0.617	0.835	0.582	0.854	0.776	<0.001
3I-SS	≥4	0.779 (0.769–0.789)	0.359	0.443	0.916	0.662	0.815	0.787	<0.001
LAMS	≥4	0.767 (0.757–0.777)	0.441	0.626	0.815	0.558	0.854	0.764	<0.001
PASS	≥2	0.765 (0.755–0.775)	0.452	0.623	0.829	0.576	0.855	0.773	<0.001
FPSS	≥5	0.761 (0.752–0.771)	0.357	0.459	0.898	0.625	0.817	0.779	<0.001
G-FAST	≥3	0.759 (0.749–0.769)	0.406	0.746	0.660	0.450	0.875	0.683	<0.001
s-NIHSS-1	≥2	0.755 (0.745–0.766)	0.402	0.788	0.614	0.432	0.886	0.662	<0.001
ROSIER	≥4	0.730 (0.720–0.740)	0.386	0.689	0.697	0.459	0.858	0.695	<0.001
VAN	≥2	0.718 (0.708–0.728)	0.372	0.834	0.538	0.402	0.897	0.618	<0.001
FAST	≥3	0.709 (0.699–0.719)	0.370	0.684	0.686	0.448	0.854	0.685	<0.001
aNIHSS	≥1	0.695 (0.684–0.705)	0.305	0.549	0.756	0.456	0.818	0.700	<0.001

3I-SS indicates 3-item Stroke Scale; 4I-SS, 4-item Stroke Scale; aNIHSS, abbreviated NIHSS; AUC, area under the curve; CG-FAST, Conveniently-Grasped Field Assessment Stroke Triage; CI, confidence interval; CPSSS, Cincinnati Prehospital Stroke Severity scale; FAST, face–arm–speech–time test; FAST-ED, Field Assessment Stroke Triage for Emergency Destination scale; FPSS, Finnish Prehospital Stroke Scale; G-FAST, gaze–face–arm–speech–time test; LAMS, Los Angeles Motor Scale; LVOS, large vessel occlusion stroke; mNIHSS, modified NIHSS; NIHSS, National Institutes of Health Stroke Scale; NPV, negative

NIHSS Score and Arteriographic Findings in Acute Ischemic Stroke

Urs Fischer, MD; Marcel Arnold, MD; Krassen Nedeltchev, MD; Caspar Brekenfeld, MD; Pietro Ballinari, MSc; Luca Remonda, MD; Gerhard Schroth, MD; Heinrich P. Mattle, MD

Background and Purpose—To test the hypothesis that the National Institutes of Health Stroke Scale (NIHSS) score is associated with the findings of arteriography performed within the first hours after ischemic stroke.

Methods—We analyzed NIHSS scores on hospital admission and clinical and arteriographic findings of 226 consecutive patients (94 women, 132 men; mean age 62±12 years) who underwent arteriography within 6 hours of symptom onset in carotid stroke and within 12 hours in vertebrobasilar stroke.

Results—From stroke onset to hospital admission, 155±97 minutes elapsed, and from stroke onset to arteriography 245±100 minutes elapsed. Median NIHSS was 14 (range 3 to 38), and scores differed depending on the arteriographic findings ($P<0.001$). NIHSS scores in basilar, internal carotid, and middle cerebral artery M1 and M2 segment occlusions (central occlusions) were higher than in more peripherally located, nonvisible, or absent occlusions. Patients with NIHSS scores ≥10 had positive predictive values (PPVs) to show arterial occlusions in 97% of carotid and 96% of vertebrobasilar strokes. With an NIHSS score of ≥12, PPV to find a central occlusion was 91%. In a multivariate analysis, NIHSS subitems such as "level of consciousness questions," "gaze," "motor leg," and "neglect" were predictors of central occlusions.

Conclusions—There is a significant association of NIHSS scores and the presence and location of a vessel occlusion. With an NIHSS score ≥10, a vessel occlusion will likely be seen on arteriography, and with a score ≥12, its location will probably be central. (***Stroke*. 2005;36:2121-2125.**)

Key Words: angiography, digital subtraction ■ stroke, acute ■ thrombolytic therapy

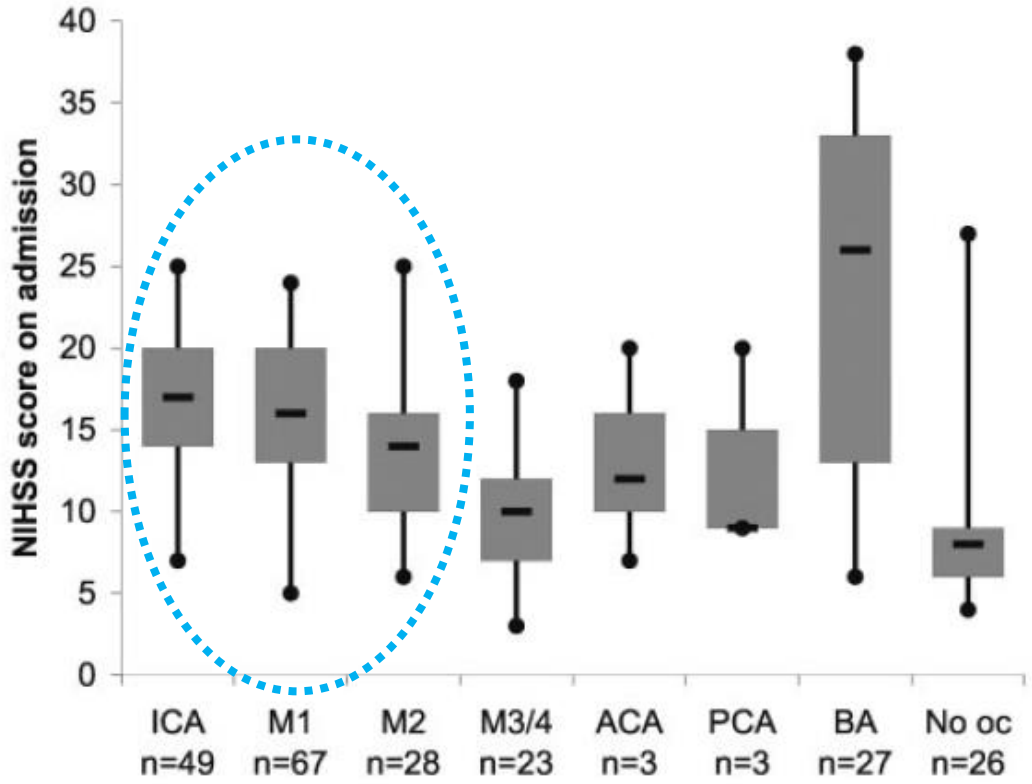
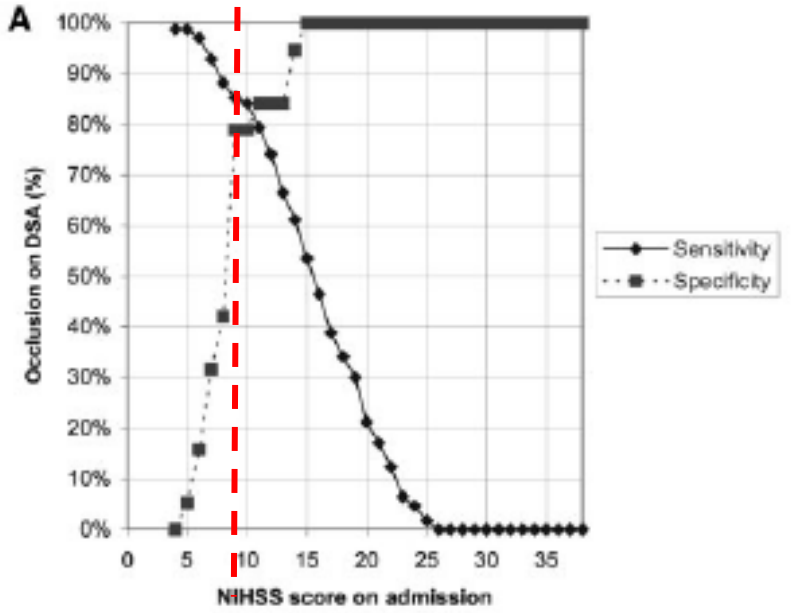


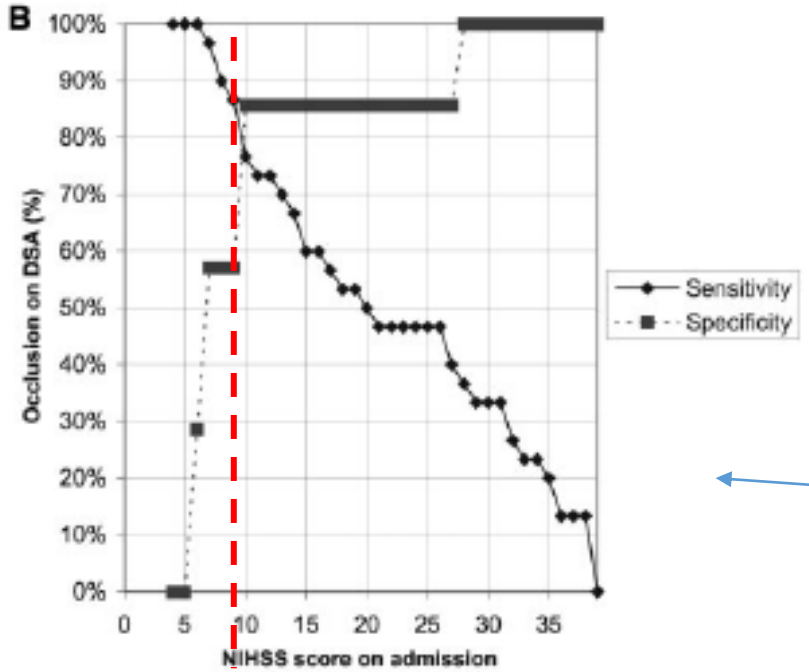
Figure 1. NIHSS (median, first and third quartile, and range) on admission and location of the vessel occlusion as seen on DSA. No oc indicates no occlusion.

NIHSS Items at Baseline and ORs for ICA, M1, M2, or BA Occlusions on DSA

	ORs for Vessel Occlusion	*P* Value (univariate model)	ORs for Vessel Occlusion	*P* Value (multivariate model)
NIHSS items				
LOC	3.3 (1.7–6.5)	0.001		
LOC alertness	3.0 (1.50.8–5.7)	0.001		
LOC questions	2.7 (1.5–5.1)	0.002	4.0 (1.9–8.4)	<0.001
LOC commands	2.7 (1.4–5.4)	0.005		
Gaze	4.6 (2.3–8.9)	<0.001	2.9 (1.4–6.2)	<0.001
Visual fields	2.8 (1.2–6.5)	0.021		
Facial palsy	2.1 (0.8–5.3)	0.129		
Motor arm	4.5 (1.8–11.5	0.002		
Motor leg	5.2 (2.5–10.9)	<0.001	4.2 (1.8–9.6)	0.001
Ataxia	0.4 (0.2–1.2)	0.1		
Sensation	2.5 (1.3–4.6)	0.005		
Language	1.7 (0.9–3.2)	0.079		
Dysarthria	1.3 (0.7–2.5)	0.4		
Neglect	3.5 (1.6–7.9)	0.002	3.2 (1.3–8.1)	0.013

Figures in parentheses indicate 95% CI.
OR indicates odds ratio; LOC, level of consciousness.





Circ post

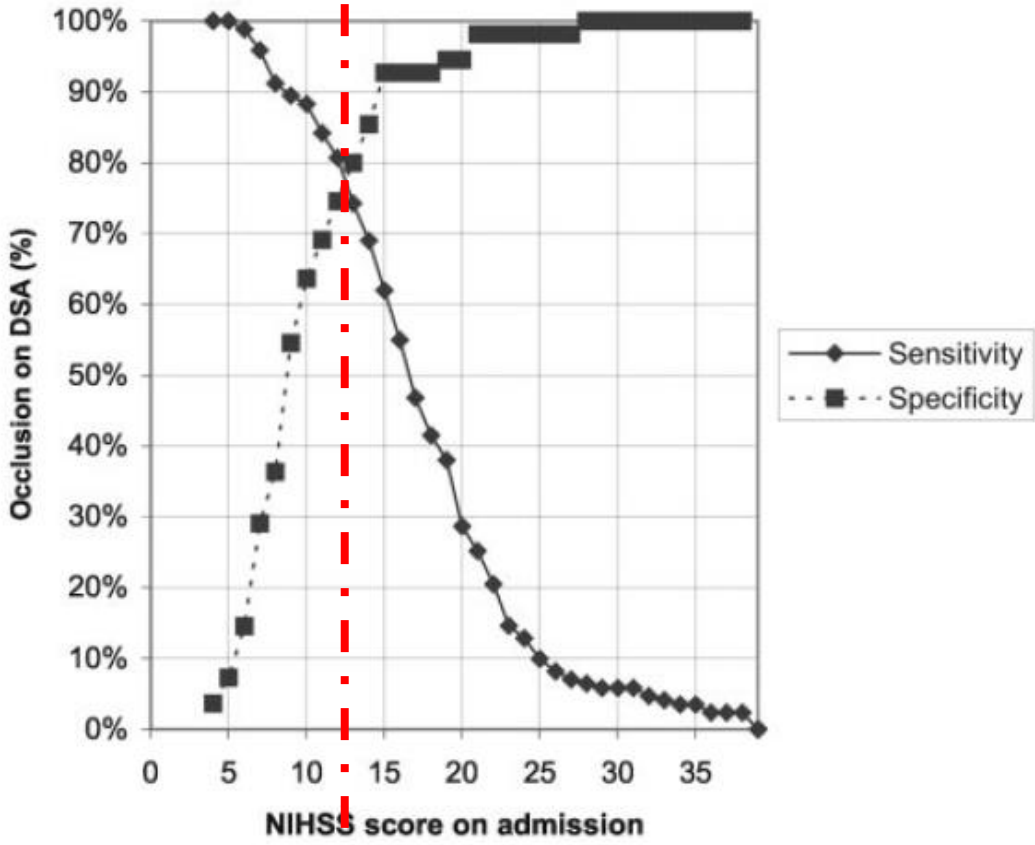


Figure 3. Sensitivity and specificity of NIHSS score on admission of all patients to find a central (ICA, M1, M2, or BA) occlusion on DSA (55 of 226 patients with peripheral occlusion).

Modified National Institutes of Health Stroke Scale for Use in Stroke Clinical Trials

Prospective Reliability and Validity

Brett C. Meyer, MD; Thomas M. Hemmen, MD; Christy M. Jackson, MD; Patrick D. Lyden, MD

Background and Purpose—To prospectively evaluate the reliability and validity of this previously developed stroke scale in an independently collected cohort. The National Institutes of Health Stroke Scale (NIHSS) has been criticized for its complexity and variability. Prior formal clinimetric analyses were used to obtain a modified version of NIHSS (mNIHSS), which retrospectively demonstrated improved reliability and validity. We sought to prospectively measure the reliability and validity of the mNIHSS.

Methods—Forty-five patients with a history of stroke or intracerebral hemorrhage were evaluated at the University of California, San Diego, Stroke Center from September 2000 through March 2001. Each patient was tested by 2 NIHSS-certified neurologists using the NIHSS, mNIHSS, Barthel Index, and Modified Rankin scales.

Results—There were a large percentage of high κ values using the mNIHSS. Only 10 (66.67%) of 15 NIHSS κ scores showed excellent agreement, whereas 10 (90.91%) of 11 mNIHSS κ scores showed excellent agreement. As predicted, the mNIHSS was more reliable than the NIHSS because of the exclusion of items with low κ values. With the use of correlation coefficient analysis, the mNIHSS was as valid as the NIHSS.

Conclusions—This prospective study found high reliability and continued validity by using a previously developed mNIHSS. Items found to have low κ values were consistent with the previously derived retrospective mNIHSS. The resulting mNIHSS scale has much higher κ values. The mNIHSS showed improved agreement between examiners and was also easier to administer, having fewer and simpler items. Further prospective evaluation should assess whether the mNIHSS could be used in lieu of the NIHSS. (***Stroke***. 2002;33:1261-1266.)

TABLE 2. κ Values, Item Reliability Table: Item Name, Number of Comparisons per Item, Weighted κ and 95% CIs for NIHSS and mNIHSS (between examiners)

Number	Item Name	Comparisons per Item, n	Weighted κ Value	95% CIs
NIHSS				
~~1a~~	LOC	45	0.457*	0.164–0.749
1b	LOC questions	45	0.937*	0.645–1.229
1c	LOC commands	45	0.943*	0.652–1.235
2	Gaze	45	0.662*	0.369–0.954
3	Visual fields	45	0.876*	0.589–1.163
~~4~~	Facial palsy	45	0.742*	0.460–1.024
5a	Left arm motor	45	0.971*	0.678–1.263
5b	Right arm motor	45	0.959*	0.669–1.249
6a	Left leg motor	45	0.947*	0.654–1.239
6b	Right leg motor	45	0.975*	0.684–1.267
~~7~~	Limb ataxia	45	0.690*	0.407–0.973
8	Sensory	45	0.892*	0.601–1.183
9	Language	45	0.841*	0.555–1.127
~~10~~	Dysarthria	45	0.289	−0.005–0.583
11	Neglect	45	0.891*	0.599–1.183
	Total	45	0.969*	0.678–1.261
mNIHSS				
1b	LOC questions	45	0.937*	0.645–1.229
1c	LOC commands	45	0.943*	0.652–1.235
2	Gaze	45	0.661*	0.369–0.954
3	Visual fields	45	0.876*	0.589–1.163
5a	Left arm motor	45	0.971*	0.678–1.263
5b	Right arm motor	45	0.959*	0.669–1.249
6a	Left leg motor	45	0.947*	0.654–1.239
6b	Right leg motor	45	0.975*	0.684–1.267
8	Sensory	45	0.910*	0.618–1.202
9	Language	45	0.841*	0.555–1.127
11	Neglect	45	0.891*	0.599–1.183
	Total	45	0.988*	0.696–1.280

TABLE 3. κ Distribution Table: Number of Items With Poor, Moderate, or Excellent κ Agreement for NIHSS and mNIHSS

Agreement Beyond Chance	Items, n (%)	
	NIHSS	mNIHSS
Poor (<=0.40)	1 (6.67)	0 (0)
Moderate (0.40–0.75)	4 (26.67)	1 (9.09)
Excellent (>=0.75)	10 (66.67)	10 (90.91)
Total	15 (100.0)	11 (100.0)

Comparison With the National Institutes of Health Stroke Scale and Prediction of Middle Cerebral Artery Occlusion

Oliver C. Singer, MD; Florian Dvorak, MD; Richard du Mesnil de Rochemont, MD;
Heiner Lanfermann, MD; Matthias Sitzer, MD; Tobias Neumann-Haefelin, MD

Background and Purpose—The purpose of the study was to design a simple stroke scale that requires minimal training but reflects initial stroke severity and is predictive of middle cerebral artery (MCA) occlusion.

Methods—The new stroke scale assessed 3 parameters: (1) level of consciousness, (2) gaze, and (3) motor function. Each item was graded 0 to 2, where 0 indicated normal findings and 2 severe abnormalities (ie, profound drowsiness or worse, forced gaze deviation, and severe hemiparesis, respectively). During a study period of 11 months, patients presenting with acute stroke symptoms (onset ≤6 hours) were examined by a stroke neurologist assessing the new scale as well as the National Institutes of Health Stroke Scale (NIHSS). In addition, 83 patients received acute magnetic resonance angiography (MRA; as part of an acute stroke protocol).

Results—The new stroke scale was strongly associated with the NIHSS. Interobserver reliability of the new scale was high (intraclass correlation coefficient 0.947). Using post hoc analysis, a score of ≥4 predicted proximal vessel occlusion (T-segment or M1-segment occlusion of the MCA on MRA) almost as accurately (overall accuracy 0.86) as an NIHSS score of ≥14 (overall accuracy 0.93).

Conclusions—The new stroke scale reflects acute stroke severity well and predicts proximal MCA occlusion with reasonable accuracy. However, the clinical scale needs further evaluation before it can be recommended as a tool for the triage of acute stroke patients. (***Stroke*. 2005;36:773-776.**)

TABLE 1. The 3-Item Stroke Scale*

Item		Score
Disturbance of consciousness	no	0
	mild	1
	severe	2 → Risvegliabile con stimolo doloroso intenso
Gaze and head deviation	absent	0
	incomplete gaze/head deviation	1 → Passa la mediana con stimolo verbale o visivo
	forced gaze/head deviation	2
Hemiparesis	absent	0
	moderate	1 → 1-2 della scala NIHSS
	severe	2 → 3-4 della scala NIHSS
Score (total)		0–6

*For detailed scoring criteria, see Materials and Methods.

Score >4

TABLE 4. Sensitivity, Specificity, PPV, and NPV of Different Cutoff Values of the 3I-SS for the Detection of Proximal Vessel Occlusion (T/M1 occlusion; n=83)

3I-SS Score	Sensitivity	Specificity	PPV	NPV	OA*
≥1	0.95	0.44	0.36	0.96	0.57
≥2	0.90	0.69	0.50	0.96	0.75
≥3	0.76	0.85	0.64	0.91	0.83
≥4	0.67	0.92	0.74	0.89	0.86
≥5	0.38	1	1	0.83	0.84
≥6	0.14	1	1	0.78	0.78

*Overall accuracy (OA) represents true positive plus true negative divided by total number of patients (n=83).

Score >4

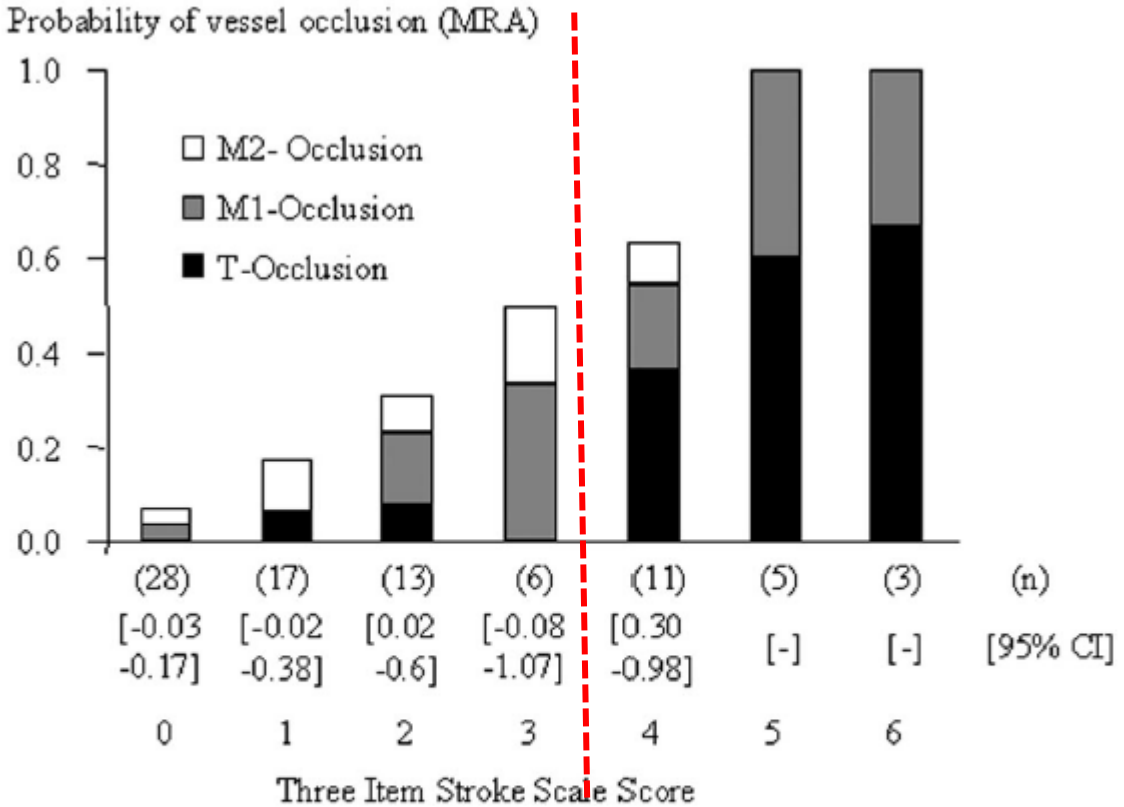


Figure 2. Relative frequency of vessel (T/M1/M2) occlusion detected by MRA for each score of the simplified 3I-SS after exclusion of ICH. n represents the number of patients per 3I-SS category. 95% CI is for the presence of any vessel occlusion (T/M1/M2 occlusion).

A Brief Prehospital Stroke Severity Scale Identifies Ischemic Stroke Patients Harboring Persisting Large Arterial Occlusions

Bijen Nazliel, MD; Sidney Starkman, MD; David S. Liebeskind, MD; Bruce Ovbiagele, MD; Doojin Kim, MD; Nerses Sanossian, MD; Latisha Ali, MD; Brian Buck, MD; Pablo Villablanca, MD; Fernando Vinuela, MD; Gary Duckwiler, MD; Reza Jahan, MD; Jeffrey L. Saver, MD

Background and Purpose—The Los Angeles Motor Scale (LAMS) is a brief 3-item stroke severity assessment measure designed for prehospital and Emergency Department use.

Methods—The LAMS and NIHSS were scored in under-12-hour acute anterior circulation ischemic stroke patients. Stroke severity ratings were correlated with cervicocerebral vascular occlusion on CTA, MRA, and catheter angiography. Receiver operating curves, c statistics, and likelihood ratios were used to evaluate the predictive value for vascular occlusion of stroke severity ratings.

Results—Among 119 patients, mean age was 67 (±18), 45% were male. Time from onset to ED arrival was mean 190 minutes (range 10 to 660). Persisting large vessel occlusions (PLVOs) were present in 62% of patients. LAMS stroke severity scores were higher in patients harboring a vascular occlusion, median 5 (IQR 4 to 5) versus 2 (IQR 1 to 3). Similarly, NIHSS stroke severity scores were higher in PLVO patients, 19 (14 to 24) versus 5 (3 to 7). ROC curves demonstrated that the LAMS was highly effective in identifying patients with PLVOs, c statistic 0.854. At the optimal threshold of 4 or higher, LAMS scores showed sensitivity 0.81, specificity 0.89, and overall accuracy 0.85. LAMS performance was comparable to NIHSS performance (c statistic 0.933). The positive likelihood ratio associated with a LAMS score ≥4 was 7.36 and the negative likelihood ratio 0.21.

Conclusions—Stroke severity assessed by the LAMS predicts presence of large artery anterior circulation occlusion with high sensitivity and specificity. The LAMS is a promising instrument for use by prehospital personnel to identify select stroke patients for direct transport to Comprehensive Stroke Centers capable of endovascular interventions. (***Stroke*. 2008;39:2264-2267.**)

Key Words: acute stroke ■ cerebral infarct ■ scales ■ LAMS (Los Angeles Motor Scale) ■ NIHSS

Stessi items della LAMPSS fatta per identificare sintomi indicativi di uno stroke

Table. The Los Angeles Motor Scale (LAMS)

Facial droop	
Absent	0
Present	1
Arm drift	
Absent	0
Drifts down	1
Falls rapidly	2
Grip strength	
Normal	0
Weak grip	1
No grip	2

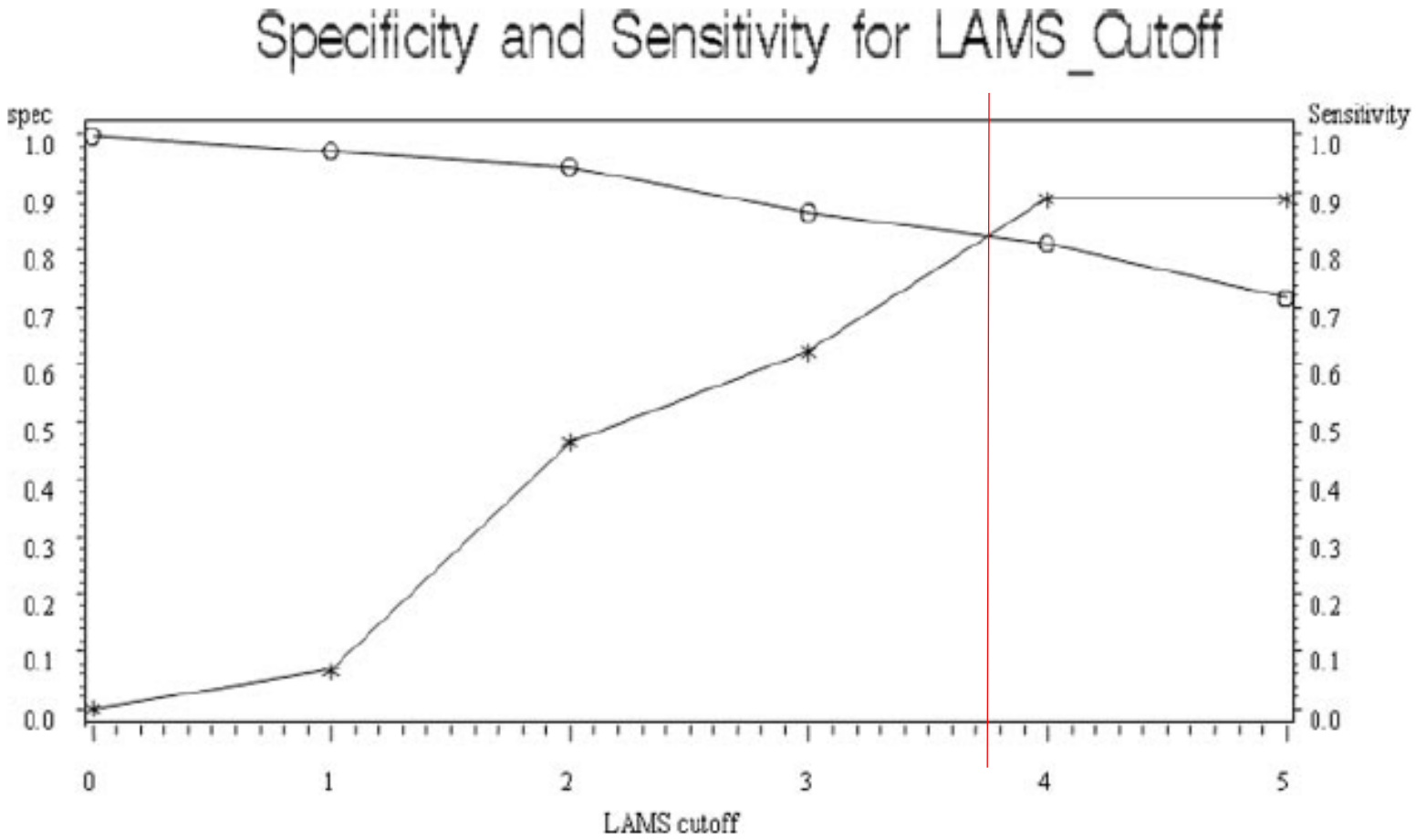


Figure. Receiver operating curve showing specificity (asterisks) and sensitivity (open circles) of LAMS Scores in predicting persisting large vessel occlusion.

Stroke severity scores on the Los Angeles Motor Scale predict the presence of persisting large vessel occlusions. Performing the LAMS/LAPSS is a highly expeditious strategy to identify stroke patients in the field, assess their severity, and determine the likelihood that they are candidates for endovascular therapies. For individual hospitals performing endovascular interventions, once paramedics identify a patient meeting with a LAMS score of ≥4, prearrival notification could accelerate endovascular interventions by permitting early mobilization of the endovascular team and readying of the angiographic suite. For regional systems of care in which EMS routes patients directly to the most appropriate receiving hospitals, a LAMS score ≥4 may be used to route select patients directly to Comprehensive Stroke Centers, avoiding delays introduced by initial delivery to and secondary transfer from nonendovascular sites.

Design and Validation of a Prehospital Scale to Predict Stroke Severity

Cincinnati Prehospital Stroke Severity Scale

Brian S. Katz, MD; Jason T. McMullan, MD; Heidi Sucharew, PhD;
Opeolu Adeoye, MD, MS; Joseph P. Broderick, MD

Background and Purpose—We derived and validated the Cincinnati Prehospital Stroke Severity Scale (CPSSS) to identify patients with severe strokes and large vessel occlusion (LVO).

Methods—CPSSS was developed with regression tree analysis, objectivity, anticipated ease in administration by emergency medical services personnel and the presence of cortical signs. We derived and validated the tool using the 2 National Institute of Neurological Disorders and Stroke (NINDS) tissue-type plasminogen activator Stroke Study trials and Interventional Management of Stroke III (IMS III) Trial cohorts, respectively, to predict severe stroke (National Institutes of Health Stroke Scale [NIHSS] ≥15) and LVO. Standard test characteristics were determined and receiver operator curves were generated and summarized by the area under the curve.

Results—CPSSS score ranges from 0 to 4; composed and scored by individual NIHSS items: 2 points for presence of conjugate gaze (NIHSS ≥1); 1 point for presence of arm weakness (NIHSS ≥2); and 1 point for presence abnormal level of consciousness commands and questions (NIHSS level of consciousness ≥1 each). In the derivation set, CPSSS had an area under the curve of 0.89; score ≥2 was 89% sensitive and 73% specific in identifying NIHSS ≥15. Validation results were similar with an area under the curve of 0.83; score ≥2 was 92% sensitive, 51% specific, a positive likelihood ratio of 3.3, and a negative likelihood ratio of 0.15 in predicting severe stroke. For 222 of 303 IMS III subjects with LVO, CPSSS had an area under the curve of 0.67; a score ≥2 was 83% sensitive, 40% specific, positive likelihood ratio of 1.4, and negative likelihood ratio of 0.4 in predicting LVO.

Conclusions—CPSSS can identify stroke patients with NIHSS ≥15 and LVO. Prospective prehospital validation is warranted. (***Stroke*. 2015;46:1508-1512. DOI: 10.1161/STROKEAHA.115.008804.**)

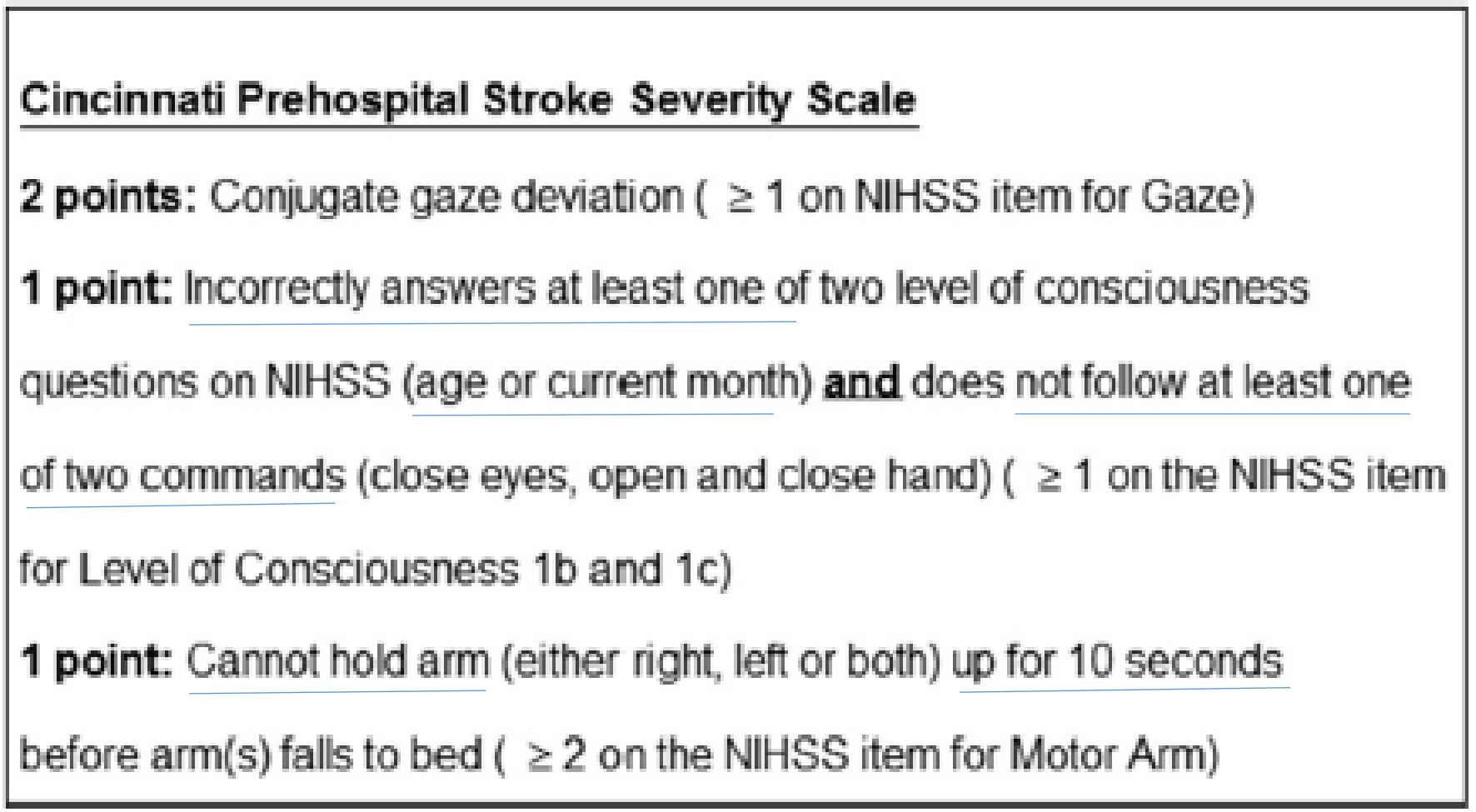


Figure 1. The Cincinnati Prehospital Stroke Severity Scale's individual items and scoring. NIHSS indicates National Institutes of Health Stroke Scale.

4 punti
Score 2-4
→LVO

Discussion

We found that the CPSSS has high sensitivity and acceptable specificity in detecting the presence of severe stroke, moderate stroke, and LVO among populations of patients with AIS. Specifically, the CPSSS can identify stroke patients who could be most likely to benefit from rapid triage to a CSC, including those who harbor proximal LVO that are appropriate targets for intravenous tPA and endovascular therapy. These patients may also be eventual candidates for hemicraniectomy and benefit from a dedicated Neurological Intensive Care Unit (ICU). Given the time-sensitivity of the above therapies, accurate initial triage of patients to hospitals, where these therapies are available, is a key to prevent delays in care and increased costs associated with transfers.

Table 2. Comparison of CPSSS to Other Published Prehospital Stroke Severity Scales

	CPSSS	LAMS	RACE	I3SS
Derivation data set (n)	624	119	654	171
Validated in independent data set (Y/N)	Y	N	Y	N
No. of items scored	3	3	6	3
Sensitivity/specificity for severe stroke	89%/72%	NA	NA	86%/95%*
Sensitivity/specificity for LVO	83%/40%	81%/89%†	85%/67%‡	67%/92%§
Evaluated in prehospital setting (Y/N)	N	N	Y	N

CPSSS indicates Cincinnati Prehospital Stroke Severity Scale; CTA, computed tomography angiography; I3SS, 3-Item Stroke Scale; LAMS, Los Angeles Motor Scale; LVO, large vessel occlusion; MRA, magnetic resonance angiography; N, no; NA, not applicable; RACE, Rapid Arterial Occlusion Evaluation; and Y, yes.

*Severe stroke defined as National Institutes of Health Stroke Scale (NIHSS) ≥14.

†LVO defined as terminal intracranial carotid artery occlusion, M1 segment middle cerebral artery occlusion, M2 segment middle cerebral artery occlusion, and M3/M4 segment middle cerebral artery occlusion using catheter angiography, MRA, CTA, and carotid ultrasound.

‡LVO was defined as occlusion of the terminal intracranial carotid artery, proximal middle cerebral artery (M1 segment), tandem (extracranial carotid artery plus middle cerebral artery) and basilar artery with transcranial duplex (50% of cases), CTA, and MRA.

§LVO defined as T/M1 occlusion all using MRA.

Scala RACE

Design and Validation of a Prehospital Stroke Scale to Predict Large Arterial Occlusion

The Rapid Arterial Occlusion Evaluation Scale

Natalia Pérez de la Ossa, MD, PhD; David Carrera, MD; Montse Gorchs, BD; Marisol Querol, BD; Mònica Millán, MD, PhD; Meritxell Gomis, MD, PhD; Laura Dorado, MD, PhD; Elena López-Cancio, MD, PhD; María Hernández-Pérez, MD; Vicente Chicharro, MD; Xavier Escalada, MD; Xavier Jiménez, MD, PhD; Antoni Dávalos, MD, PhD

Background and Purpose—We aimed to develop and validate a simple prehospital stroke scale to predict the presence of large vessel occlusion (LVO) in patients with acute stroke.

Methods—The Rapid Arterial oCclusion Evaluation (RACE) scale was designed based on the National Institutes of Health Stroke Scale (NIHSS) items with a higher predictive value of LVO on a retrospective cohort of 654 patients with acute ischemic stroke: facial palsy (scored 0–2), arm motor function (0–2), leg motor function (0–2), gaze (0–1), and aphasia or agnosia (0–2). Thereafter, the RACE scale was validated prospectively in the field by trained medical emergency technicians in 357 consecutive patients transferred by Emergency Medical Services to our Comprehensive Stroke Center. Neurologists evaluated stroke severity at admission and LVO was diagnosed by transcranial duplex, computed tomography, or MR angiography. Receiver operating curve, sensitivity, specificity, and global accuracy of the RACE scale were analyzed to evaluate its predictive value for LVO.

Results—In the prospective cohort, the RACE scale showed a strong correlation with NIHSS (r=0.76; P<0.001). LVO was detected in 76 of 357 patients (21%). Receiver operating curves showed a similar capacity to predict LVO of the RACE scale compared with the NIHSS (area under the curve 0.82 and 0.85, respectively). A RACE scale ≥5 had sensitivity 0.85, specificity 0.68, positive predictive value 0.42, and negative predictive value 0.94 for detecting LVO.

Conclusions—The RACE scale is a simple tool that can accurately assess stroke severity and identify patients with acute stroke with large artery occlusion at prehospital setting by medical emergency technicians. (***Stroke*. 2014;45:87-91.**)

Table 1. RACE Scale

Item	RACE Score	NIHSS Score Equivalence
Facial palsy		
Absent	0	0
Mild	1	1
Moderate to severe	2	2–3
Arm motor function		
Normal to mild	0	0–1
Moderate	1	2
Severe	2	3–4
Leg motor function		
Normal to mild	0	0–1
Moderate	1	2
Severe	2	3–4

Table 1. RACE Scale

Item	RACE Score	NIHSS Score Equivalence
Head and gaze deviation		
Absent	0	0
Present	1	1–2
Aphasia* (if right hemiparesis)		
Performs both tasks correctly	0	0
Performs 1 task correctly	1	1
Performs neither tasks	2	2
Agnosia† (if left hemiparesis)		
Patient recognizes his/her arm and the impairment	0	0
Does not recognized his/her arm or the impairment	1	1
Does not recognize his/her arm nor the impairment	2	2
Score total	0–9	

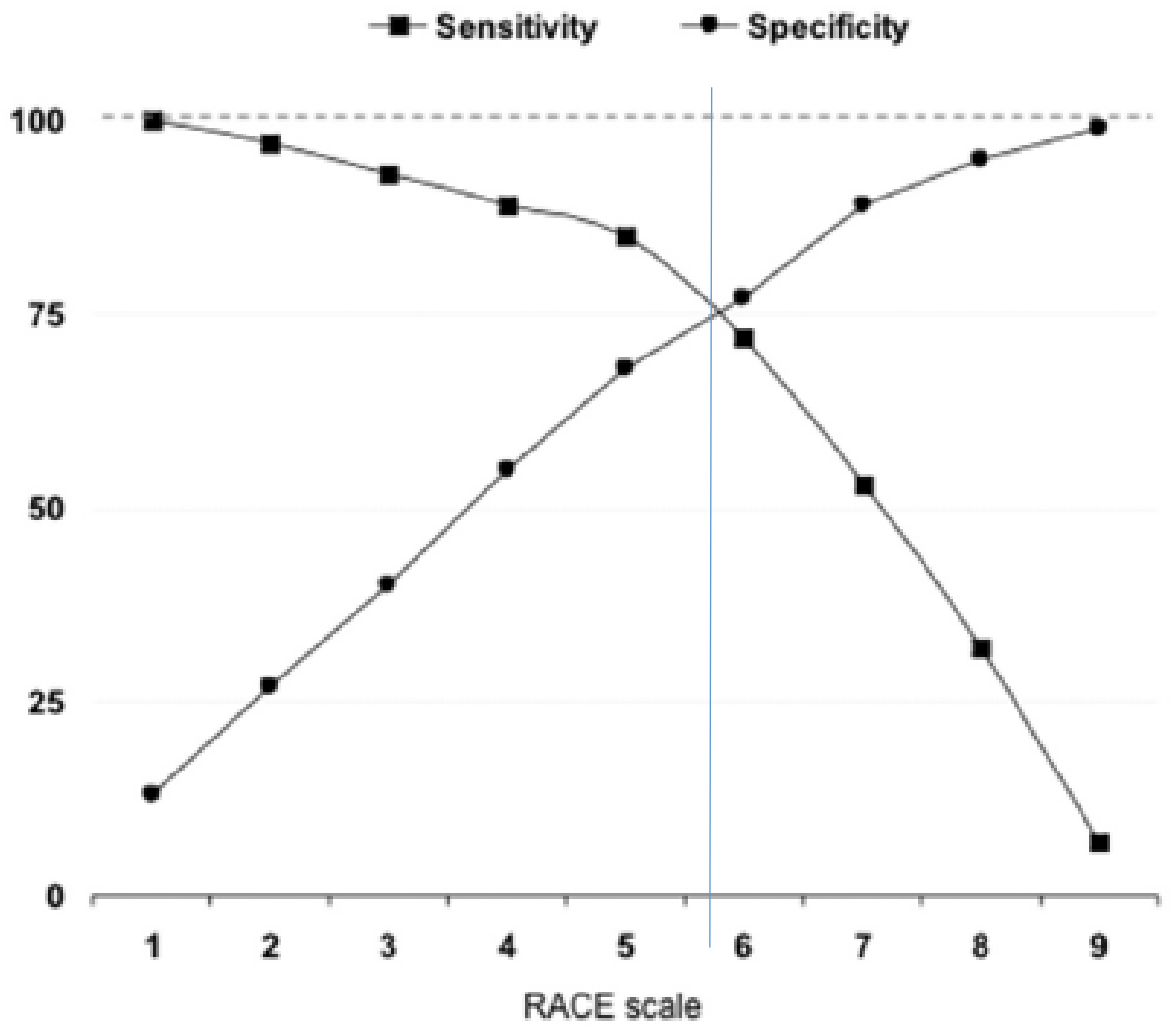


Figure 1. Sensitivity (squares) and specificity (circles) of different cutoff values of the Rapid Arterial oCclusion Evaluation (RACE) scale for the detection of large vessel occlusion.

Table 3. Sensitivity, Specificity, PPV, NPV, and Overall Accuracy of Different Cutoff Values of the RACE Scale for the Detection of Large Artery Occlusion

RACE Score	No.	Sensitivity	Specificity	PPV	NPV	Accuracy
≥1	320	1.00	0.13	0.24	1.00	0.31
≥2	278	0.97	0.27	0.27	0.97	0.42
≥3	239	0.93	0.40	0.30	0.96	0.51
≥4	194	0.89	0.55	0.35	0.95	0.62
≥5	154	0.85	0.68	0.42	0.94	0.72
≥6	120	0.72	0.77	0.46	0.91	0.76
≥7	71	0.53	0.89	0.56	0.87	0.81
≥8	37	0.32	0.95	0.65	0.84	0.82
9	9	0.07	0.99	0.56	0.79	0.79

NPV indicates negative predictive value; PPV, positive predictive value; and RACE, Rapid Arterial oCclusion Evaluation.

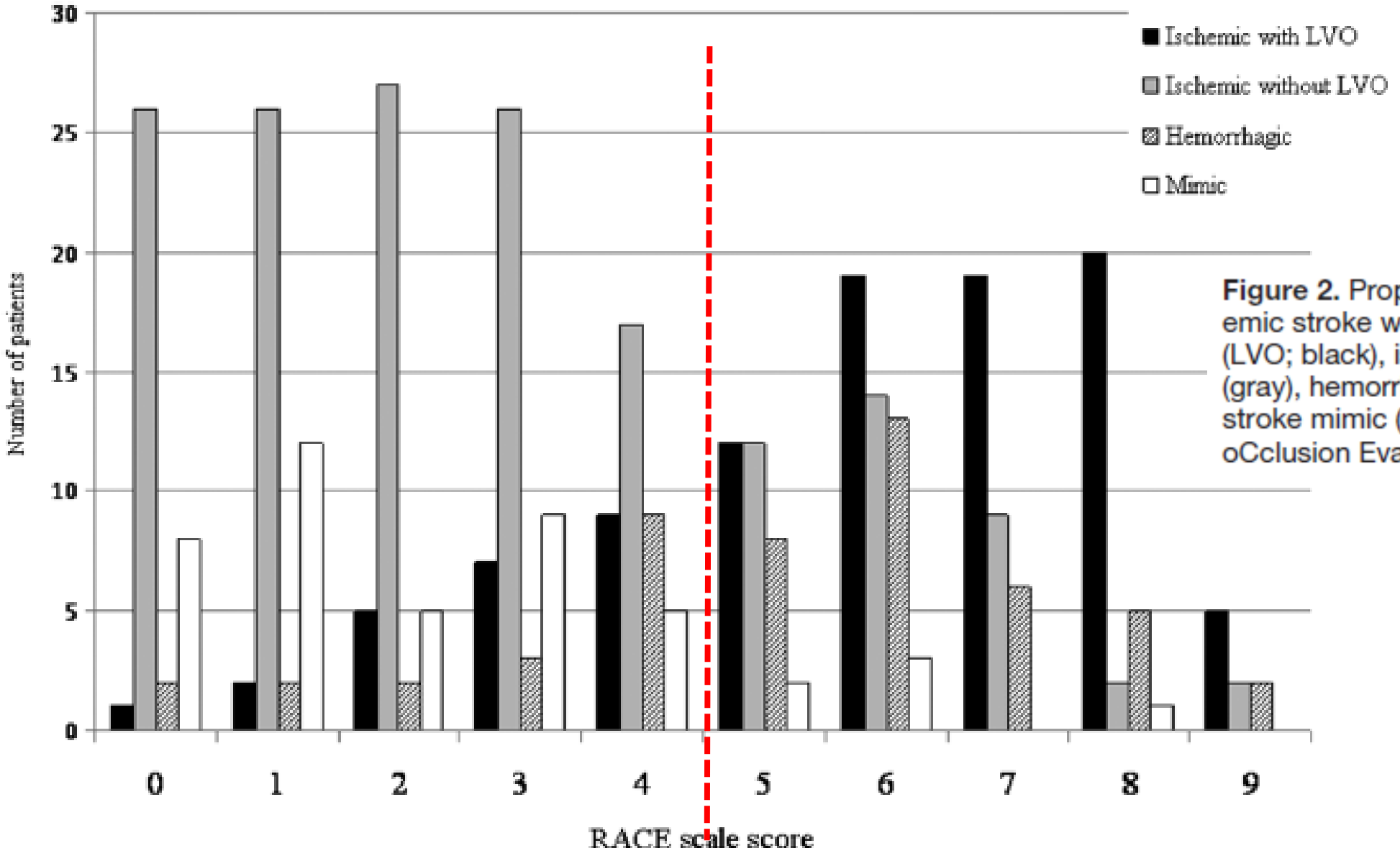


Figure 2. Proportion of patients with ischemic stroke with large vessel occlusion (LVO; black), ischemic stroke without LVO (gray), hemorrhagic stroke (dashed), or stroke mimic (white) for every Rapid Arterial oCclusion Evaluation (RACE) scale score.

Journal of the American Heart Association

ORIGINAL RESEARCH

Novel Prehospital Triage Scale for Detecting Large Vessel Occlusion and Its Cause

Jianan Wang, MD; Xiaoxian Gong, MD; Wansi Zhong, MD; Ying Zhou, PhD; Min Lou, MD, PhD

BACKGROUND: Patients with large vessel occlusion stroke (LVOS) need to be rapidly identified and transferred to comprehensive stroke centers. However, current prehospital evaluation and strategies still remain challenging.

METHODS AND RESULTS: We retrospectively reviewed our prospectively collected database of patients with acute ischemic stroke (AIS). Based on the items of National Institutes of Health Stroke Scale and medical history that had a strong association with LVOS, we designed the 4-item Stroke Scale (4I-SS) and validated it in multi-centers. The 4I-SS incorporated gaze, level of consciousness, arm weakness, and atrial fibrillation. Receiver operating characteristic analysis was used to compare the 4I-SS with previously established prehospital prediction scales. Finally, 1630 and 11 440 patients were included in the derivation and validation cohort, respectively. In the validation cohort, Youden Index, area under the curve, sensitivity, specificity, positive predictive value, negative predictive value, and accuracy of the 4I-SS≥4 to predict LVOS were 0.494, 0.800, 0.657, 0.837, 0.600, 0.868, and 0.788, respectively, and that of the 4I-SS≥7 to predict basilar artery occlusion were 0.200, 0.669, 0.229, 0.971, 0.066, 0.974, and 0.899, respectively. Youden Index and area under the curve were higher than previously published scales for predicting LVOS. Further analysis showed that for predicting whether cardiogenic embolism was the cause, its accuracy was 0.922 when the 4I-SS score, including atrial fibrillation, was ≥6, and its accuracy of predicting the occluded vessel was intracranial internal carotid artery or M1 segment of the middle cerebral artery when it was ≥7 was 0.590.

CONCLUSIONS: The 4I-SS is an effective and simple tool that can identify LVOS and its cause.

Table 1. The 4I-SS and Its Correspondence to the NIHSS

Item	4I-SS	NIHSS
Gaze		
Normal	0	0
Partial or forced deviation	2	1–2
LOC		
Normal	0	0
Mild disturbance	1	1
Severe disturbance	2	2–3
Arm weakness		
No drift	0	0
Drift but does not hit bed	1	1
Some effort against gravity, no effort against gravity or no movement	3	2–4
AF		
Yes	1	
No	0	

4I-SS indicates 4-item Stroke Scale; AF, atrial fibrillation; LOC, level of consciousness; and NIHSS, National Institutes of Health Stroke Scale.

Table 5. Sensitivity, Specificity, PPV, NPV, and Accuracy of Different Cutoff Values of the 4I-SS in Detecting CE in the Validation Cohort

Validation cohort (n=11 440)					
4I-SS score	Sensitivity	Specificity	PPV	NPV	Accuracy
≥4	0.752	0.928	0.560	0.968	0.909
≥5	0.609	0.959	0.645	0.953	0.921
≥6	0.564	0.966	0.669	0.948	0.922
≥7	0.340	0.983	0.713	0.924	0.913
≥8	0.191	0.991	0.725	0.910	0.904

4I-SS indicates 4-item Stroke Scale; CE, cardiogenic embolism; NPV, negative predictive value; and PPV, positive predictive value.

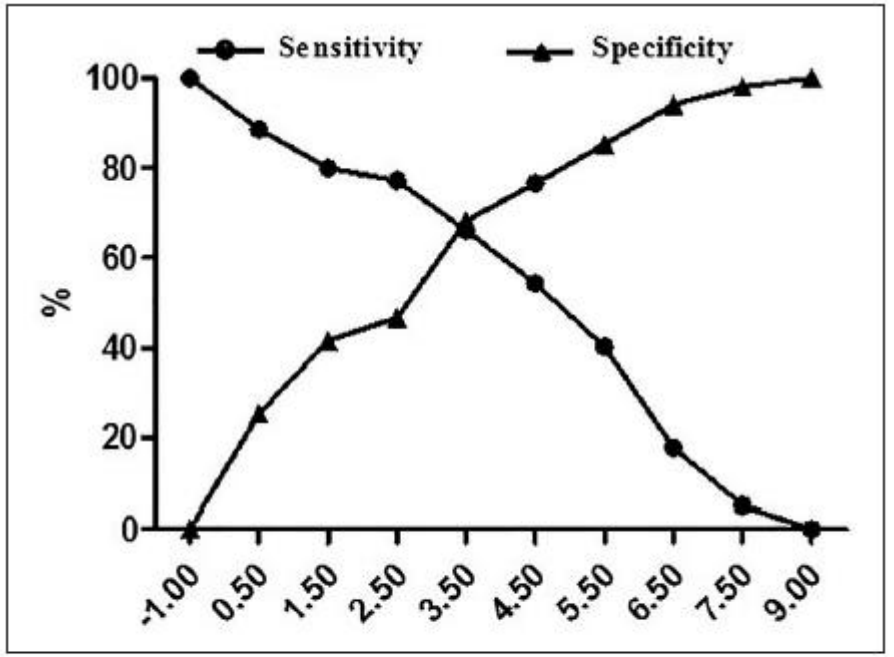


Figure. Sensitivity and specificity of different cutoff values of the 4-Item Stroke Scale in detecting large vessel occlusion stroke in the derivation cohort.

CONCLUSIONS

The 4I-SS is an effective and simple tool that can identify LVOS and its cause, and moderately predict the occluded vessel.

- **MA ALLA FINE TUTTE QUESTE SCALE SERVONO?**

Journal of
Clinical Medicine

MDPI

Article

Assessment of Clinical Scales for Detection of Large Vessel Occlusion in Ischemic Stroke Patients from the Dijon Stroke Registry

Gauthier Duloquin [1,2], Mathilde Graber [1,2], Lucie Garnier [1,2], Sophie Mohr [1,2], Maurice Giroud [1,2], Catherine Vergely [1,2] and Yannick Béjot [1,2,*]

Table 1. Items used in different scales in order to predict occlusion along with patients with available data in the Dijon Stroke Registry.

Scale	Patients with Data	Gender	AF	mRS	Clinical items													
					Consciousness	Questions	Commands	Gaze	Visual	Diplopia	False Palsy	Arm Motor	Leg Motor	Ataxia	Sensory	Language	Dysarthria	Neglect
CPSSS	949				X			X				x						
ROSIER	949								X		X	X	X			X	X	
RACE	949						X	X			X	X	X					X
ASTRAL	943	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X
mNIHSS	938					X	X	X	X			X	X		X	X		X
aNIHSS	949										X	X	X				X	
sNIHSS5	949							X	X				X			X		
PASS	949					X		X				X						
3ISS	949				X			X				X	X					
Van	949						X		X	X		X	X			X		X
LVOS	941							X			X	X	X			X		
MPSS	951										X	X				X	X	
sNIHSS-EMS	941				X						X	X	X		X	X	X	
G-FAST	949							X			X	X				X		
FAST-ED	946							X			X	X				X		X
NIHSS	961				X	X	X	X	X	X	X	X	X	X	X	X	X	X

Table 3. Positive predictive value (PPV) and negative predictive value (NPV) of the different scales for the restricted and the wide definition of large vessel occlusion (LVO).

Scale	Restricted Definition of LVO		Wide Definition of LVO	
	PPV	NPV	PPV	NPV
CPSSS	0.35	0.95	0.44	0.91
ROSIER	0.35	0.97	0.45	0.94
RACE	0.38	0.96	0.48	0.92
ASTRAL	0.41	0.96	0.52	0.92
mNIHSS	0.35	0.97	0.46	0.94
aNIHSS	0.17	0.99	0.23	0.96
sNIHSS5	0.34	0.96	0.45	0.92
PASS	0.36	0.96	0.45	0.92
3ISS	0.27	0.96	0.35	0.93
VAN	0.34	0.97	0.44	0.94
LVOS	0.28	0.98	0.38	0.96
MPSS	0.29	0.99	0.39	0.96
G-FAST	0.38	0.95	0.49	0.92
FAST-ED	0.39	0.96	0.52	0.91
NIHSS	0.34	0.97	0.45	0.94
sNIHSS-EMS	0.31	0.97	0.41	0.94

5. Conclusions

To conclude, our study demonstrated that currently available clinical stroke severity scales failed to combine both a high sensitivity and specificity to detect LVO in routine clinical practice. These results support the need for further studies to address the issue of the best strategy for pre-hospital triage of IS patients and to assess the effectiveness of alternative management, such as mobile stroke units [40].

When considering the restricted definition of LVO, the application of the scales that had the highest specificity would miss almost 30% of patients with an actual LVO. Conversely, the use of scales with the highest sensitivity would be associated with an unconfirmed suspicion of LVO in 20% to 30% of patients, and even two-thirds for the aNIHSS scale. The reliability of the scales was even poorer when considering the wide definition of LVO. Because of the limited number of thrombectomy-capable centres in France, as in many other countries, our results seem to indicate that decision making regarding pre-hospital triage could not rely exclusively on these scales since this would expose the system to the risk of excessive workload.

Clinical Scales Do Not Reliably Identify Acute Ischemic Stroke Patients With Large-Artery Occlusion

Guillaume Turc, PhD*; Benjamin Maïer, MD*; Olivier Naggara, PhD; Pierre Seners, MD; Clothilde Isabel, MD; Marie Tisserand, PhD; Igor Raynouard, MD; Myriam Edjlali, MD; David Calvet, PhD; Jean-Claude Baron, ScD; Jean-Louis Mas, MD; Catherine Oppenheim, PhD

Background and Purpose—It remains debated whether clinical scores can help identify acute ischemic stroke patients with large-artery occlusion and hence improve triage in the era of thrombectomy. We aimed to determine the accuracy of published clinical scores to predict large-artery occlusion.

Methods—We assessed the performance of 13 clinical scores to predict large-artery occlusion in consecutive patients with acute ischemic stroke undergoing clinical examination and magnetic resonance or computed tomographic angiography ≤6 hours of symptom onset. When no cutoff was published, we used the cutoff maximizing the sum of sensitivity and specificity in our cohort. We also determined, for each score, the cutoff associated with a false-negative rate ≤10%.

Results—Of 1004 patients (median National Institute of Health Stroke Scale score, 7; range, 0–40), 328 (32.7%) had an occlusion of the internal carotid artery, M1 segment of the middle cerebral artery, or basilar artery. The highest accuracy (79%; 95% confidence interval, 77–82) was observed for National Institute of Health Stroke Scale score ≥11 and Rapid Arterial Occlusion Evaluation Scale score ≥5. However, these cutoffs were associated with false-negative rates >25%. Cutoffs associated with an false-negative rate ≤10% were 5, 1, and 0 for National Institute of Health Stroke Scale, Rapid Arterial Occlusion Evaluation Scale, and Cincinnati Prehospital Stroke Severity Scale, respectively.

Conclusions—Using published cutoffs for triage would result in a loss of opportunity for ≥20% of patients with large-artery occlusion who would be inappropriately sent to a center lacking neurointerventional facilities. Conversely, using cutoffs reducing the false-negative rate to 10% would result in sending almost every patient to a comprehensive stroke center. Our findings, therefore, suggest that intracranial arterial imaging should be performed in all patients with acute ischemic stroke presenting within 6 hours of symptom onset. **(*Stroke*. 2016;47:1466-1472. DOI: 10.1161/STROKEAHA.116.013144.)**

to be strongly associated with LAO at baseline.[20] However, whether this score is truly helpful in identifying patients with LAO remains debated.[21,22] Indeed, at intersection of sensitivity and specificity curves to identify LAO, Hansen et al[9] observed an NIHSS score cutoff of 6, whereas other groups suggested very different cut points, such as 14.[8] The NIHSS value maximizing the sum of sensitivity and specificity was 11 in our population, which is in line with previous studies.[6,7,21] However, using this cutoff as a rule for patient triage would have led to sending 35% of our cohort to a CSC but would have resulted in a potential loss of opportunity for the 27% of patients with an LAO sent to centers lacking neurointerventional facilities. Although a recent study showed a much lower FNR (12%) using the NIHSS score cutoff ≥11,[6] our results are in line with 2 previous studies in which FNRs of 23% and 35% were observed.[7,21]

QUALE MODELLO ORGANIZZATIVO?

- TUTTI AL CENTRO DI 2 LIVELLO (TROMBECTOMIA, NCH)?

- Prima al centro che fa trombolisi EV e poi invio i casi selezionati al centro di 2 livello per trombectomia?

REVIEW

Mothership versus drip and ship for thrombectomy in patients who had an acute stroke: a systematic review and meta-analysis

Mohammad Ismail,[1] Xavier Armoiry,[2,3] Noam Tau,[4] François Zhu,[5] Udi Sadeh-Gonik,[6] Michel Piotin,[7] Raphael Blanc,[7] Mikaël Mazighi,[7] Serge Bracard,[5,8] René Anxionnat,[5,8] Emmanuelle Schmitt,[5] Gioia Mione,[9] Lisa Humbertjean,[9] Jean-Christophe Lacour,[9] Sébastien Richard,[9,10] Charlotte Barbier,[1] Bertrand Lapergue,[11] Benjamin Gory[5,8]

Conclusions Patients who had an acute ischemic stroke admitted directly to a comprehensive stroke center (MS patients) with endovascular capacities may have better 90-day outcomes than those receiving DS treatment. However, major limitations of current evidence (ie, retrospective studies and selection bias) suggest a need for adequately powered studies. Multicenter randomized controlled trials are expected to answer this question.

Table 1 Study baseline characteristics

Study, year	MS/DS (n)	Study period	Study design	Device used	ICA-M1-M2 occlusion, % (MS/DS)	Intravenous thrombolysis, % (MS/DS)	Other functional outcome parameters		
							Age	NIHSS	ASPECTS
Saver *et al*[10] 2015	67/31	December 2012–November 2014	RCT	SR	NA	NA	NA	NA	NA
Park *et al*[11] 2016	77/28	January 2011–April 2014	PR, RE	SR, ADAPT	41.6–68.8/39.3–75*	100/100	☑	☑	NA
Prothmann *et al*[12] 2017	38/53	February 2013–February 2015	PR, RE	SR	13–71.7/73.7–15.8*	60.5/66	☑	NA	NA
Weber *et al*[13] 2016	300/343	June 2012–August 2013	PR, RE	SR, ADAPT	19.3–57.7-15.3/19–51.3–16.3	50.3/46.9	☑	☑	NA
Rinaldo *et al*[14] 2017	62/78	2009–2016	RR, RE	NA	27.4–51.6–11.3/23.1–66.7–2.6	64.5/53.8	☑	☑	☑
Gerschenfeld *et al*[15] 2017	59/100	January 2013–April 2016	PR, RE	SR, ADAPT	33.9–57.6–8.5/36–49–15	100/100	☑	☑	☑
Froehler *et al*[17] 2017	539/445	August 2014–June 2016	PR, RE	SR	22.8–54–19.1/22.5–56.2–15.5	61/67.2	☑	☑	☑
Weisenburger-Lile *et al*[16] 2018	286/602	December 2012–December 2016	PR, RE	SR, ADAPT	14–53.7–14.4/18.6–50.6–12.6	100/100	☑	☑	☑

*ICA-MCA.

☑Variable accounted in the study.

ADAPT, a direct aspiration first pass technique; ASPECTS, Alberta Stroke Programme Early CT Score; DS, drip and ship; ICA, internal carotid artery; M1, M1 segment of the middle cerebral artery; M2, M2 segment of the middle cerebral artery; MCA, middle cerebral artery; MS, mothership; NIHSS, National Institutes of Health Stroke Scale; PR, prospective database; RCT, randomized controlled trial; RR, retrospective database; RE, retrospective analysis; SR, stent retriever.

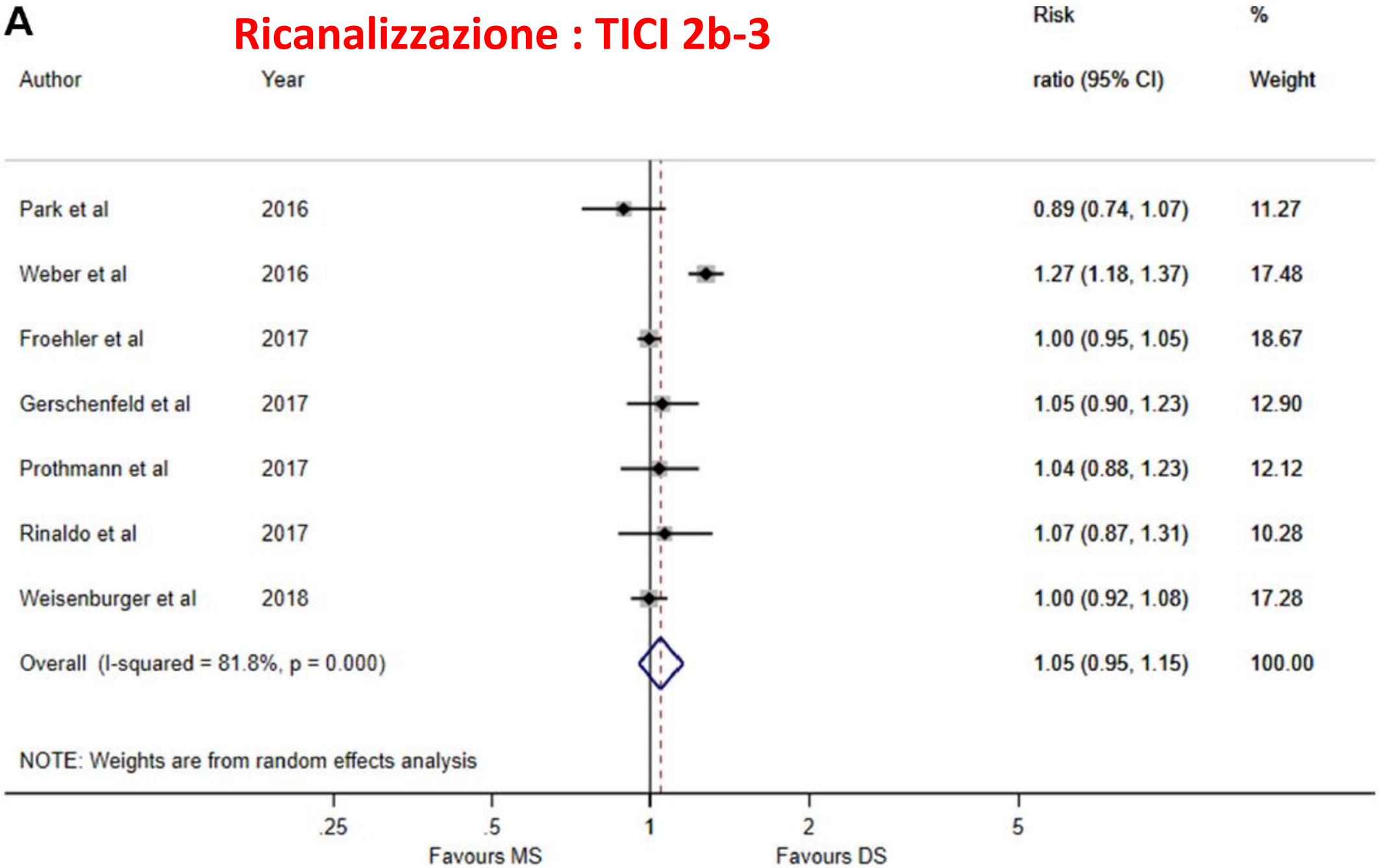
Table 2 Mean time metrics

Study, year	MS/DS (n)	Symptoms onset-to-thrombolysis, min (MS/DS)*	Symptoms onset-to-puncture, min (MS/DS)*	Symptoms onset-to-successful reperfusion, min (MS/DS)*
Saver *et al*[10] 2015	67/31	NA	179 (147–238)/275 (245–334)	NA
Park *et al*[11] 2016	77/28	NA	219±56/300±63	NA
Prothmann *et al*[12] 2017	38/53	NA	137/233	180 (112–386)/289 (172– 469)†
Weber *et al*[13] 2016	300/343	92±114/115±116	150 (34–913)/233 (60–1260)†	245 (69–1022)/292 (91–1376)†
Rinaldo *et al*[14] 2017	62/78	NA	NA	277±173/420±220
Gerschenfeld *et al*[15] 2017	59/100	135 (114–155)/150 (120–190)	189 (163–212)/248 (220–291)	240 (202–285)/297 (255–357)
Froehler *et al*[17] 2017	539/445	110/98	158/274	202 (160–265)/311.5 (255–356)
Weisenburger-Lile *et al*[16] 2018	286/602	131 (110–161)/150 (120–180)	171 (142–208)/260 (222–300)	218 (181–260)/315 (266– 375)

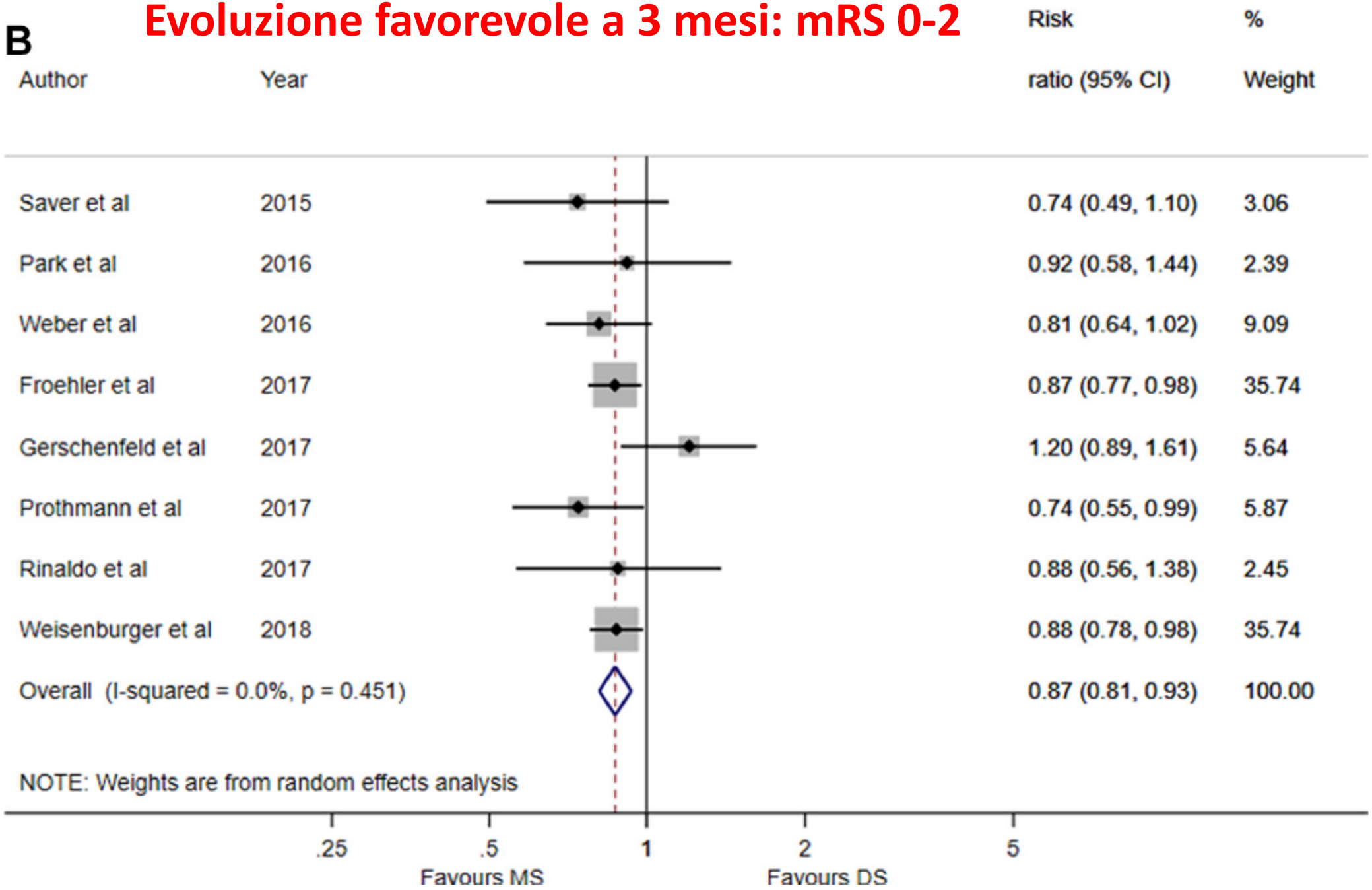
Successful reperfusion was defined as TICI or mTICI ≥2b at the end of thrombectomy.
*Mean±SD or median (IQR) reported; †range.
DS, drip and ship; MS, mothership; mTICI; modified Thrombolysis In Cerebral Infarction.

A

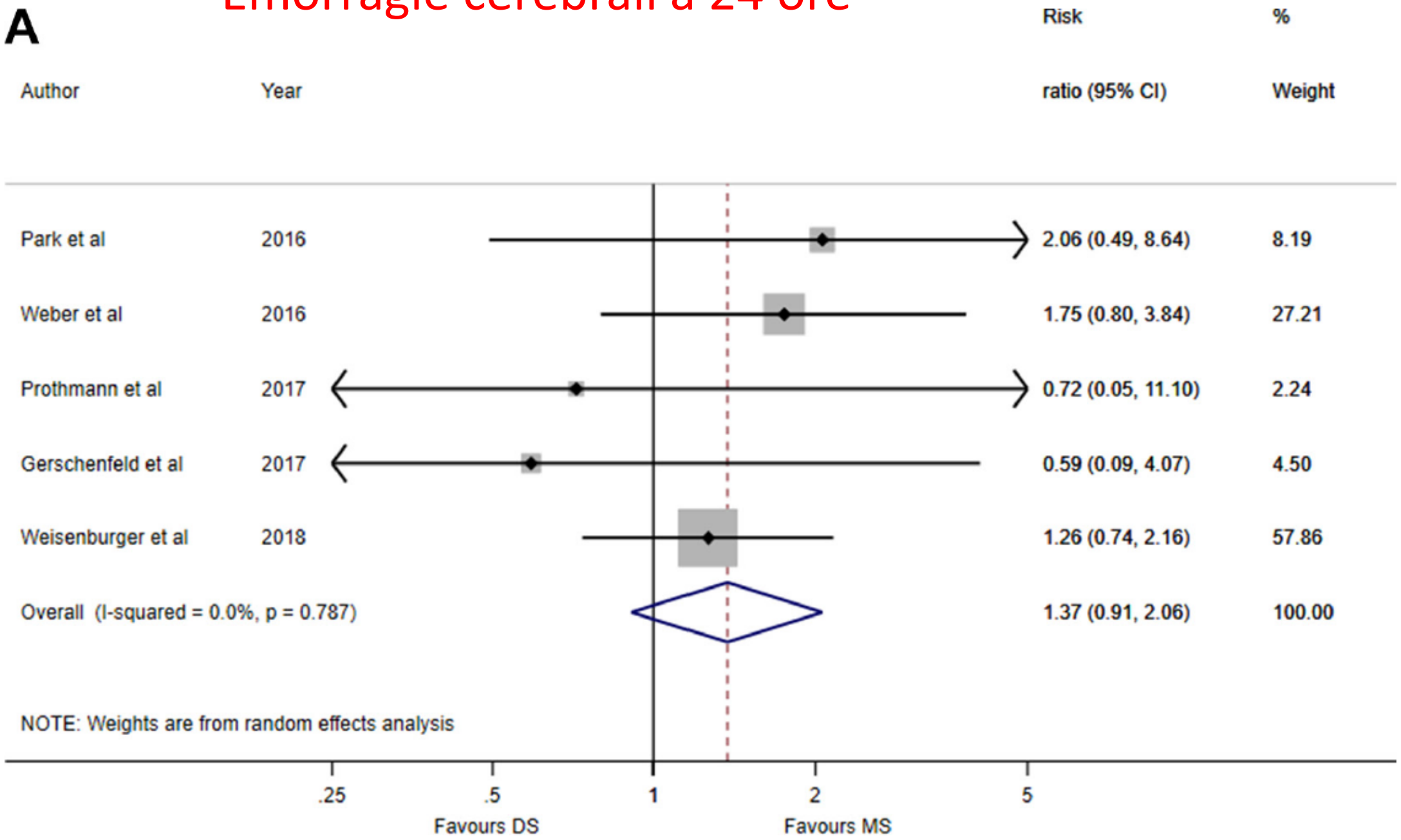
Ricanalizzazione : TICI 2b-3



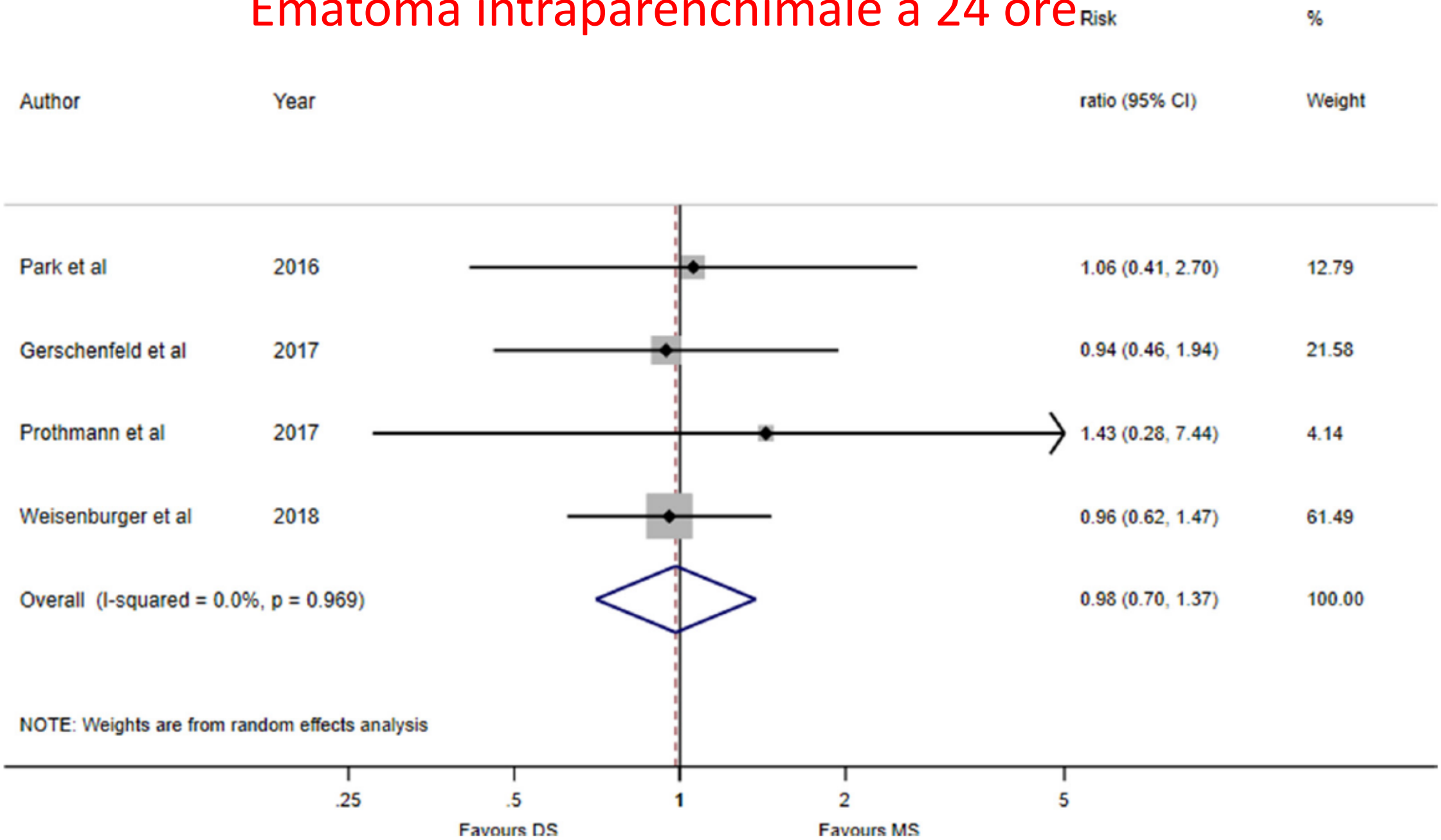
Evoluzione favorevole a 3 mesi: mRS 0-2



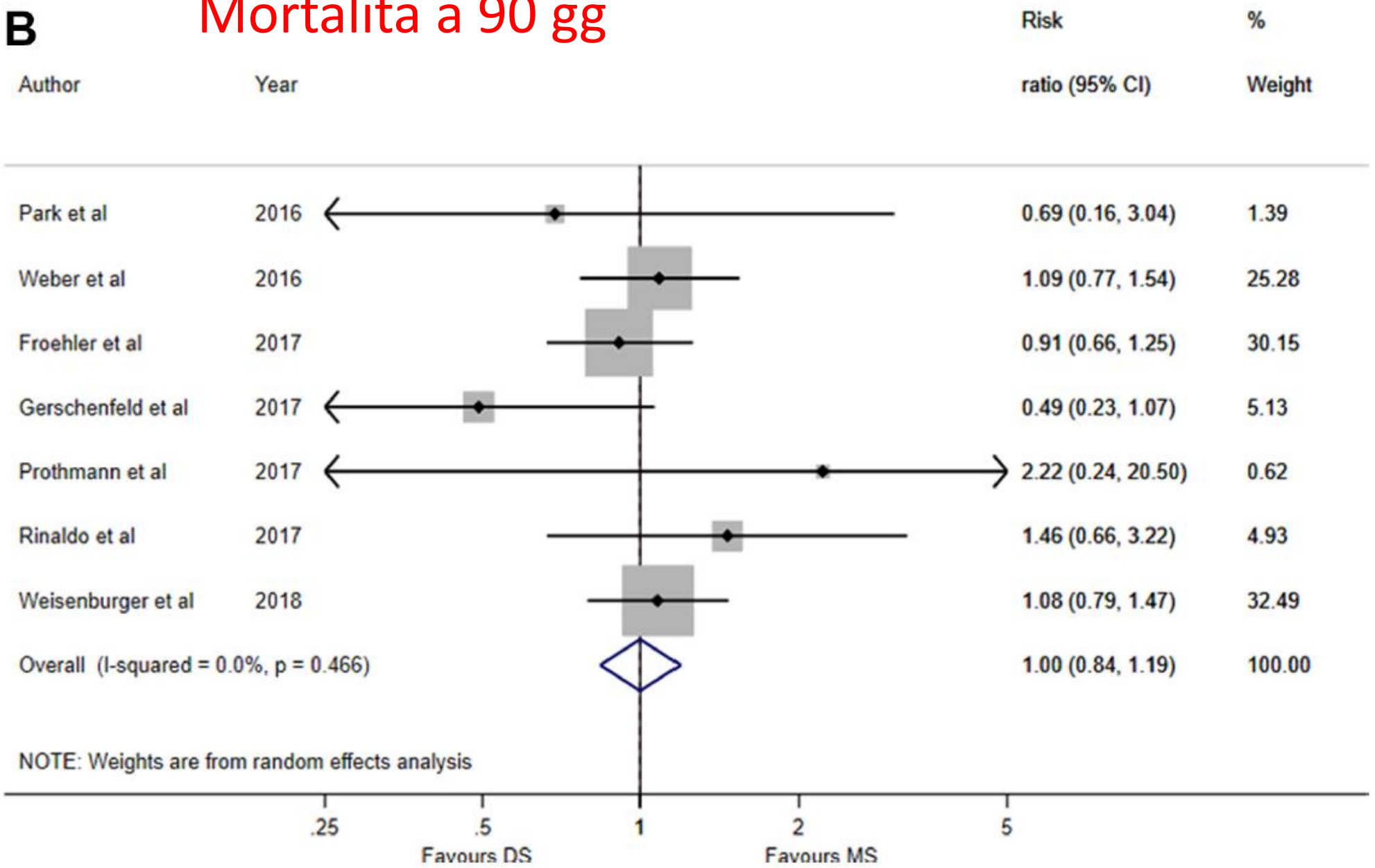
Emorragie cerebrali a 24 ore



Ematoma intraparenchimale a 24 ore



Mortalita a 90 gg



CONCLUSIONS

This meta-analysis reported that patients undergoing IV thrombolysis and MT in a comprehensive stroke centers, without going first to a primary stroke center (MS) had better 90-day functional outcomes than patients undergoing IV thrombolysis in primary stroke centers first (DS); there were no concerns about safety. These results do not correlate with the current guidelines, which recommend rapid transport of patients with a stroke to the nearest primary stroke center capable of providing IV thrombolytic therapy, even if they are being considered for MT.

JAMA Neurology | Original Investigation

Modeling Stroke Patient Transport for All Patients With Suspected Large-Vessel Occlusion

Jessalyn K. Holodinsky, MSc; Tyler S. Williamson, PhD; Andrew M. Demchuk, MD; Henry Zhao, MBBS; Luke Zhu; Michael J. Francis; Mayank Goyal, MD; Michael D. Hill, MD, MSc; Noreen Kamal, PhD

CONCLUSIONS AND RELEVANCE This study suggests that decision making for prehospital transport can be modeled using existing clinical trial data and that these models can be dynamically adapted to changing realities. Based on current median treatment times to realize the full benefit of endovascular therapy on a population level, the study findings suggest that delivery of the treatment should be regionally centralized. The study modeling suggests that transport decision making is context specific and the radius of superiority of the transport strategy changes based on treatment times at both centers, transport times, and the triaging tool used.

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JOURNAL OF STROKE

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Review

Mothership versus Drip-and-Ship Model for Mechanical Thrombectomy in Acute Stroke: A Systematic Review and Meta-Analysis for Clinical and Radiological Outcomes

Michele Romoli,[a,b] Maurizio Paciaroni,[c] Georgios Tsivgoulis,[d,e] Elio Clemente Agostoni,[f] Simone Vidale[a]

Conclusions Patients with acute ischemic stroke eligible for reperfusion strategies might benefit more from MS paradigm as compared to DS. RCTs are needed to further refine best management taking into account logistics, facilities and resources.

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ARTICLE

Drip and ship for mechanical thrombectomy within the Neurovascular Network of Southwest Bavaria

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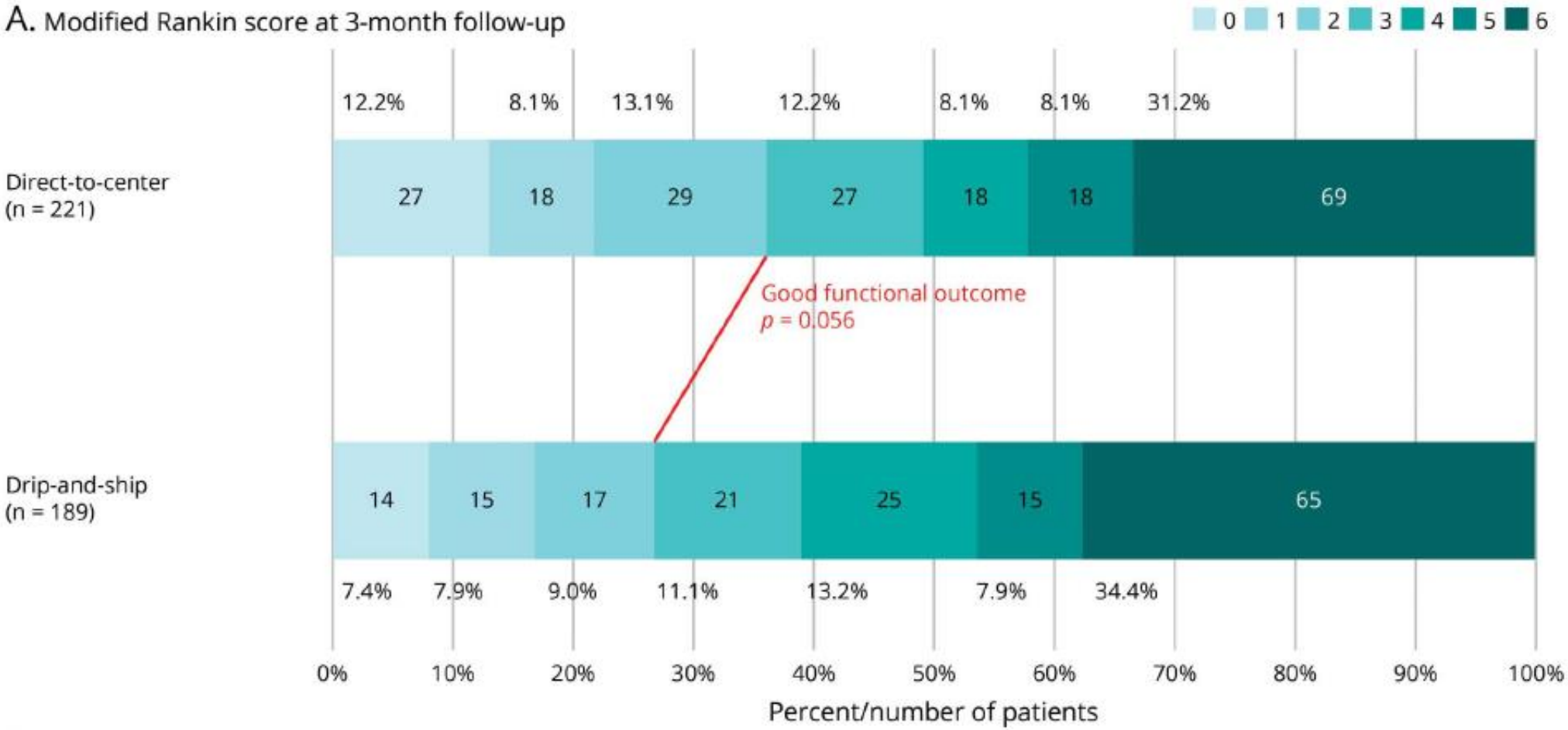
Conclusion

DS patients benefit from MT without relevant safety concerns, but with a trend to unfavorable outcome compared to DTC patients. These results suggest that DS is suitable to provide MT in rural areas where DTC is not possible.

Figure 2 Modified Rankin Scale (mRS) score at 3 months follow-up



B. Modified Rankin score at 3-month follow-up and comparison with patient selection according to HERMES meta-analysis

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SAGE

Transfer to the Local Stroke Center versus Direct Transfer to Endovascular Center of Acute Stroke Patients with Suspected Large Vessel Occlusion in the Catalan Territory (RACECAT): Study protocol of a cluster randomized within a cohort trial

Sònia Abilleira[1], Natalia Pérez de la Ossa[2], Xavier Jiménez[3], Pere Cardona[4], Dolores Cocho[5], Francisco Purroy[6], Joaquín Serena[7], Luis San Román[8], Xabier Urra[9], Marta Vilaró[10], Jordi Cortés[10], José Antonio González[10], Ángel Chamorro[9], Miquel Gallofré[1], Tudor Jovin[11], Carlos Molina[12], Erik Cobo[10], Antoni Dávalos[2] and Marc Ribó[12]

Abstract

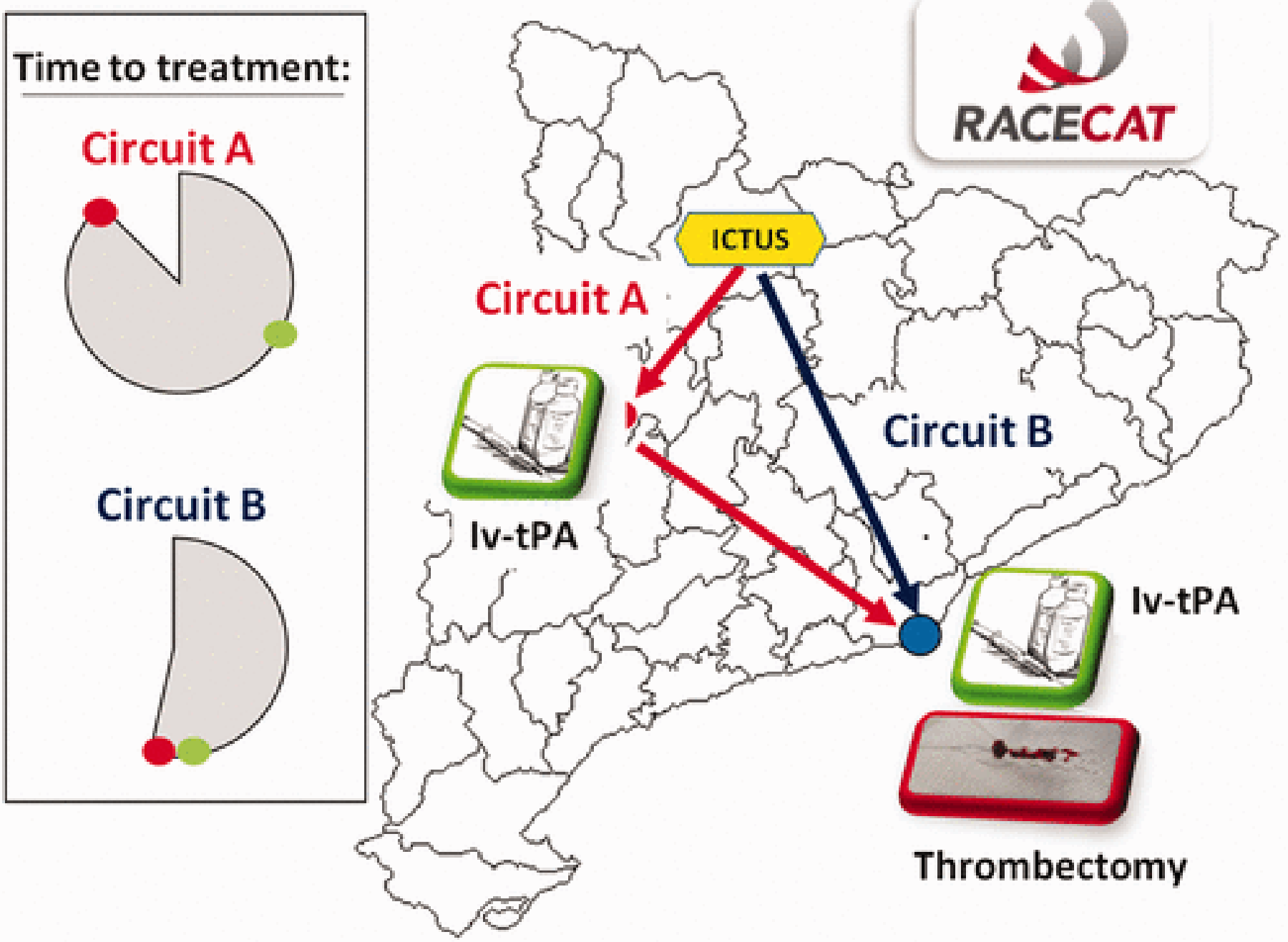
Rationale: Optimal pre-hospital delivery pathways for acute stroke patients suspected to harbor a large vessel occlusion have not been assessed in randomized trials.

Aim: To establish whether stroke subjects with rapid arterial occlusion evaluation scale based suspicion of large vessel occlusion evaluated by emergency medical services in the field have higher rates of favorable outcome when transferred directly to an endovascular center (endovascular treatment stroke center), as compared to the standard transfer to the closest local stroke center (local-SC).

Design: Multicenter, superiority, cluster randomized within a cohort trial with blinded endpoint assessment.

Procedure: Eligible patients must be 18 or older, have acute stroke symptoms and not have an immediate life threatening condition requiring emergent medical intervention. They must be suspected to have intracranial large vessel occlusion based on a pre-hospital rapid arterial occlusion evaluation scale of $\geq$5, be located in geographical areas where the default health authority assigned referral stroke center is a non-thrombectomy capable hospital, and estimated arrival at a thrombectomy capable stroke hospital in less than 7 h from time last seen well. Cluster randomization is performed according to a pre-established temporal sequence (temporal cluster design) with three strata: day/night, distance to the endovascular treatment stroke center, and week/week-end day.

Study outcome: The primary endpoint is the modified Rankin Scale score at 90 days. The primary safety outcome is mortality at 90 days.


Time to treatment:
Circuit A
Circuit B
RACECAT
ICTUS
Circuit A
Iv-tPA
Circuit B
Iv-tPA
Thrombectomy

ISO
ITALIAN STROKE ORGANIZATION

HOME PROFILO

AHA/ASA Guideline

Guidelines for the Early Management of Patients With Acute Ischemic Stroke: 2019 Update to the 2018 Guidelines for the Early Management of Acute Ischemic Stroke

A Guideline for Healthcare Professionals From the American Heart Association/American Stroke Association

LINEE GUIDA

"Le linee guida italiane di prevenzione e trattamento dell'Ictus cerebrale rientrano nei compiti statutari di ISO Organization nella realizzazione delle linee-guida SPREAD. Il Panel di esperti designato da ISO provvede all

LINEE GUIDA 2020: TERAPIE DI RIVASCOLARIZZAZIONE

LINEE GUIDA

ISO SPREAD WEB SITE

PICO: in pazienti adulti con sospetto ictus acuto potenziali candidati all'intervento endovascolare nel setting pre-ospedaliero, il modello "mothership" rispetto a quello "drip&ship" migliora l'esito clinico?

Raccomandazione 9.52

In pazienti adulti con sospetto ictus acuto potenziali candidati all'intervento endovascolare nel setting pre-ospedaliero, **non vi è evidenza della superiorità del modello mother-ship rispetto al modello drip&ship**, per cui **è raccomandato** l'arruolamento dei pazienti in trial specifici.

Raccomandazione per la ricerca

Sintesi 9.54

In assenza di evidenze a favore del modello *mother-ship* o del modello *drip&ship*, la letteratura indica che il modello adottato dovrebbe dipendere dall'organizzazione locale e dalle caratteristiche del paziente. Il modello ***mother-ship*** sarebbe da preferire quando il tempo di trasporto al centro di secondo livello dotato di interventistica endovascolare sia **al di sotto dei 30-45 minuti**, mentre il modello ***drip&ship*** sarebbe preferibile quando i tempi per raggiungere il centro ictus di secondo livello siano **superiori ai 45 minuti**, purché il tempo door-to-needle del centro ictus di primo livello non sia superiore ai 60 minuti

PICO: in pazienti adulti con sospetto ictus acuto, l'uso di scale pre-ospedaliere rispetto al loro non utilizzo, incrementa l'identificazione di pazienti con ictus ischemico candidabili al trattamento endovascolare?

Raccomandazione 9.51

In pazienti adulti con sospetto ictus acuto l'utilizzo di scale pre-ospedaliere **non è raccomandato** per identificare pazienti con ictus ischemico candidabili al trattamento endovascolare

Forza raccomandazione: Forte contro ↓↓

Qualità Evidenza: bassa ⊕⊕

DRIP and SHIP

FASE PREOSPEDALIERA→118

AHA/ASA Guideline

Guidelines for the Early Management of Patients With Acute Ischemic Stroke: 2019 Update to the 2018 Guidelines for the Early Management of Acute Ischemic Stroke

A Guideline for Healthcare Professionals From the American Heart Association/American Stroke Association

3. Patients with a positive stroke screen or who are strongly suspected to have a stroke should be transported rapidly to the closest healthcare facilities that are able to administer IV alteplase.	I	B-NR
The 2013 recommendation referred to initial emergency care as described elsewhere in the guidelines, which specified administration of IV alteplase as part of this care. The current recommendation is unchanged in intent but reworded to make this clear.		
4. When several IV alteplase–capable hospital options exist within a defined geographic region, the benefit of bypassing the closest to bring the patient to one that offers a higher level of stroke care, including mechanical thrombectomy, is uncertain.	IIb	B-NR

MOTERSHIP

1.3. EMS Systems

1.3. EMS Systems	COR	LOE	New, Revised, or Unchanged
1. Regional systems of stroke care should be developed. These should consist of the following: (a) healthcare facilities that provide initial emergency care, including administration of IV alteplase, and (b) centers capable of performing endovascular stroke treatment with comprehensive periprocedural care to which rapid transport can be arranged when appropriate.	I	A	Recommendation reworded for clarity from 2015 Endovascular. COR and LOE unchanged. See Table XCV in online Data Supplement 1 for original wording.
2. EMS leaders, in coordination with local, regional, and state agencies and in consultation with medical authorities and local experts, should develop triage paradigms and protocols to ensure that patients with a known or suspected stroke are rapidly identified and assessed by use of a validated and standardized tool for stroke screening.	I	B-NR	Recommendation reworded for clarity from 2013 Stroke Systems of Care. COR and LOE added to conform with ACC/AHA 2015 Recommendation Classification System. See Table XCV in online Data Supplement 1 for original wording.
Multiple stroke screening tools have been developed for prehospital evaluation of suspected stroke. A 2016 systematic review assessed the performance of 7 tools.[26] Those with the highest number of subjects in whom the tool had been applied included Cincinnati Prehospital Stroke Scale (CPSS),[27] Los Angeles Prehospital Stroke Screen (LAPSS),[28] Recognition of Stroke in the Emergency Room (ROSIER),[29] and FAST (Face, Arm, Speech, Time).[30] CPSS and FAST performed similarly with regard to sensitivity (range, 44%–95% for CPSS, 79%–97% for FAST) but both had poor specificity (range, 24%–79% for CPSS, 13%–88% for FAST). More complex tools such as LAPSS had improved specificity (range, 48%–97%) but at the cost of sensitivity (range, 59%–91%). All tools inadequately accounted for false-negative cases, thereby likely artificially boosting performance. The review concluded that no strong recommendation could be made for use of one tool over another.			See Tables III and IV in online Data Supplement 1.

1.6. Telemedicine

1.6. Telemedicine	COR	LOE
1. For sites without in-house imaging interpretation expertise, teleradiology systems approved by the US Food and Drug Administration are recommended for timely review of brain imaging in patients with suspected acute stroke.	I	A
2. When implemented within a telestroke network, teleradiology systems approved by the US Food and Drug Administration are effective in supporting rapid imaging interpretation in time for IV alteplase administration decision making.	I	A
Studies of teleradiology to read brain imaging in acute stroke have successfully assessed feasibility; agreement between telestroke neurologists, radiologists, and neuroradiologists over the presence or absence of radiological contraindications to IV alteplase; and reliability of telestroke radiological evaluations. Further support for this unchanged recommendation from the 2013 AIS Guidelines with LOE upgraded to A is provided by 3 additional studies published since the 2013 Guidelines.[55–57]		

3. The use of telemedicine/telestroke resources and systems should be supported by healthcare institutions, governments, payers, and vendors as one method to ensure adequate 24/7 coverage and care of acute stroke patients in a variety of settings.	**I**	**C-EO**
4. Telestroke/teleradiology evaluations of AIS patients can be effective for correct IV alteplase eligibility decision making.	**IIa**	**B-R**
The STRokEDOC (Stroke Team Remote Evaluation Using a Digital Observation Camera) pooled analysis supported the hypothesis that telemedicine consultations, which included teleradiology, compared with telephone-only resulted in statistically significantly more accurate IV alteplase eligibility decision-making for patients exhibiting symptoms and signs of an acute stroke syndrome in EDs.[58]		

1.6. Telemedicine (Continued)	COR	LOE	New, Revised, or Unchanged
5. Administration of IV alteplase guided by telestroke consultation for patients with AIS can be beneficial.	**IIa**	**B-NR**	New recommendation.
A systematic review and meta-analysis was performed to evaluate the safety and efficacy of IV alteplase delivered through telestroke networks in patients with AIS. sICH rates were similar between patients subjected to telemedicine-guided IV alteplase and those receiving IV alteplase at stroke centers. There was no difference in mortality or in functional independence at 3 months between telestroke-guided and stroke center–managed patients. The findings indicate that IV alteplase delivery through telestroke networks is safe and effective in the 3-hour time window.[59]			See Table XII in online Data Supplement 1.
6. Telestroke networks may be reasonable for triaging patients with AIS who may be eligible for interfacility transfer in order to be considered for emergency mechanical thrombectomy.	**IIb**	**B-NR**	New recommendation.
An observational study compared clinical outcomes of EVT between patients with anterior circulation stroke transferred after teleconsultation and those directly admitted to a tertiary stroke center. The study evaluated 151 patients who underwent emergency EVT for anterior circulation stroke. Of these, 48 patients (31.8%) were transferred after teleconsultation, and 103 (68.2%) were admitted primarily through an ED. Transferred patients were younger, received IV alteplase more frequently, had prolonged time from stroke onset to EVT initiation, and tended to have lower rates of symptomatic intracranial hemorrhage and mortality than directly admitted patients. Similar rates of reperfusion and favorable functional outcomes were observed in patients treated by telestroke and those who were directly admitted. Telestroke networks may enable the triage and the delivery of EVT to selected ischemic stroke patients transferred from remote hospitals.[60]			See Table XII in online Data Supplement 1.
7. Providing alteplase decision-making support via telephone consultation to community physicians is feasible and safe and may be considered when a hospital has access to neither an in-person stroke team nor a telestroke system.	**IIb**	**C-LD**	New recommendation.
The advantages of telephone consultations for patients with acute stroke syndromes are feasibility, history of use, simplicity, availability, portability, short consultation time, and facile implementation.[61]			See Table XIII in online Data Supplement 1.

PICO

In pazienti adulti con ictus ischemico acuto candidabili a trombolisi con r-TPA e.v., l'applicazione di strategie di intervento rispetto alla non applicazione di alcuna strategia, può consentire di ridurre l'intervallo di tempo fra esordio dei sintomi e trattamento?

Il gruppo ISO SPREAD suggerisce che l'applicazione delle seguenti dieci strategie di intervento può consentire di ridurre in maniera rilevante l'intervallo di tempo fra esordio dei sintomi e trattamento con r-tPA e.v. entro 4.5 ore dall'esordio dei sintomi in pazienti con ictus ischemico acuto

- 1**) pre-notifica dell'ospedale ricevente quando l'ictus è riconosciuto sul territorio da parte del Servizio Medico di Emergenza;**
- 2) protocolli che rendano rapidi il triage in PS (entro 10 minuti) e la notifica dello stroke team (entro 15 minuti);
- 3) sistema di attivazione per singola chiamata dello stroke team e del protocollo per gli studi di imaging cerebrale;
- 4) kit di strumenti di supporto per la decisione clinica (linee guida, algoritmi specifici dell'ospedale, NIHSS score, ecc);
- 5) acquisizione e interpretazione rapida degli studi di imaging cerebrale (TC entro 25 minuti dall'arrivo in Pronto Soccorso e completa interpretazione dell'esame radiologico entro 45 minuti dall'arrivo);