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SVIN Society of Vascular and Interventional Neurology

International Perspectives on Stroke Triage, Diagnosis and Treatment

Episode 2: Diagnosis – Imaging and Resource Utilization

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Overview

- Jointly presented by ASA and SVIN
- No CEs available for webinar
- Certificate of Completion is available

Disclosures

- **Dr. Thomas Leung**: none
- **Jennifer Potter-Vig, PhD**: none
- **Dr. David Liebeskind**: Consultant for Cerenovus, Genentech, Medtronic, Stryker as Imaging Core Lab
- **Dr. Colin Derdeyn**: Equity: Pulse, Inc (Chair, Scientific Advisory Board); Research Support: Siemens Healthineers; DSMBs – Penumbra (MIND), NoNO (ESCAPE NA1 and FRONTIER), Genae (TIGERTRIEVER); NeuroInterventional PI - MOST Trial (NIH NINDS)
- **Dr. Achala Vagal**: PI, R01 NIH/NINDS NS103824; PI, RF1 NINDS/NIA NS117643; Co-I, R01 NIH/NINDS NS100417; Co-I, NIH/NINDS 1U01NS100699; Co-I, NIH/NINDS U01NS110772; PI, Imaging Core Lab, ENDOLOW Trial, Cerenovus, Johnson & Johnson
- **Dr. Marc Ribó**: Co-Principal Investigator of RACECAT Trial: funded by Medtronic through Fundació Ictus; Co-Principal Investigator of WE-TRUST Trial: funded by Philips; Co-founder of Anaconda Biomed; Consulting agreements: Medtronic, Stryker, Cerenovus, Apta Targets, Anaconda Biomed, CV Aid, Methinks AI.

To Ask a Question

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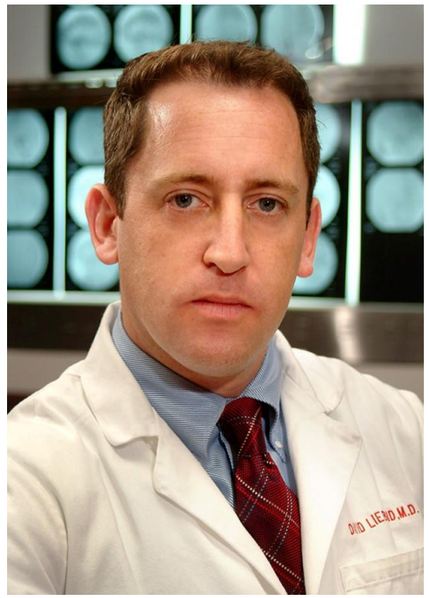
Moderators

Colin P. Derdeyn, MD, FACR

Jennifer Potter-Vig, PhD

Panelists

David S. Liebeskind, MD, FAAN, FAHA, FANA, FSVIN, FWSO



Achala Vagal, MD, MS

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Panelists

Dr. Marc Ribó

Dr. Thomas Leung, MB ChB, FESO, FAHA

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Imaging of Acute Ischemic Stroke

David S Liebeskind, MD

Professor of Neurology
Director, Neurovascular Imaging Research Core
Director, UCLA Comprehensive Stroke Center
President, Society of Vascular and Interventional Neurology (SVIN)
Past-President, American Society of Neuroimaging (ASN)
Board of Directors, World Stroke Organization

Objectives

- Understand evidence-based guidelines for imaging.
- Distinguish which imaging is proper based on assessment.
- Compare considerations in access to stroke diagnosis in various countries and regions of the world.
- Describe transfers and the mobile stroke unit.

Multimodal Imaging in AIS

- Use what you have - acquisition, interpretation to implementation in decision-making
- Practice in era of precision stroke medicine
- Imaging is part of clinical examination
- Patterns, not size, are key
- Ischemia, blood flow and hemorrhage - stroke is a vascular event…depicted best on multimodal

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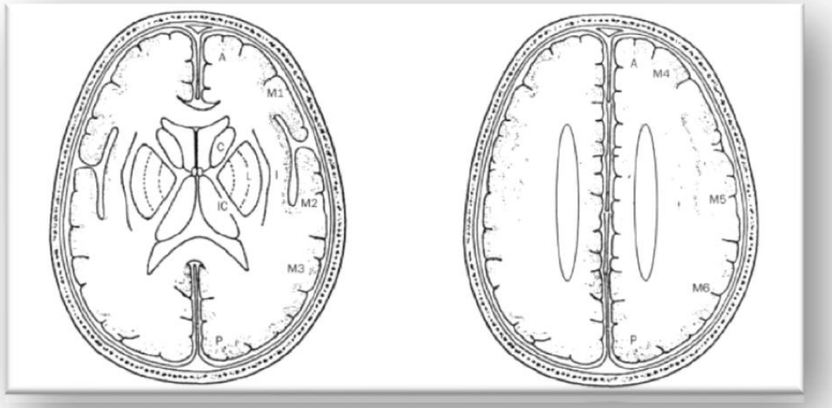
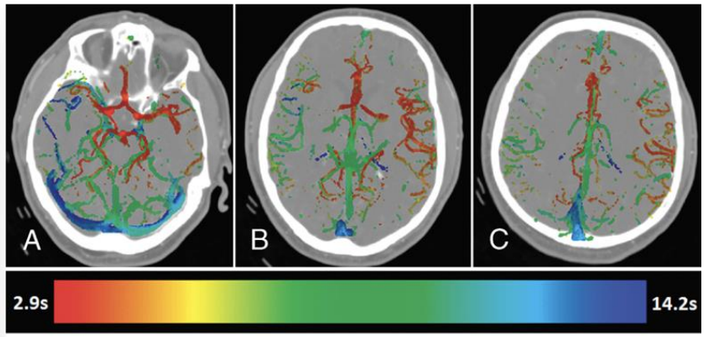
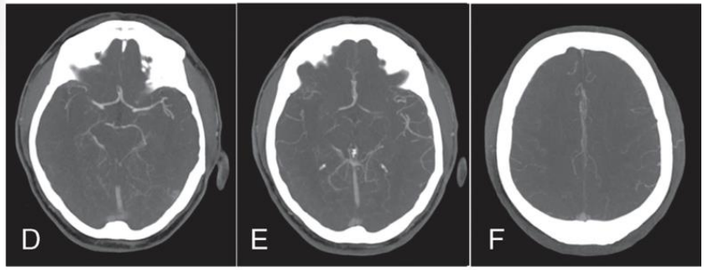
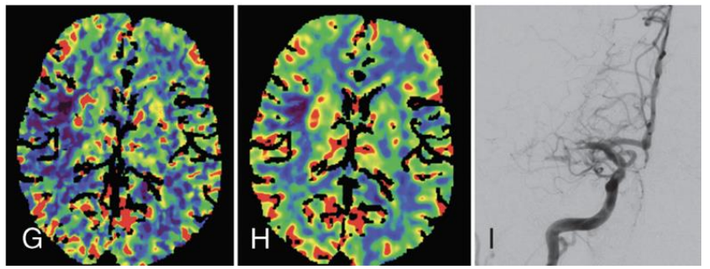
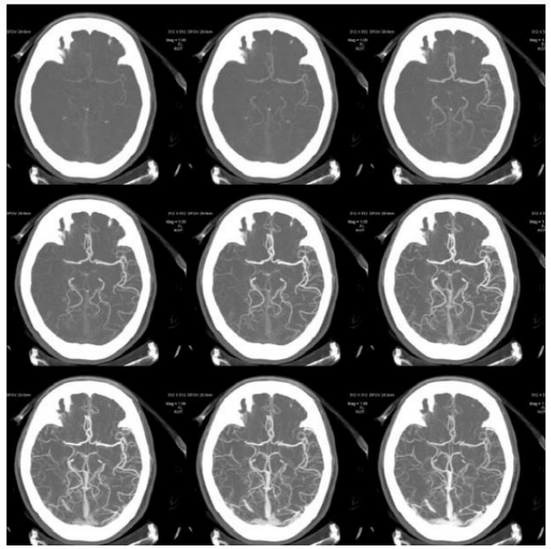
Multimodal CT











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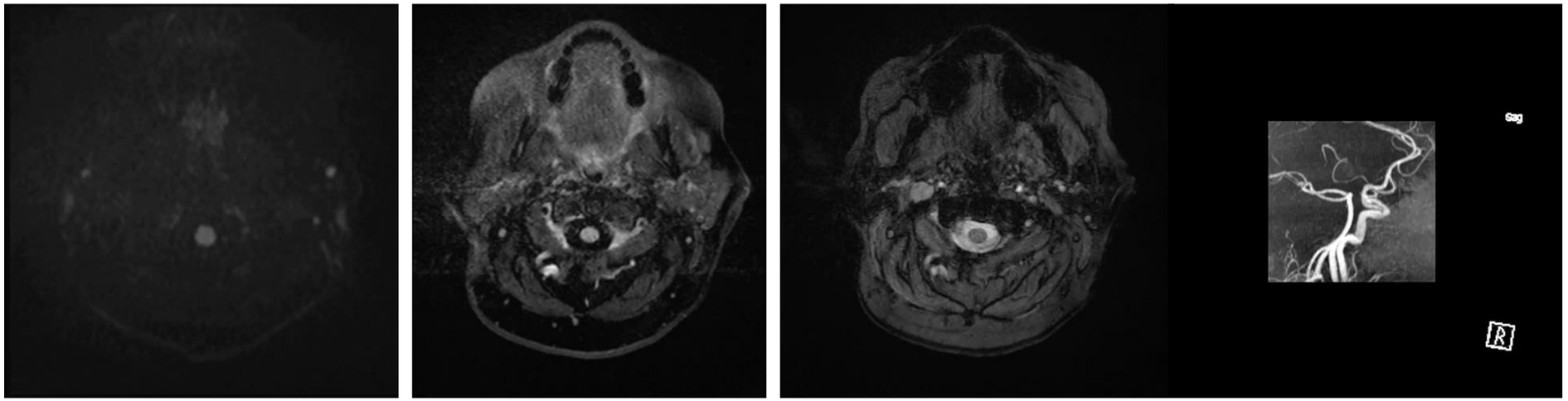
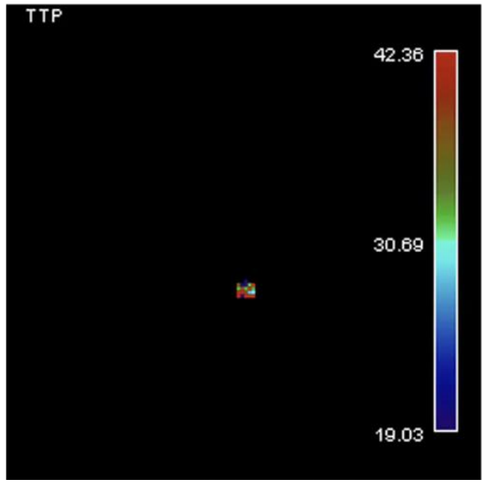
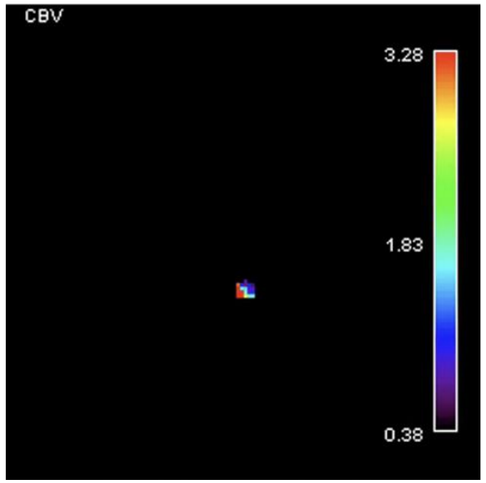
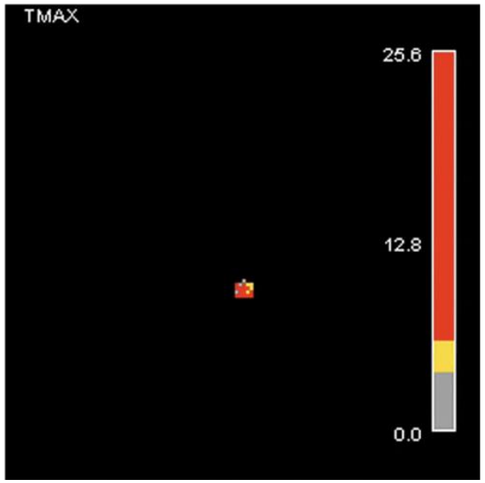
Multimodal MRI









From Ideal to Real

- Evolution of precision medicine with imaging in AIS
- Math analogy
  - Defining variables - core size (x), penumbral extent (y)
  - Considering disparate definitions of core (x) and penumbra (y) - CT vs DWI, rCBF, Tmax thresholds
  - Expanding number of equation terms - x+y=outcome
  - Refining probabilistic basis and estimates
  - Conditional terms - IF, OR, AND
  - Multivariate computations that vary for individuals across a population
  - “AI” - modernization, but black box, inevitably rooted in most important clinical questions and context…

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Acute Stroke Imaging…

- Overview of current imaging modalities & strategies
- Role of multimodal CT and MRI, TCD, DSA
- From prototypical M1 MCAO to real-world care
- Case examples as snapshot of “acute stroke imaging” and perfusion

Imaging Selection for Thrombolysis & Thrombectomy

- Consensus on imaging for thrombolysis and thrombectomy for acute ischemic stroke:
- Use available resources and hone expertise
- Imaging modalities offer distinct perspectives
- Selection of patients is outdated

Disparities in Stroke Care

- Local, regional and global disparities in imaging resources
- Expertise varies widely, yet develops with practice and matters tremendously
- Diagnostic confidence is paramount, but also varies

Decision-Making with Imaging

- Imaging is a component of the clinical evaluation
- Isolated results of any imaging study cannot be used to make clinically relevant decisions
- Imaging strategies as support tools
- Multimodal CT or MRI, direct thrombectomy
- Post-processing - semi-automated
- Interpretation and real-time implementation in routine clinical practice

Simplification of Stroke

- Protocols, guidelines and consensus statements are mere tools, not a guaranteed recipe for successful outcomes
- Acute ischemic stroke pathophysiology is complex and highly individualized (e.g. collaterals)
- Expertise matters
- Least common denominator of stroke imaging - from basic approaches (e.g. noncontrast CT) to more informative strategies (e.g.perfusion)

Imagining…

- Imaging definitions vary
  - “penumbra” and “core”
  - Volumes of thresholded parameters (e.g. cc of rCBF<30%)
- Modalities depict different facets
  - Stenosis (CTA or MRA)
  - Collaterals (CTA or DSA)
- “secret sauce” of post-processing
- ASPECTS as the Rorschach test of acute stroke imaging

Precision Medicine in Stroke Imaging

- Selecting imaging strategies for each individual patient, not about patient selection
- Imaging of phenotype in acute ischemic stroke
  - establishes a specific subtype diagnosis
  - provides insight on expected prognosis
  - informs medical decisions about selective treatments

frontiers in NEUROLOGY

PERSPECTIVE ARTICLE
published: 24 March 2014
doi: 10.3389/fneur.2014.00029

Developing precision stroke imaging

Edward Feldmann[1] and David S. Liebeskind[2]*

[1] Tufts Medical Center, Boston, MA, USA
[2] University of California Los Angeles Stroke Center, Los Angeles, CA, USA

Edited by:
Pooja Khatri, University of Cincinnati, USA

Reviewed by:
Bin Jiang, Beijing Neurosurgical Institute, China
Shyam Prabhakaran, Rush University Medical Center, USA

*Correspondence:
David S. Liebeskind, University of California Los Angeles Stroke Center, 710 Westwood Plaza, Los Angeles, CA 90095, USA
e-mail: davidliebeskind@yahoo.com

Stroke experts stand at the cusp of a unique opportunity to advance the care of patients with cerebrovascular disorders across the globe through improved imaging approaches. NIH initiatives including the Stroke Progress Review Group promotion of imaging in stroke research and the newly established NINDS Stroke Trials network converge with the rapidly evolving concept of precision medicine. Precision stroke imaging portends the coming shift to individualized approaches to cerebrovascular disorders where big data may be leveraged to identify and manage stroke risk with specific treatments utilizing an improved neuroimaging infrastructure, data collection, and analysis. We outline key aspects of the stroke imaging field where precision medicine may rapidly transform the care of stroke patients in the next few years.

Keywords: stroke, neuroimaging, precision medicine

Cerebrovascular disease

REVIEW

Principles of precision medicine in stroke

Jason D Hinman,[1] Natalia S Rost,[2] Thomas W Leung,[3] Joan Montaner,[4] Keith W Muir,[5] Scott Brown,[6] Juan F Arenillas,[7] Edward Feldmann,[8] David S Liebeskind[1]

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International Perspectives on Stroke Diagnosis

Achala Vagal, MD,MS

Vice Chair of Research
Professor of Radiology
University of Cincinnati Medical Center

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Learning Objectives

- Understand evidence-based guidelines for imaging
- Distinguish which imaging is proper based on assessment

Role of imaging in stroke?

- Is there hemorrhage?
- Location and extent of acute ischemia?
- Presence and site of vessel occlusion ?
- Collateral status ?
- Is there salvageable brain ?
- Is this a stroke mimic?

Imaging is a triage & treatment selection tool

Evidence for best imaging paradigm selection for LVO

None of the trials compared the effect of the selection of EVT candidates with and without advanced imaging selection

Vessel Imaging
AHA/ASA Guidelines: 2019 Update

2.2.3. Mechanical Thrombectomy Eligibility–Vessel Imaging	COR	LOE
1. For patients who otherwise meet criteria for mechanical thrombectomy, noninvasive vessel imaging of the intracranial arteries is recommended during the initial imaging evaluation.	I	A
2. For patients with suspected LVO who have not had noninvasive vessel imaging as part of their initial imaging assessment for stroke, noninvasive vessel imaging should then be obtained as quickly as possible (eg, during alteplase infusion if feasible).	I	A

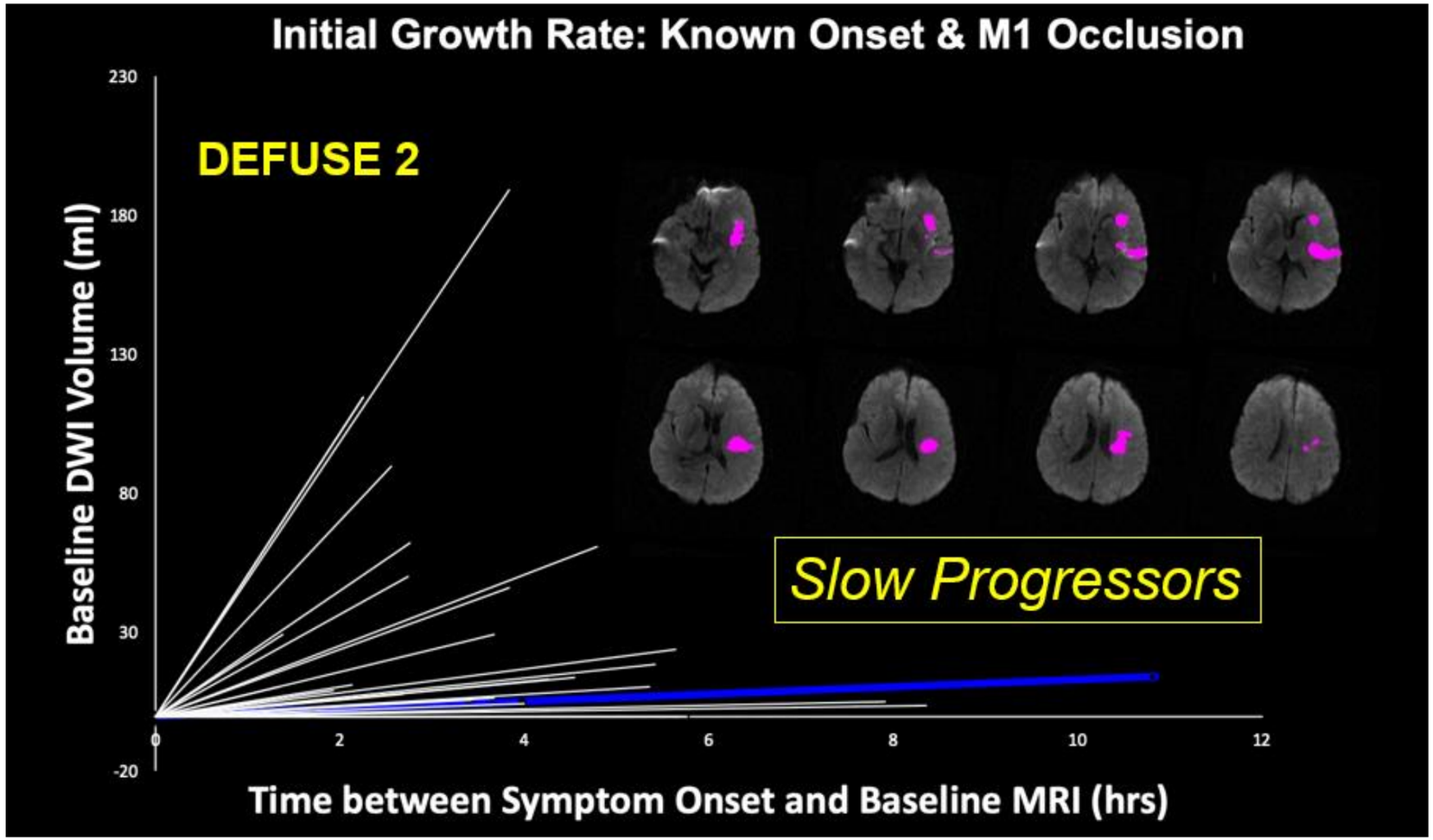
Powers et al. 2019 Update to the 2018 Guidelines for the Early Management of Acute Ischemic Stroke. Stroke. Volume 50, Issue 12, December 2019

Advanced imaging for extending treatment windows

Premise

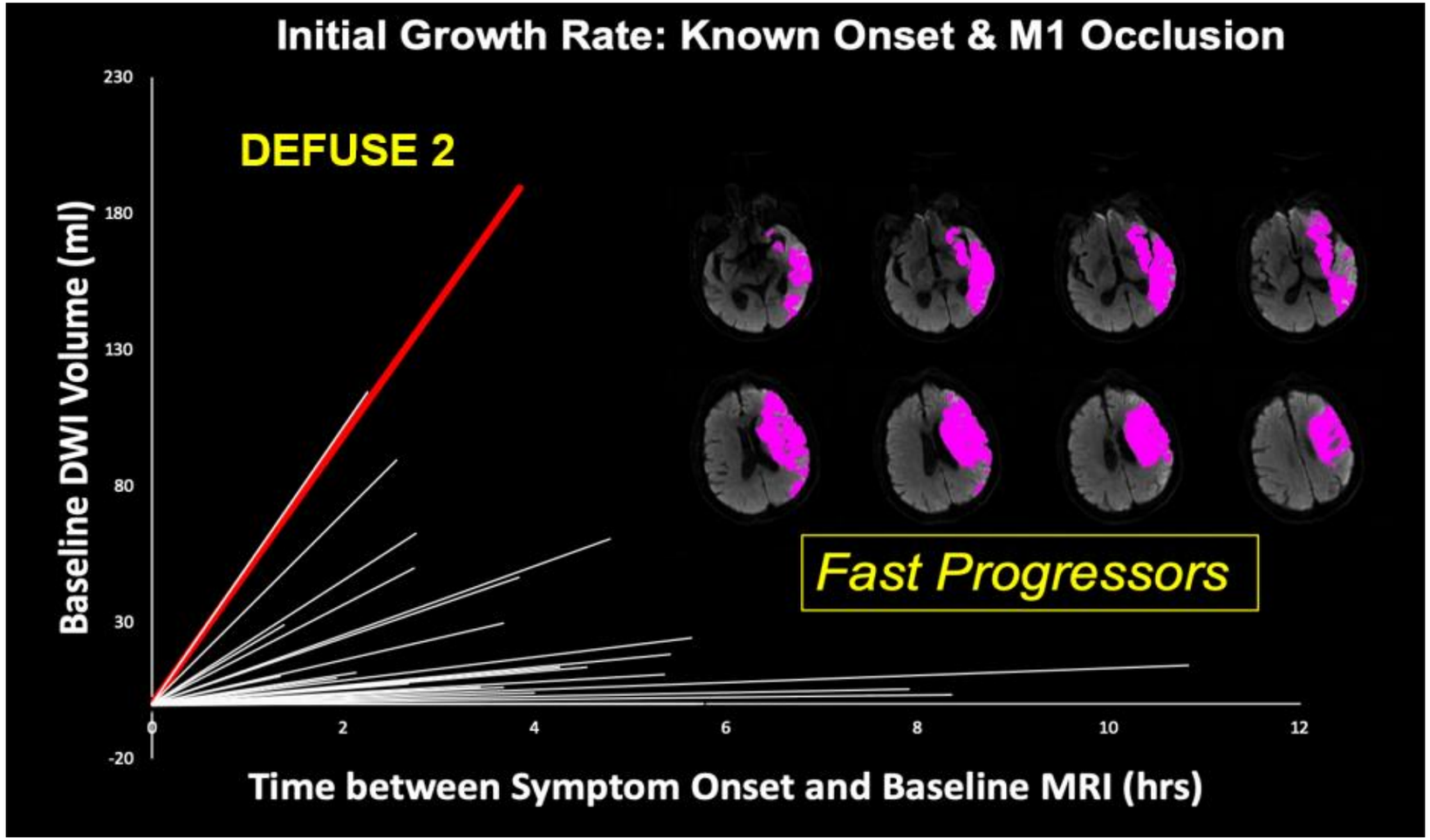
- Infarct growth is variable
- Many patients have salvageable tissue beyond standard treatment times
- Advanced imaging can identify these patients
- These may benefit from reperfusion treatments in delayed time period

Infarct growth rates are highly variable



Wheeler HM, et al. Int J Stroke. 2015
Courtesy: Dr. Greg Albers

Infarct growth rates are highly variable



Wheeler HM, et al. Int J Stroke. 2015
Courtesy: Dr. Greg Albers

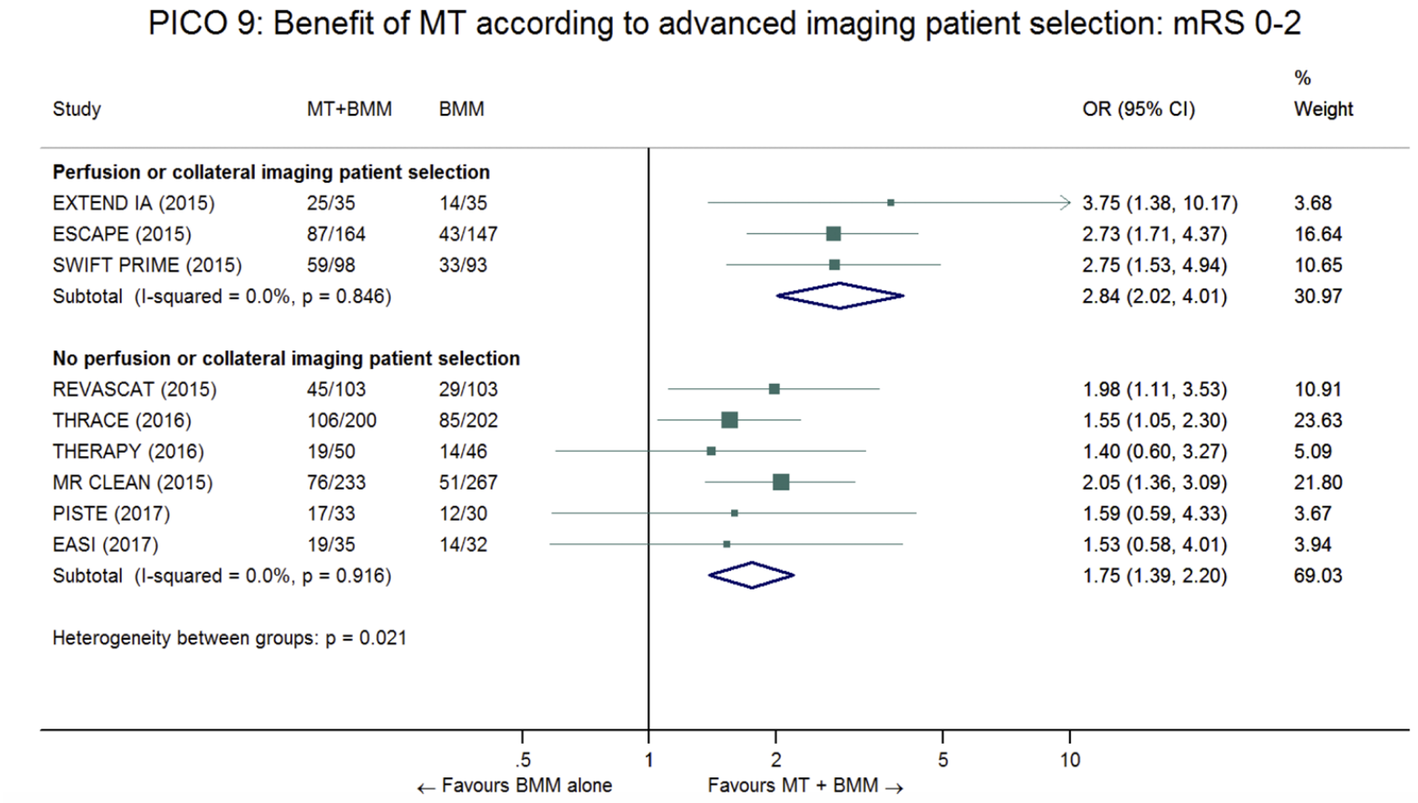
Perfusion Imaging
AHA/ASA Guidelines: 2019 Update

2.2.4 Mechanical Thrombectomy Eligibility-Multimodal Imaging

Recommendations	COR	LOE
1. When selecting patients with AIS within 6 to 24 hours of last known normal who have LVO in the anterior circulation, obtaining CTP or DW-MRI, with or without MRI perfusion, is recommended to aid in patient selection for mechanical thrombectomy, but only when patients meet other eligibility criteria from one of the RCTs that showed benefit from mechanical thrombectomy in this extended time window.	I	A
2. When evaluating patients with AIS within 6 hours of last known normal with LVO and an Alberta Stroke Program Early Computed Tomography Score (ASPECTS) of ≥ 6, selection for mechanical thrombectomy based on CT and CTA or MRI and MRA is recommended in preference to performance of additional imaging such as perfusion studies.	I	B-NR

Powers et al. 2019 Update to the 2018 Guidelines for the Early Management of Acute Ischemic Stroke. Stroke. Volume 50, Issue 12, December 2019

Less than 6 hours : Higher benefit with use of advanced imaging



ORs for functional independence - **2.84** (trials with advanced imaging)
- **1.75** (trials without advanced imaging)

Turc G, Bhogal P, Fischer U, et al. J NeuroIntervent Surg 2019

Less than 6 hours: Advanced imaging for patient selection for LVO

- Patient selection with perfusion/collateral imaging does modify expected therapy effect.
- BUT - Advanced imaging may exclude patients who have the potential to respond favorably to reperfusion.
- EVT was clearly superior in trials in which only NCCT/CTA were required - MR CLEAN

ESO/ESMINT Guidelines 2019

Recommendations

- In adult patients with anterior circulation large vessel occlusion-related acute ischemic stroke presenting from 0 to 6 hours from time last known well, advanced imaging is not necessary for patient selection.

Quality of evidence: **Moderate** ⊕⊕⊕; strength of recommendation: **Weak** ↓?

- In adult patients with anterior circulation large vessel occlusion-related acute ischemic stroke presenting beyond 6 hours from time last known well, advanced imaging selection is necessary.

Quality of evidence: **Moderate** ⊕⊕⊕; strength of recommendation: **Strong** ↑↑

Role of perfusion in extended window thrombolysis (4.5-9 hours and Wake up stroke)

Extending thrombolysis to 4·5–9 h and wake-up stroke using perfusion imaging: a systematic review and meta-analysis of individual patient data

Bruce C V Campbell, Henry Ma*, Peter A Ringleb*, Mark W Parsons, Leonid Churilov, Martin Bendszus, Christopher R Levi, Chung Hsu, Timothy J Kleinig, Marc Fatar, Didier Leys, Carlos Molina, Tissa Wijeratne, Sami Curtze, Helen M Dewey, P Alan Barber, Kenneth S Butcher, Deidre A De Silva, Christopher F Bladin, Nawaf Yassi, Johannes A R Pfaff, Gagan Sharma, Andrew Bivard, Patricia M Desmond, Stefan Schwab, Peter D Schellinger, Bernard Yan, Peter J Mitchell, Joaquín Serena, Danilo Toni, Vincent Thijs, Werner Hacke†, Stephen M Davis†, Geoffrey A Donnan†, on behalf of the EXTEND, ECASS-4, and EPITHET Investigators‡*

- *Excellent outcome (mRS 0-1) 36% in alteplase group vs 29% in placebo group*
- *Trials were before EVT as standard of care*
- *Perfusion may extend time window for thrombolysis if EVT not available/ineligible*

Collateral Imaging - Data

- ESCAPE - ASPECTS 6 plus good/intermediate collaterals on multiphase CTA up to 12 hours

- Secondary analyses MR CLEAN and IMS III- supporting role of collaterals in identifying patients likely or unlikely to benefit from EVT

- HERMES collaboration - no significant modification of treatment effect by collateral grade (p interaction= 0.30)

Collateral Imaging
AHA/ASA Guidelines: 2019 Update

13. It may be reasonable to incorporate collateral flow status into clinical decision making in some candidates to determine eligibility for mechanical thrombectomy.	IIb	C-LD

Powers et al. 2019 Update to the 2018 Guidelines for the Early Management of Acute Ischemic Stroke. Stroke. Volume 50, Issue 12, December 2019

MRI in acute stroke
AHA/ASA Guidelines: 2019 Update

3. In patients with AIS who awake with stroke symptoms or have unclear time of onset > 4.5 hours from last known well or at baseline state, MRI to identify diffusion-positive FLAIR-negative lesions can be useful for selecting those who can benefit from IV alteplase administration within 4.5 hours of stroke symptom recognition.	IIa	B-R

WAKE-UP trial
IV tPA guided by imaging selectionof FLAIR-DWI mismatch had better outcomes (53.3% vs 41.8%)
Rate of sICH higher (2% vs 0.4%)

Powers et al. 2019 Update to the 2018 Guidelines for the Early Management of Acute Ischemic Stroke. Stroke. Volume 50, Issue 12, December 2019

Thomalla et al, NEJM 2018

AHA/ASA 2019 Update

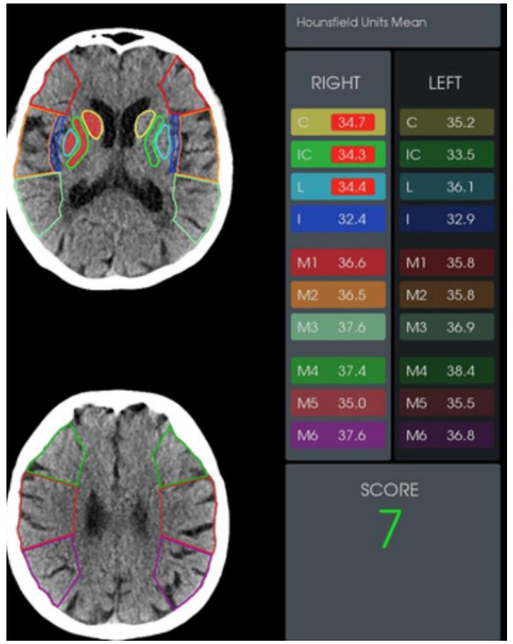
2.2.1. Initial Imaging	COR	LOE	New, Revised, or Unchanged
1. All patients with suspected acute stroke should receive emergency brain imaging evaluation on first arrival to a hospital before initiating any specific therapy to treat AIS.	I	A	Recommendation reworded for clarity from 2013 AIS Guidelines. COR and LOE unchanged. See Table XCV in online Data Supplement 1 for original wording.
2. Systems should be established so that brain imaging studies can be performed as quickly as possible in patients who may be candidates for IV fibrinolysis or mechanical thrombectomy or both.	I	B-NR	New recommendation.

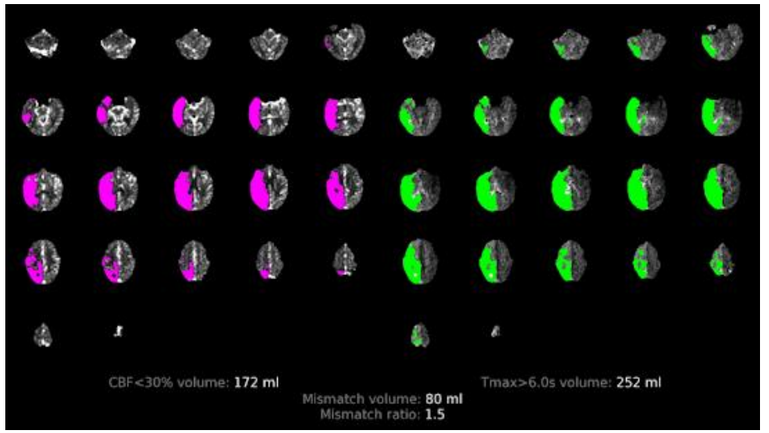
2.2.2. IV Alteplase Eligibility (Continued)	COR	LOE	New, Revised, or Unchanged
2. In patients eligible for IV alteplase, because benefit of therapy is time dependent, treatment should be initiated as quickly as possible and not delayed for additional multimodal neuroimaging, such as CT and MRI perfusion imaging.	I	B-NR	New recommendation.

Advanced imaging should NOT delay IV thrombolysis or door–to–groin puncture times

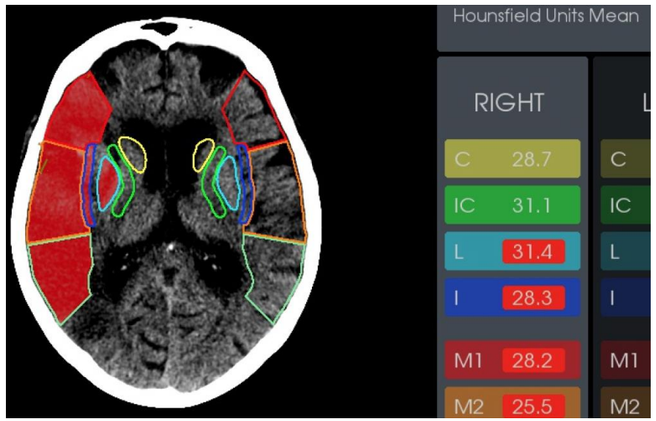
Powers et al. 2019 Update to the 2018 Guidelines for the Early Management of Acute Ischemic Stroke. Stroke. Volume 50, Issue 12, December 2019

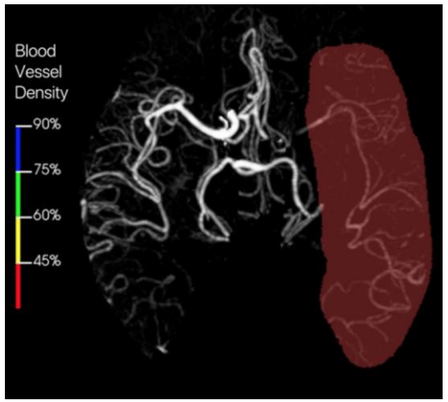
Artificial Intelligence: *Man vs machine*

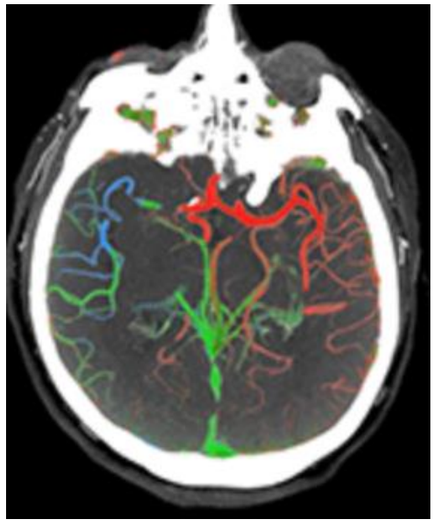




Automated ASPECTS
Automated LVO detection
Automated perfusion
Automated collaterals







The "Art" and "Science"

4Ps – there is a 5th P

Parenchyma **Pipes** **Penumbra** **Perfusion**

PATIENT

Who is likely to benefit from reperfusion

Who is unlikely to benefit / most likely to be harmed

Judgement based on evidence, experience and patient factors

Which imaging paradigm is better for "Code Stroke"?

Depends on multiple factors….

- Local/Institutional preferences and resources
- Timing of stroke – early/late/wake up
- Create OUR best systems of care (from the 911 call to rehabilitation)
- Fast streamlined imaging workflows
- Radiology plays an integral part

Fisher et al. Variance of imaging protocols. Stroke. 2018;49:1805–1808

Conclusion

- Changing landscape
- Imaging is critical for diagnosis (CT remains the workhorse)
- Institutions will have to adopt efficient workflows
- The clock is always ticking .....

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CATALAN STROKE NETWORK

MARC RIBO

Vall d'Hebron
Barcelona Campus Hospitalari

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EL ATLAS DEL ICTUS

Check for updates

Original research article

EUROPEAN STROKE JOURNAL

European Stroke Journal
0(0) 1–16
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DOI: 10.1177/2396987318786023
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SAGE

Access to and delivery of acute ischaemic stroke treatments: A survey of national scientific societies and stroke experts in 44 European countries

Diana Aguiar de Sousa*[1], Rascha von Martial*[2], Sònia Abilleira[3], Thomas Gattringer[4], Adam Kobayashi[5], Miquel Gallofré[6], Franz Fazekas[4], Istvan Szikora[7], Valery Feigin[8], Valeria Caso[9] and Urs Fischer[2]; on behalf of the ESO ESMINT EAN SAFE Survey on Stroke Care collaborators†

Inhabitants
7.5M
Stroke Incidence
187.4 cases por 100.000 hab
14.000/year

Optimal:
23 Stroke Units
8 CSC

Optimal:
2520 iv tPA / year
700 EVT / year

Ideal:
1125-1500 EVT/ year

ESO Target for Centers:
3 stroke units / 1.000.000
1 comprehensive SC / 1.000.000

ESO Target for Treatments:
Rate of iv.tPA: 18%
Rate of EVT: 5%

Ideal target:
150-200 EVT / 1M hab

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Catalan Stroke Network

Optimal:
23 Stroke Units

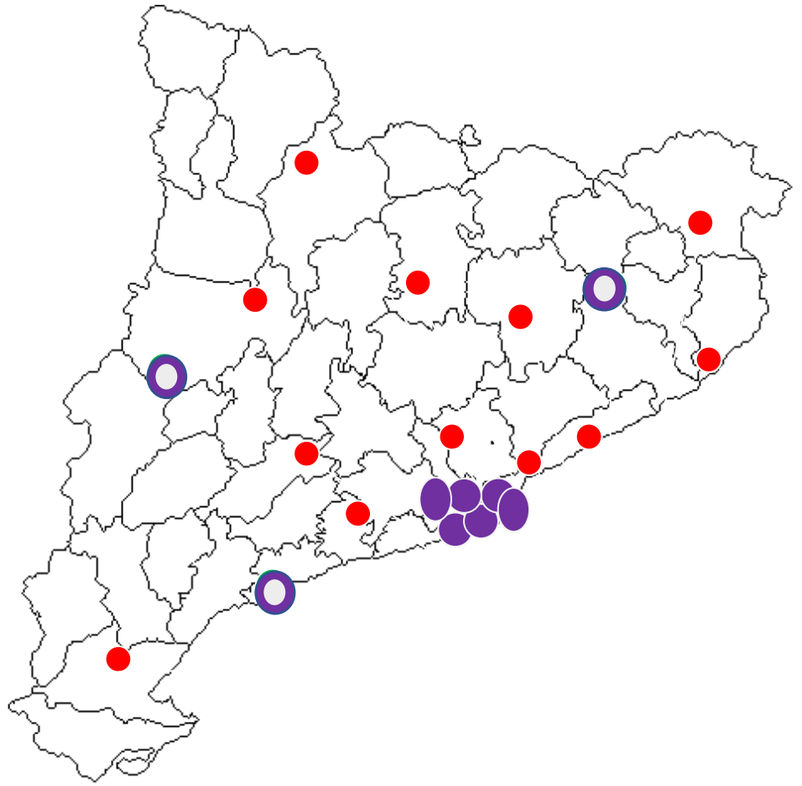
8 CSC

Optimal:
2520 iv tPA / year
700 EVT / year

Ideal:
1125-1500 EVT/ year

26 Stroke Units

6 Comprehensive Stroke Centers
+ 3 TEV ready centers



Optimal:
2520 iv tPA / year
700 EVT / year

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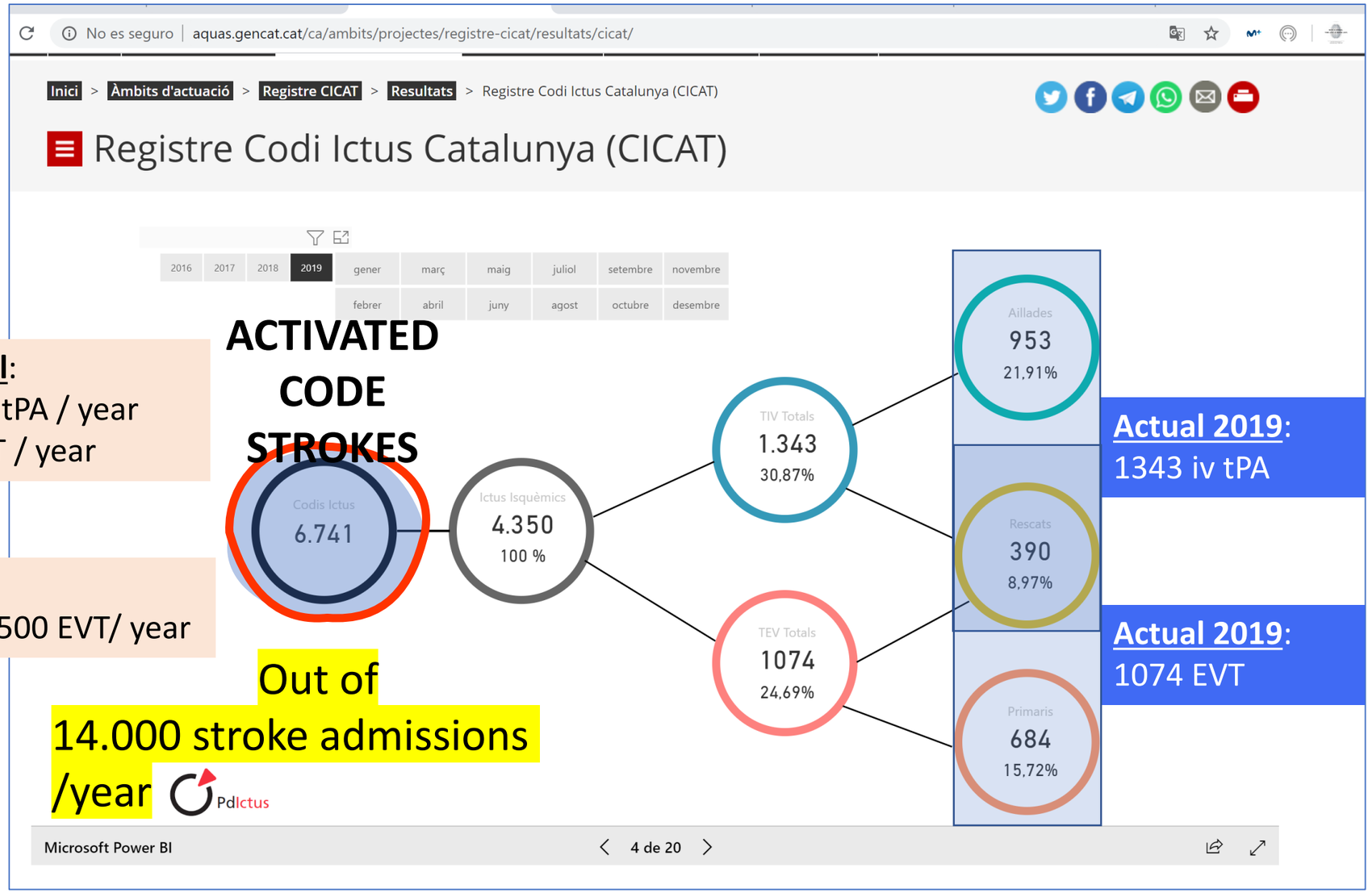
1125-1500 EVT/ year

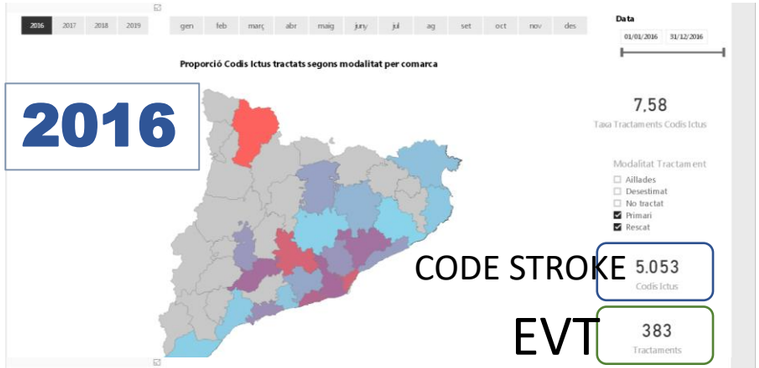


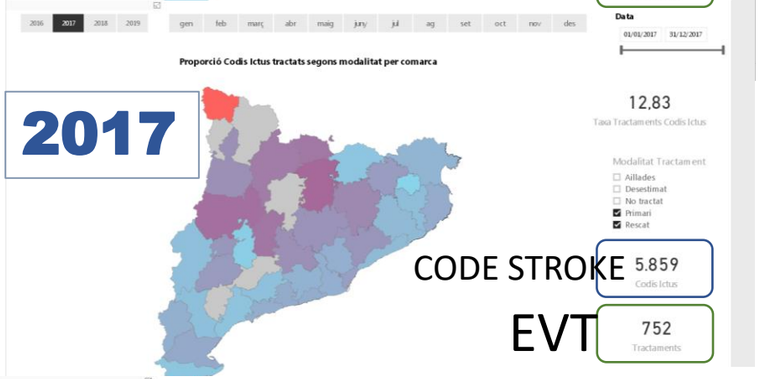
Actual 2019:
1343 iv tPA

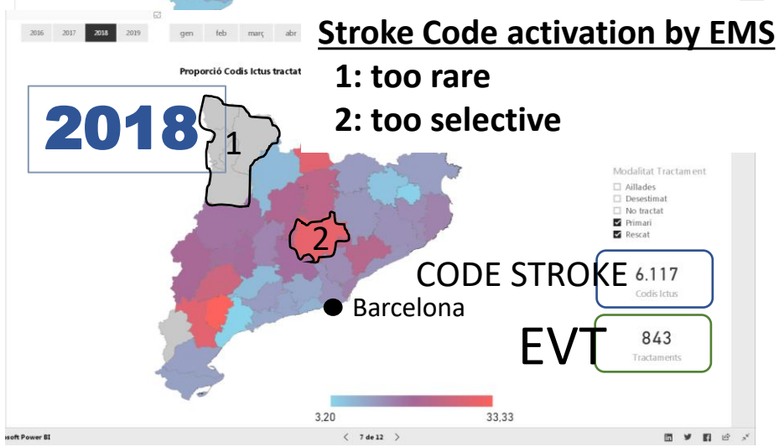
Actual 2019:
1074 EVT

Out of
14.000 stroke admissions
/year

PdIctus





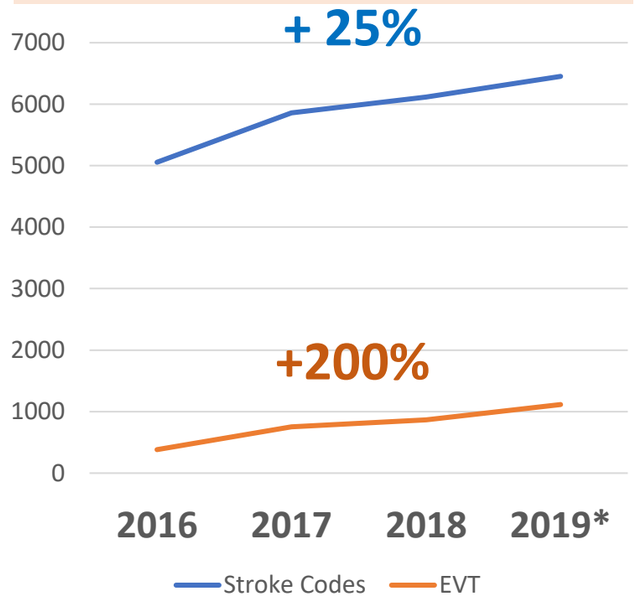


Stroke Code activation by EMS

1: too rare

2: too selective

 # EVT / #STROKE CODE ACTIVATED (per regions)

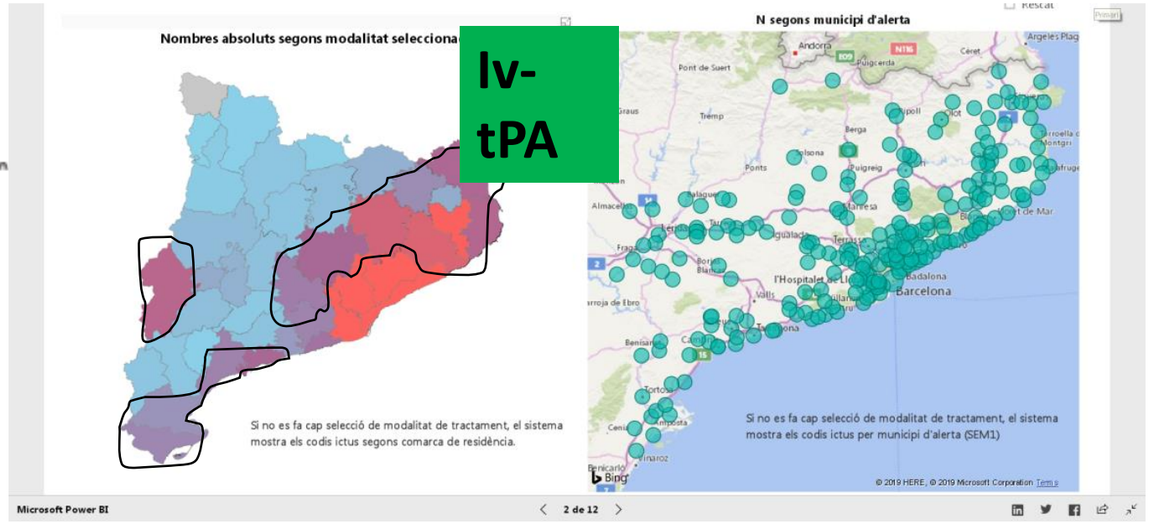


Geographical spread of EVT

Increase in absolute number of SC

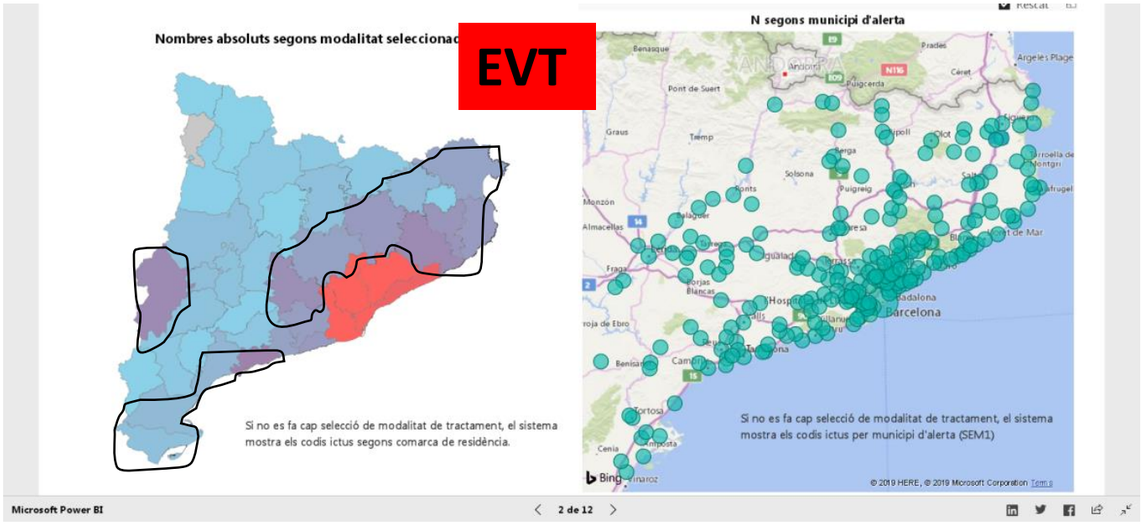
Increase in absolute number of EVT

Uneven activation of stroke codes



iv-tPA treatments According to onset location (absolute numbers)

Town of initial alert



EVT According to onset location (absolute numbers)

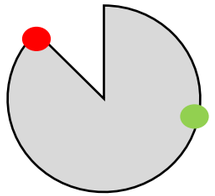
In specific areas: Better Access to iv-tPA than to EVT

American Stroke Association.
A division of the American Heart Association.

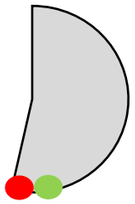
RACECAT

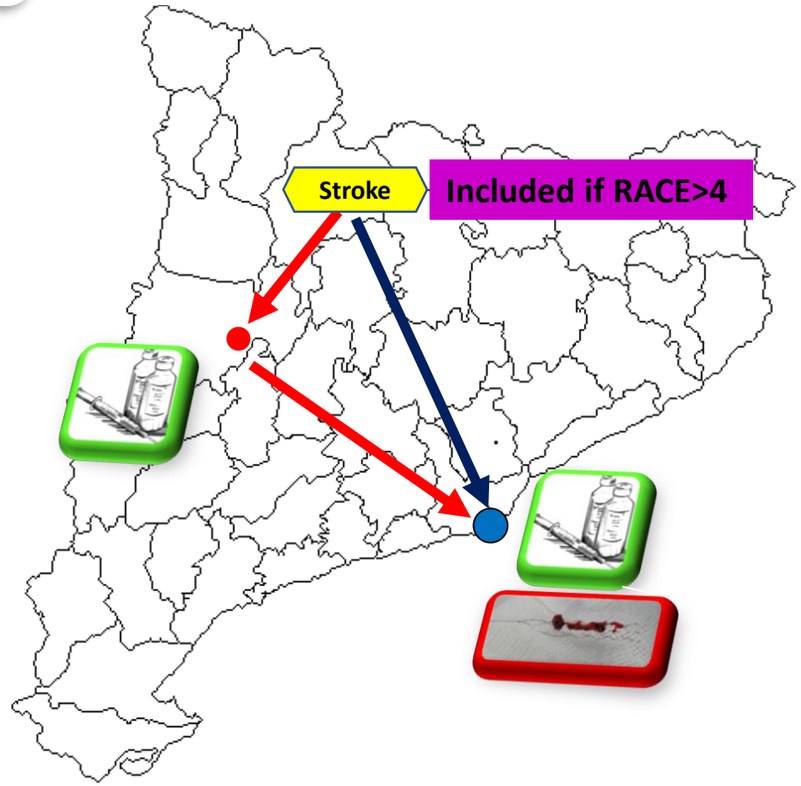
Society of Vascular and Interventional Neurology

Option A



Option B

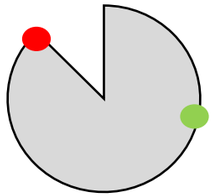




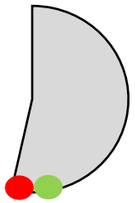
Recruitment

Final results Q4 - 2020

Option A



Option B



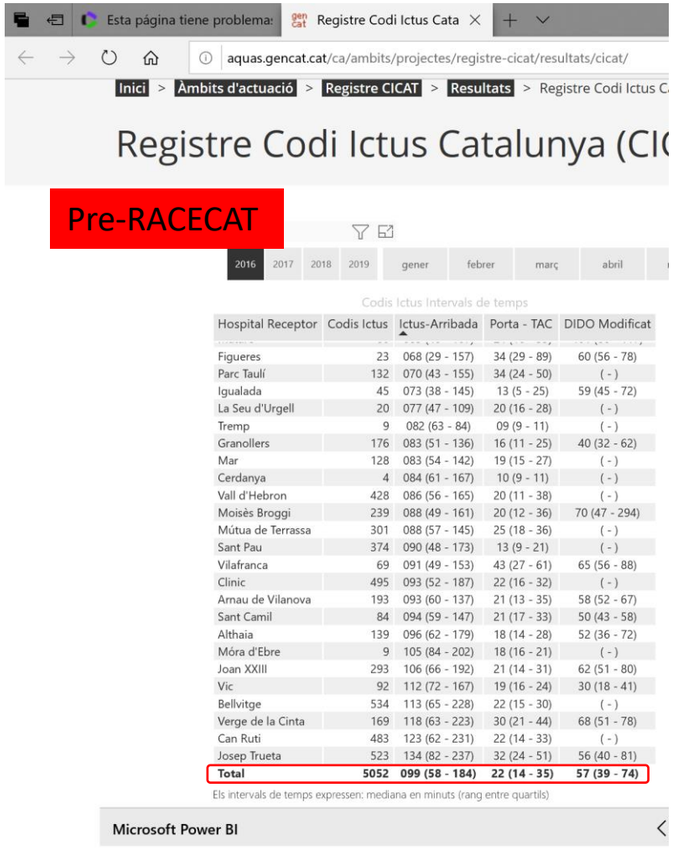
?

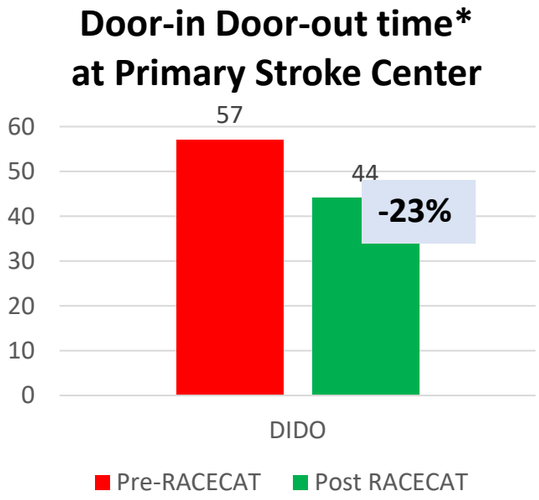
Final results Q4 - 2020

<u>Traditional approach:</u>

From now **only ONE** transfer option will be applied for all patients presenting with the RACECAT inclusión criteria

Implications of the RACECAT Study
Primary Stroke Centers



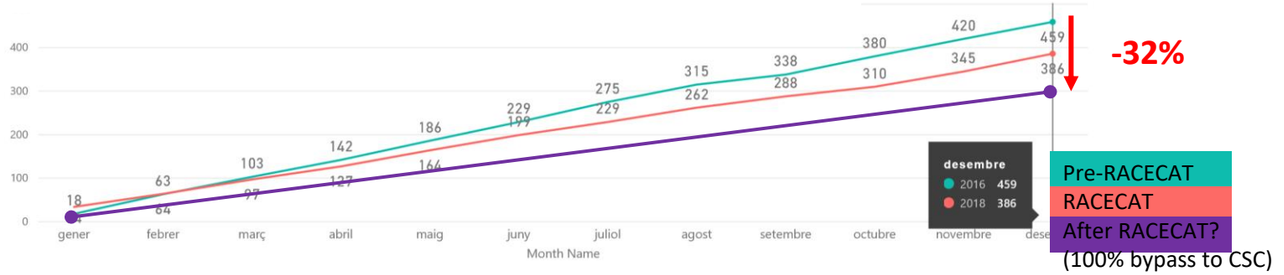


2016

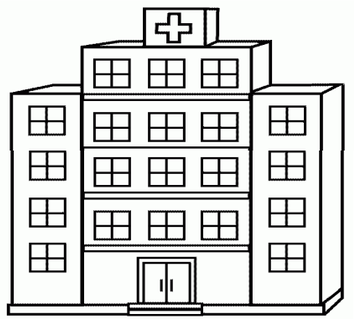
2019

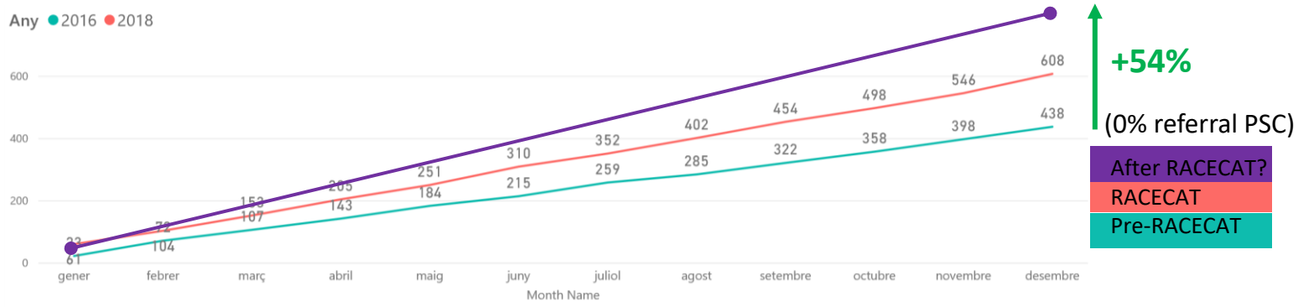
Implications of the RACECAT Study

iv-tPA in Primary Stroke Centers 2016 Vs 2018 (50% bypass to CSC)



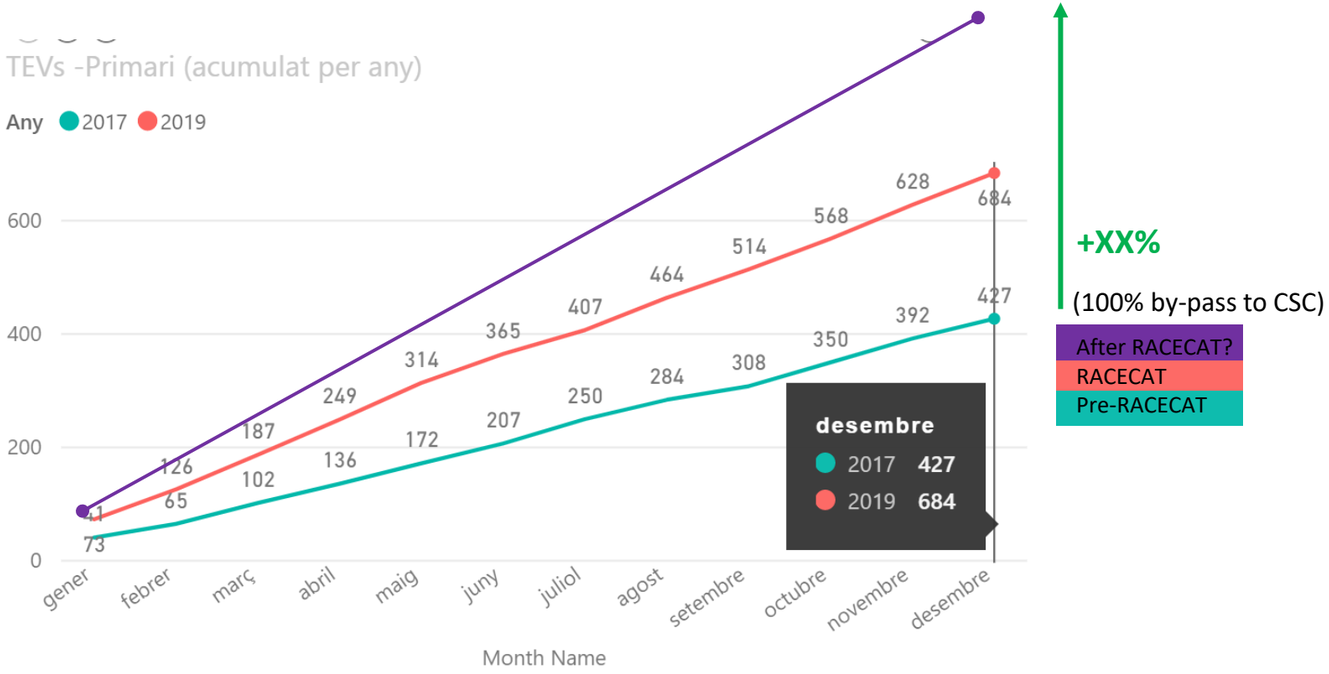
iv-tPA in Comprehensive Stroke Centers 2016 Vs 2018 (50% referral to PSC)





Implications of the RACECAT Study

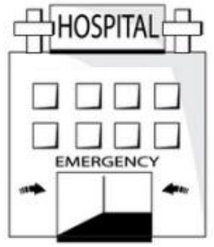
EVT in Comprehensive Stroke Centers 2017 Vs 2019 **(50% bypass to CSC)**

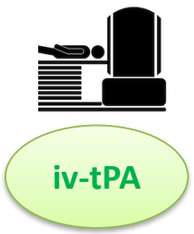


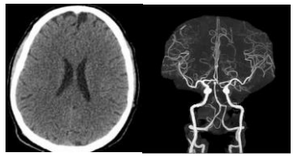
JAMA Neurology | Original Investigation

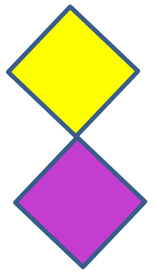
Association of a Primary Stroke Center Protocol for Suspected Stroke by Large-Vessel Occlusion With Efficiency of Care and Patient Outcomes

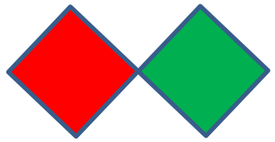
Ryan A. McTaggart, MD; Shadi Yaghi, MD; Shawna M. Cutting, MD, MS; Morgan Hemendinger; Grayson L. Baird, PhD; Richard A. Haas, MD; Karen L. Furie, MD, MPH; Mahesh V. Jayaraman, MD

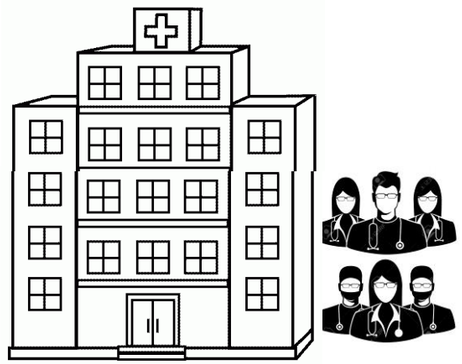












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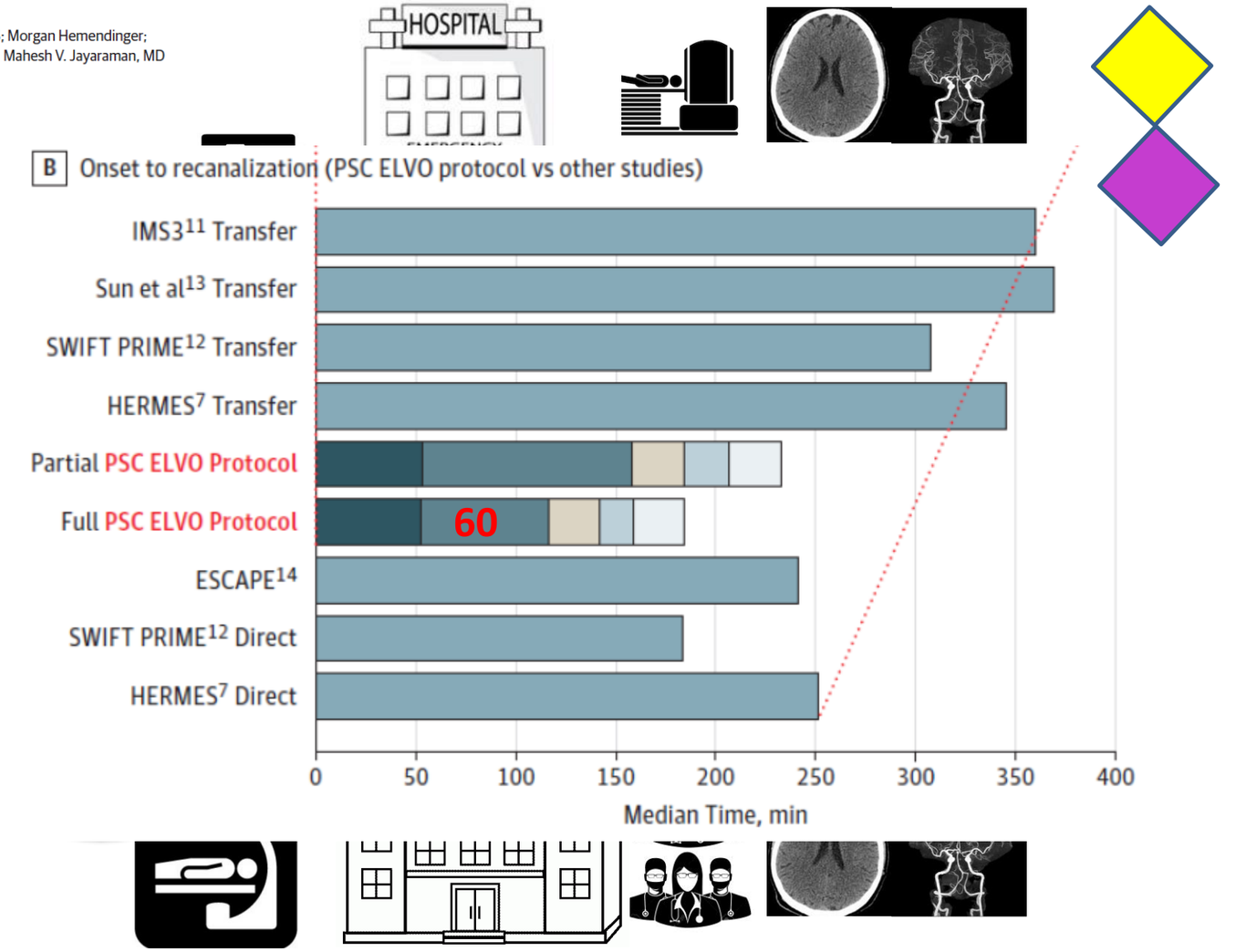
Association of a Primary Stroke Center Protocol for Suspected Stroke by Large-Vessel Occlusion With Efficiency of Care and Patient Outcomes

Ryan A. McTaggart, MD; Shadi Yaghi, MD; Shawna M. Cutting, MD, MS; Morgan Hemendinger; Grayson L. Baird, PhD; Richard A. Haas, MD; Karen L. Furie, MD, MPH; Mahesh V. Jayaraman, MD



Editorial

Should CT Angiography be a Routine Component of Acute Stroke Imaging?

The Neurohospitalist
2015, Vol. 5(3) 97-100

DOI: 10.1177/1941874415588393
nhos.sagepub.com
SAGE

Vanja Douglas, MD[1], Michel Shamy, MD, MA, FRCPC[2], and Pratik Bhattacharya, MD, MPH[3]

Stroke team available 24/7
CTA available 24/7

Stroke team not present
Many Spoke Sites are not CTA capable (24/7)
Spoke sites may not have enough volume to keep CT techs skills

American Stroke Association. A division of the American Heart Association.

Stroke

SVIN Society of Vascular and Interventional Neurology

FOCUSED UPDATES IN CEREBROVASCULAR DISEASE

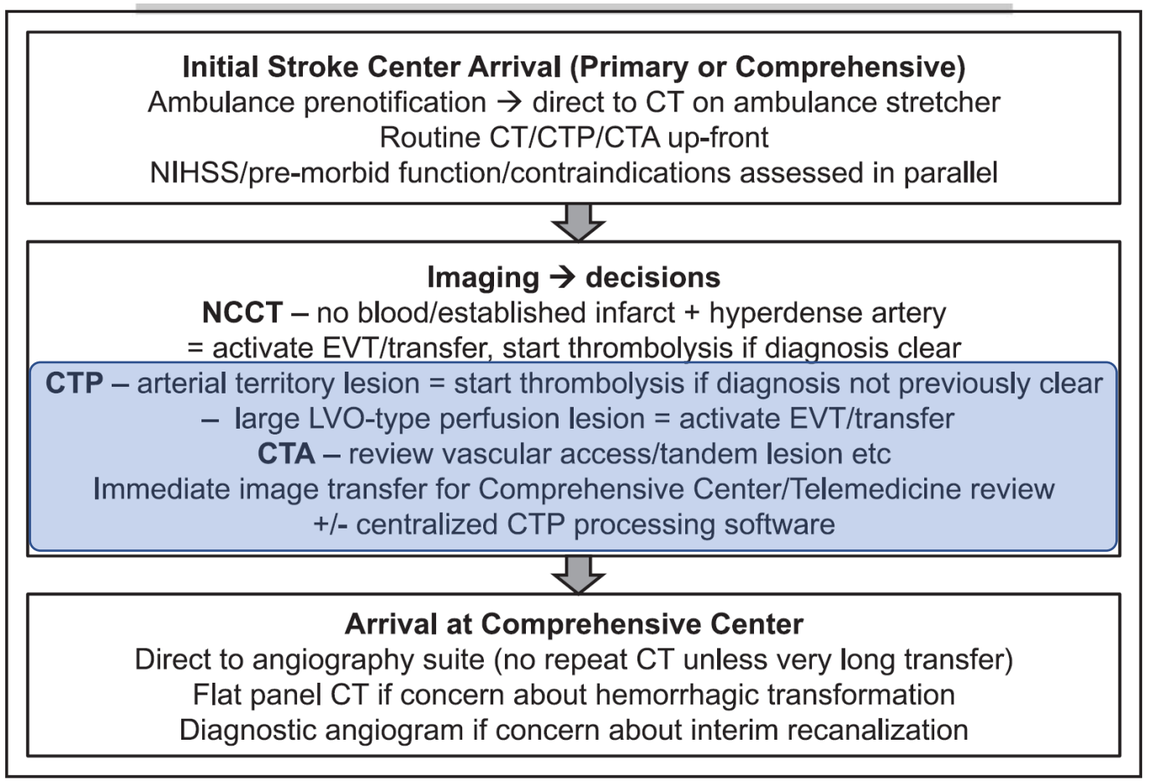
Optimal Imaging at the Primary Stroke Center

Bruce C.V. Campbell, MBBS (Hons), BMedSc, PhD, FRACP

Table 1. Aims of Imaging at Primary Stroke Centers

Fast, accurate diagnosis
requires immediate radiology or neurology interpretation of imaging on-site or via telemedicine±artificial intelligence decision assistance and team notification
Maximize eligibility for intravenous thrombolysis
requires CTP to treat >4.5 h based on current evidence
CTP abnormalities may increase confidence to treat mild stroke
Maximize eligibility for endovascular thrombectomy
requires CTP to treat >6 h based on current evidence
patients with noncontrast CT ASPECTS 0–5 may have relatively small CTP core and benefit from reperfusion
Minimize futile transfers to reduce cost and social dislocation
only transfer patients who at least meet eligibility criteria pretransport
Streamline the path to reperfusion
minimize the need for repeat imaging
ensure images accessible to receiving center
facilitate referral and decision-making at the comprehensive center

ASPECTS indicates Alberta Stroke Program Early CT Score; CT, computed tomography; and CTP, computed tomographic perfusion.

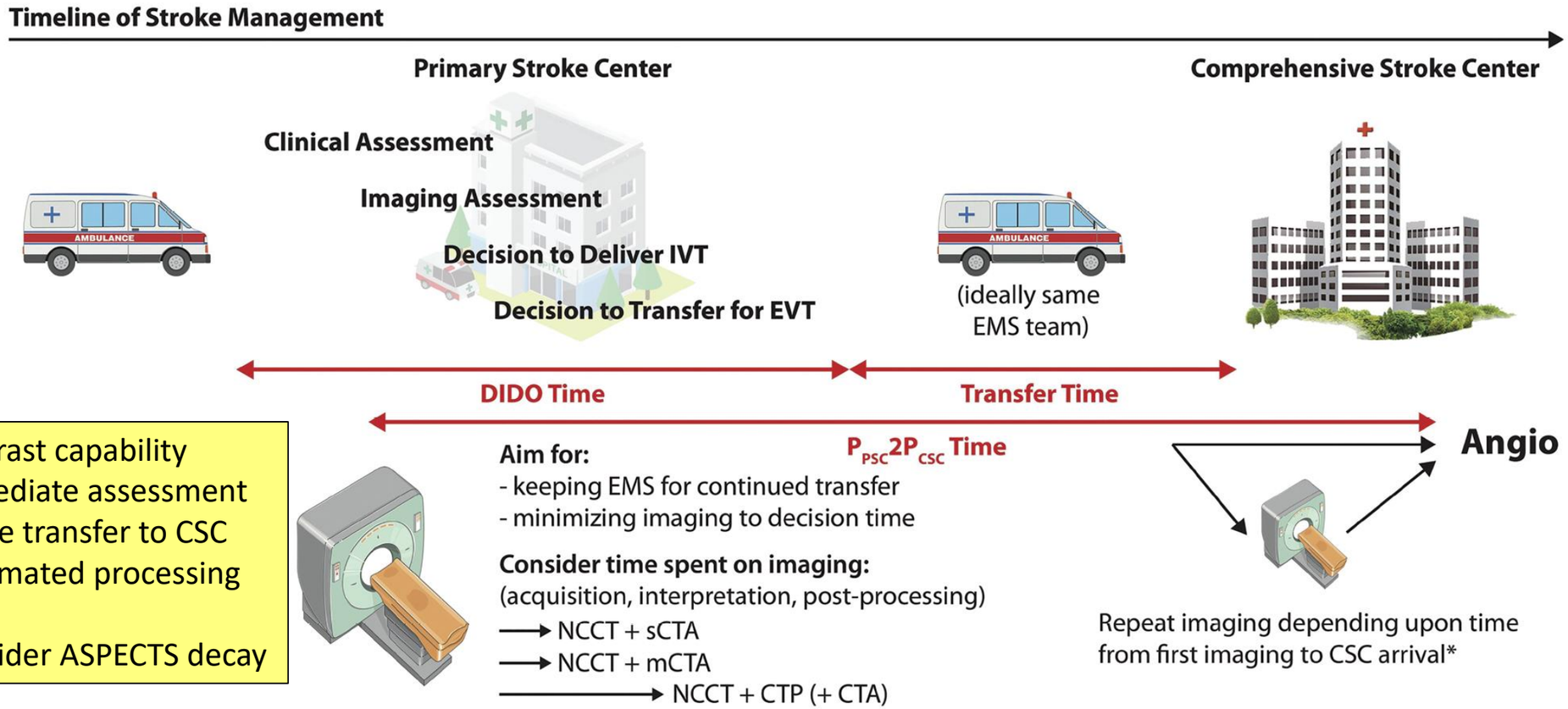


Stroke. 2020;51:1932–1940. DOI: 10.1161/STROKEAHA.119.026734

Published January 31, 2019 as 10.3174/ajnr.A5971

Imaging of Patients with Suspected Large-Vessel Occlusion at Primary Stroke Centers: Available Modalities and a Suggested Approach

M.A. Almekhlafi, W.G. Kunz, B.K. Menon, R.A. McTaggart, M.V. Jayaraman, B.W. Baxter, D. Heck, D. Frei, C.P. Derdeyn, T. Takagi, A.H. Aamodt, I.M.R. Fragata, M.D. Hill, A.M. Demchuk, and M. Goyal



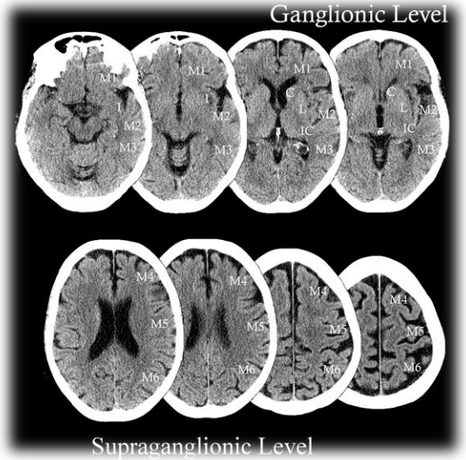
Contrast capability
Immediate assessment
Image transfer to CSC
Automated processing

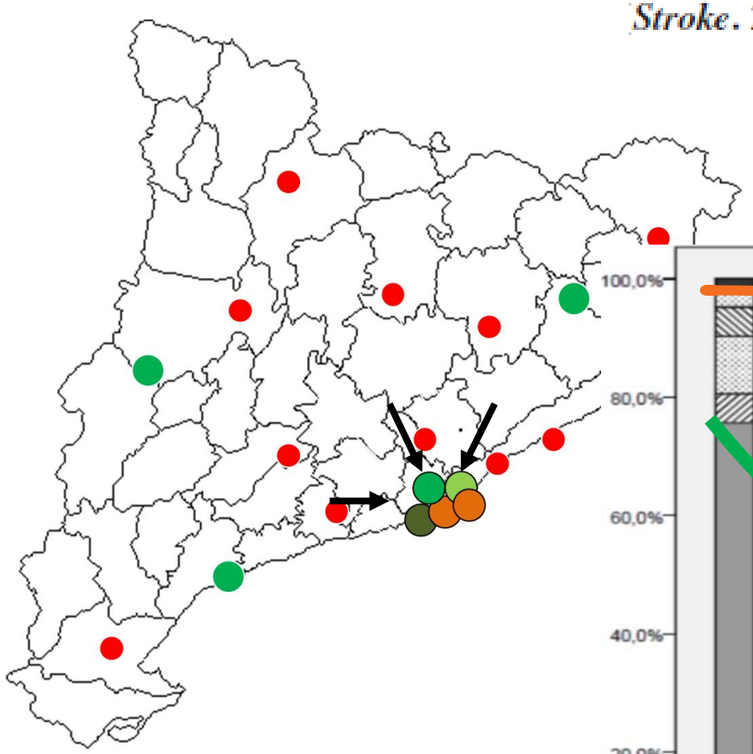
Consider ASPECTS decay

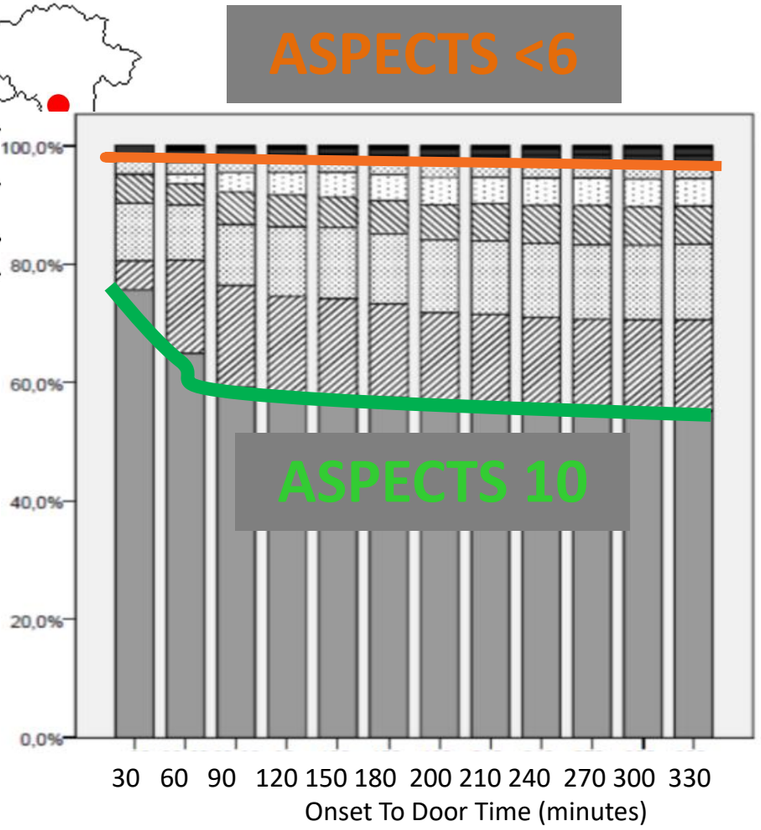
Predictors of Endovascular Treatment Among Stroke Codes Activated Within 6 Hours From Symptom Onset

Manuel Requena, MD; Natalia Pérez de la Ossa, MD, PhD; Sonia Abilleira, MD, PhD; Pere Cardona, MD; Xabier Urra, MD, PhD; Joan Martí-Fabregas, MD, PhD; Anna Rodríguez-Campello, MD; Sandra Boned, MD; Marta Rubiera, MD, PhD; Alejandro Tomasello, MD; Carlos A. Molina, MD, PhD; Marc Ribo, MD, PhD; for Catalan Stroke Code and Reperfusion Consortium

Stroke. 2018;49:00-00.







ASPECTS

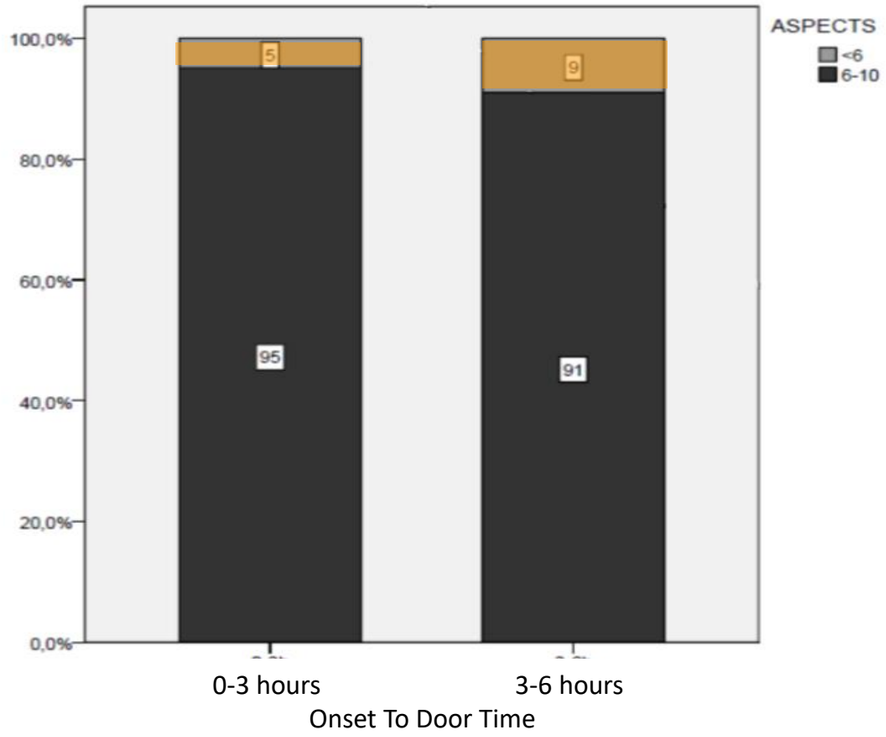


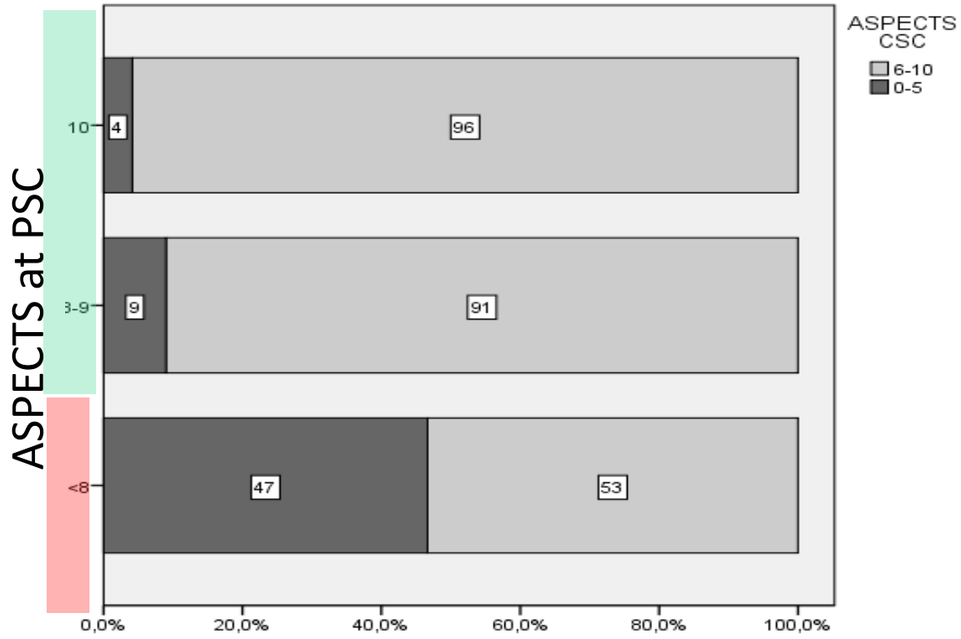
Figure 2. ASPECTS score according time from onset to admission. Perfect ASPECTS score decreased over time, the rate of ASPECTS ≥6 did not significantly decrease.

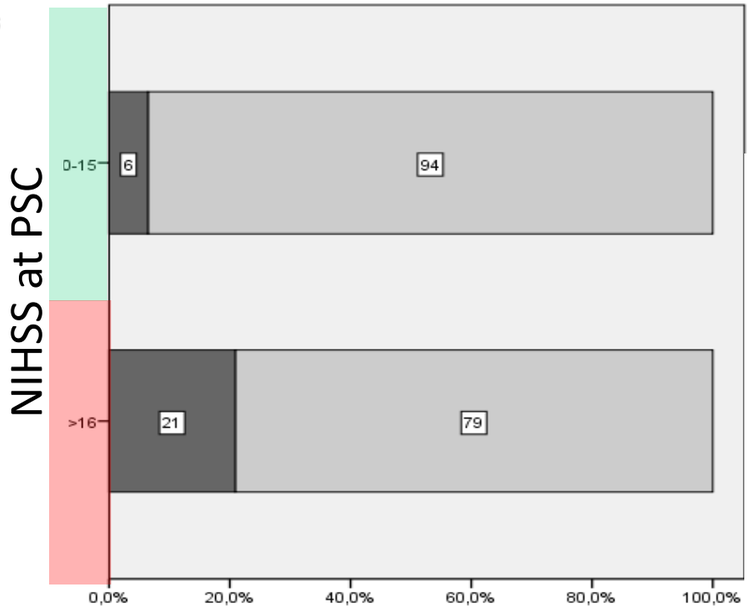
Clinical and neuroimaging criteria to improve the workflow in transfers for endovascular treatment evaluation

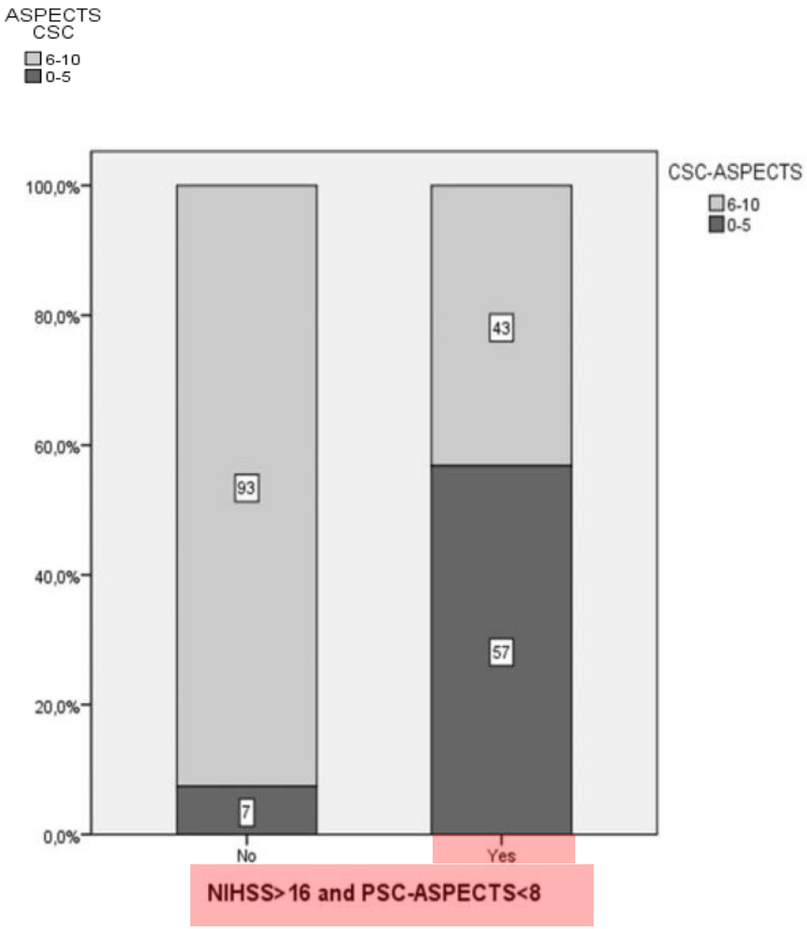
Manuel Requena[1,2], Marta Olivé-Gadea[1], Sandra Boned[1,2], Anna Ramos[3], Pere Cardona[4], Xabier Urra[5], Joaquín Serena[6], Yolanda Silva[6], Francisco Purroy[7], Xavier Ustrell[8], Sonia Abilleira[9], Alejandro Tomasello[10], Natalia Perez de la Ossa[3], Carlos A Molina[1,2], Marc Ribo[1,2] and Marta Rubiera[1,2]; for the Catalan Stroke Code and Reperfusion Consortium (Cat-SCR)

International Journal of Stroke
0(0) 1–7

DOI: 10.1177/1747493019874725
journals.sagepub.com/home/wso







ASPECTS at CSC after transfer

0-5

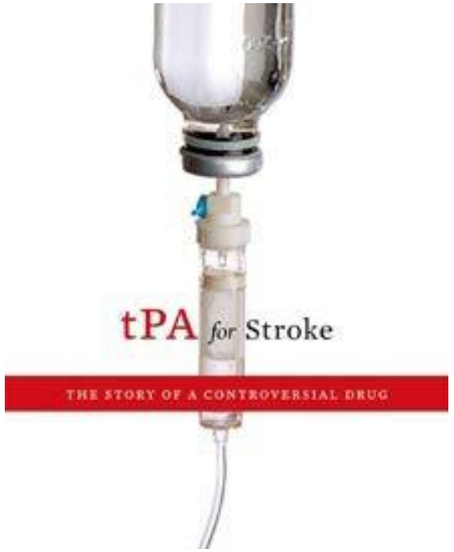
6-10

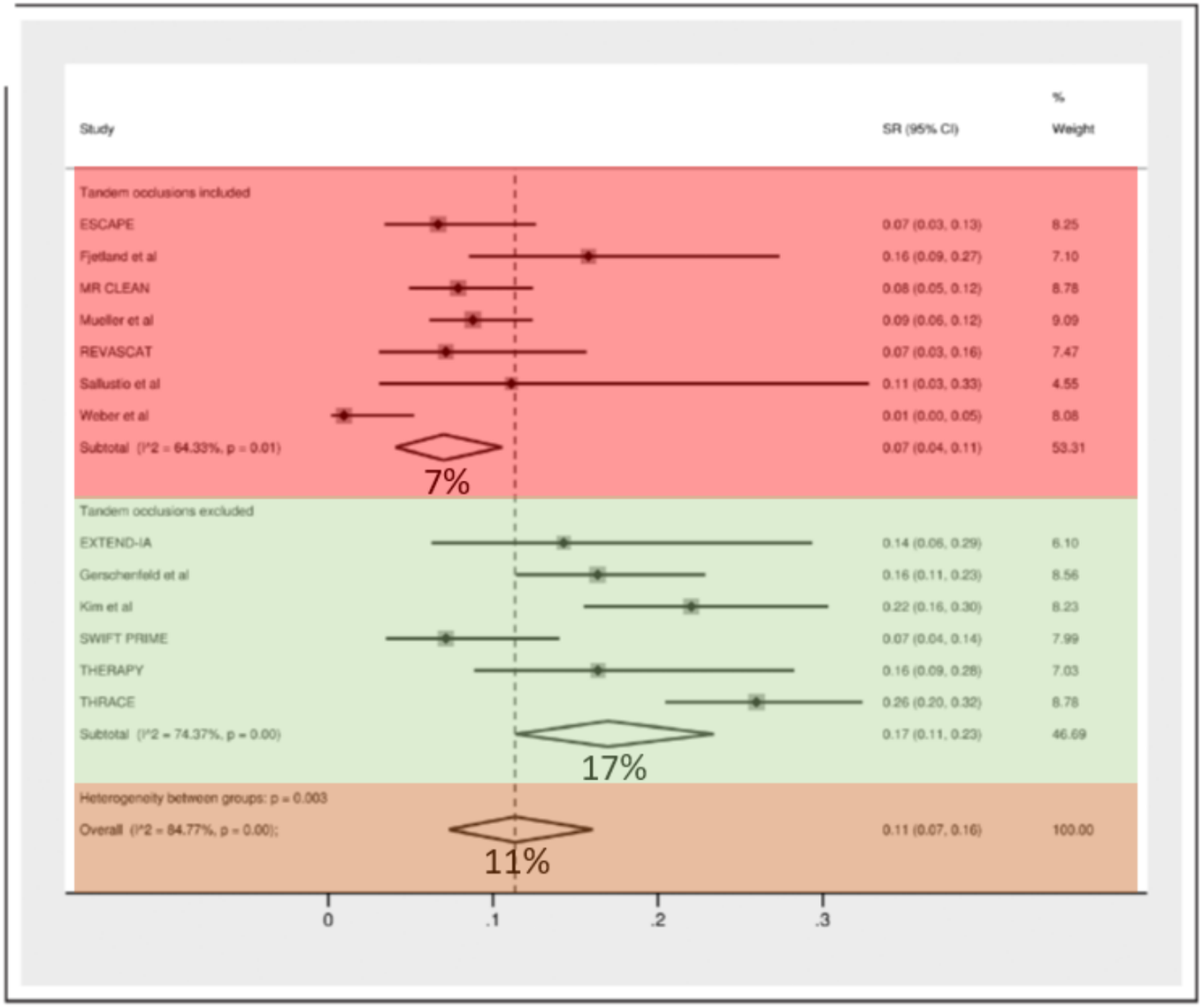
Successful Reperfusion With Intravenous Thrombolysis Preceding Mechanical Thrombectomy in Large-Vessel Occlusions

Georgios Tsivgoulis, MD; Aristeidis H. Katsanos, MD; Peter D. Schellinger, MD; Martin Köhrmann, MD; Panayiotis Varelas, MD; Georgios Magoufis, MD; Maurizio Paciaroni, MD; Valeria Caso, MD; Anne W. Alexandrov, PhD; Edip Gurol, MD; Andrei V. Alexandrov, MD

Stroke. 2018;49:232-235. DOI: 10.1161/STROKEAHA.117.019261.

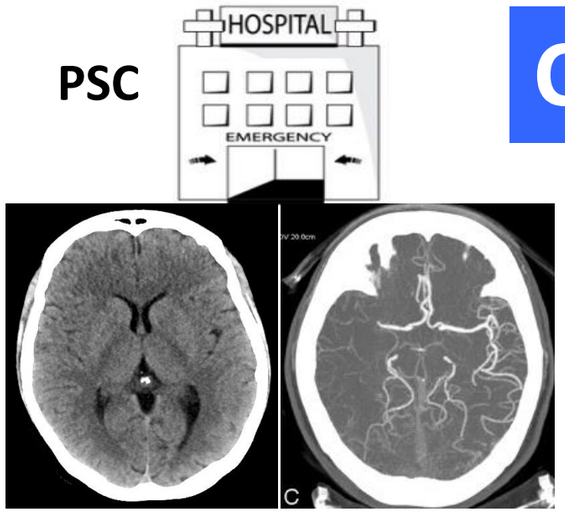
PSC





Catalan Stroke N

PSC

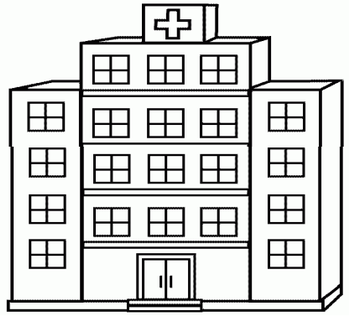


589 patients with documented LVO+

LVO transferred patients for EVT from PSC to CSC: N: 589

Excluded from EVT at CSC. N: 173 (29.3% from total)

REC at CSC arrival: N: 62 (10.5% from total)



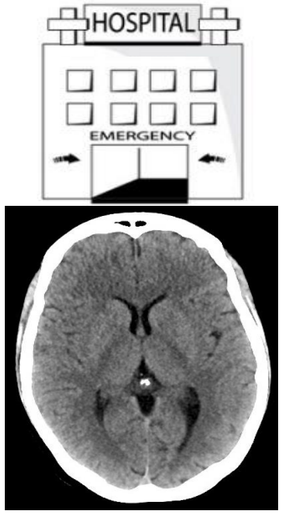
CSC

	Overall (n:589)	REC patients (n:62)	Non-REC patients (n:527)	*p value*
Female Gender (%)	257 (43.6)	23 (37.0)	234 (44.4)	0.27
Age mean (±SD)	70.4 (13.4)	68,5 (13.0)	70.7 (13.4)	0.21
RACE scale median (IQR)	7 (5-8)	5 (2-7)	7 (5-8)	**0.049**
Baseline NIHSS median (IQR)	17 (10-21)	11 (7-19)	17 (11-21)	**<0.01**
TICA occlusion at PSC (%)	67 (11.3)	4 (6.4)	63 (11.9)	0.19
MCA M1 occlusion at PSC (%)	369 (62.6)	26 (41.9)	343 (65.0)	0.28
MCA M2 occlusion at PSC (%)	101 (17.1)	17 (27.4)	84 (15.9)	**0.023**
Basilar Occlusion at PSC (%)	51 (8.6)	6 (9.6)	45 (8.5)	0.76
rtPA treatment at PSC (%)	371 (62.9)	51 (82.2)	320 (60.7)	**<0.01**
Symptoms onset to ne time minut	125 (90-166)	123 (84-155)	125 (90-169)	0.74
Symp to vas imagi mean minutes (±SD)				
Needle to vascular imaging at CSC mean minutes (±SD)	131 (101-156)	121 (89-156)	132 (106-157)	0.17
NIHSS at CSC admission (IQR) N Valid: 466	15 (12-19)	8 (6-10)	16 (13-19)	**p<0.01**
C. improvement at CSC (%). N Valid: 466	92 (15.6)	20 (55.5)	36 (17.5)	**p<0.01**
24-h NIHSS median (IQR)	10 (3-17)	4 (1-10)	10 (4-18)	**<0.01**

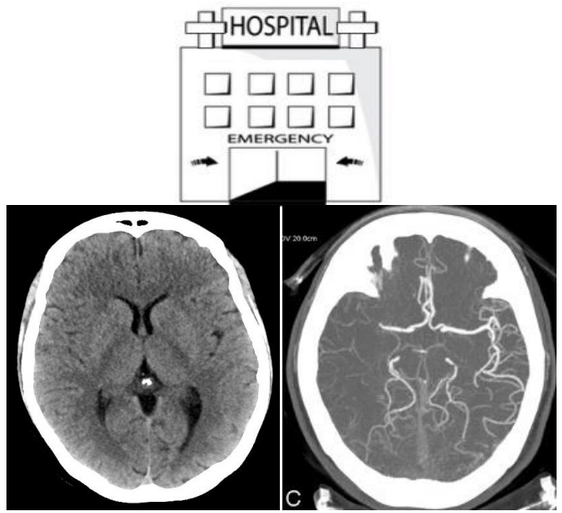
In multivariate analysis:
only tPA-treatment was associated with Recanalization at CSC
(p= 0.003, OR:4.65, 95%CI: 1.73-12.4)

Alan Flores et al. (

Catalan Stroke Network

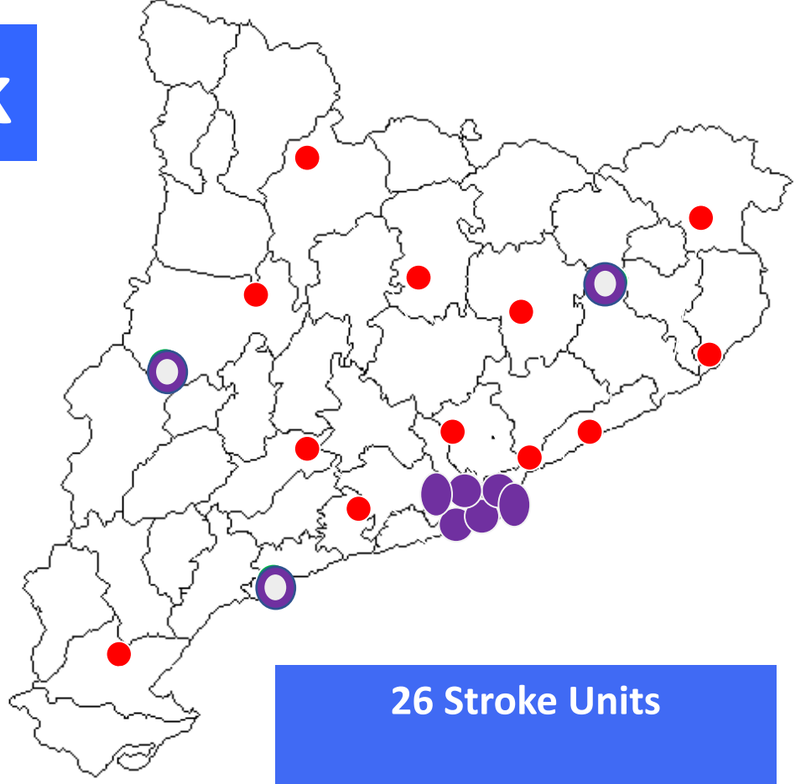


2016-2020
Primary Stroke Center
5792 ischemic stroke patients



2408 (41.6%)

3384 (58.4%)



26 Stroke Units

20 Primary SC

<u>Impact of vascular imaging at PSC on:</u>

- Workflow times (DIDO, symptom-to-groin…)
- Futile transfers
- % EVT
- Outcome

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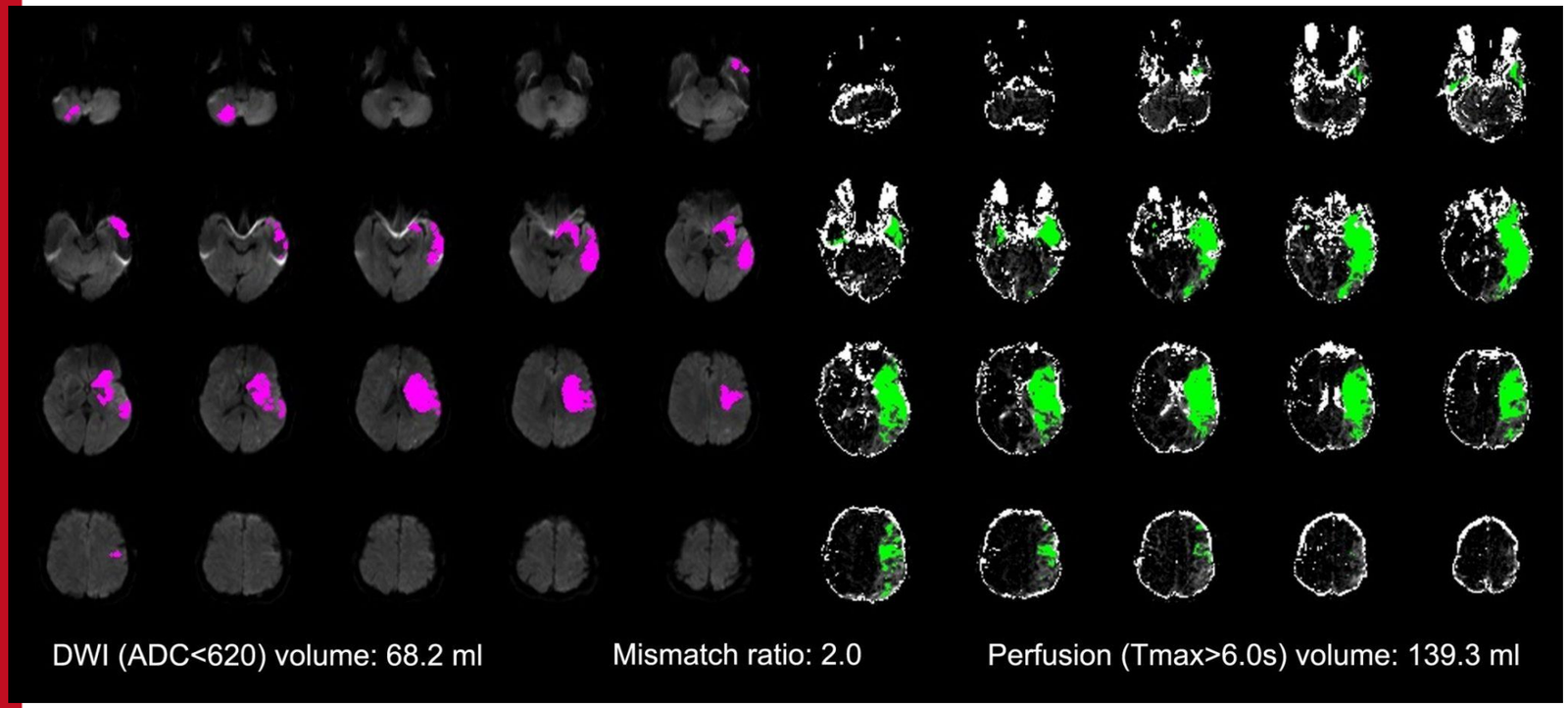
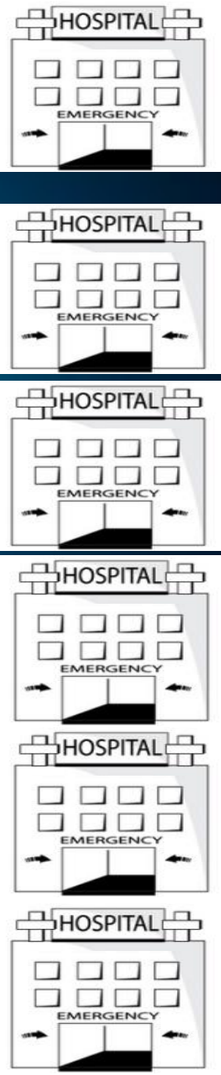
ADVANCED IMAGING ?





PSC

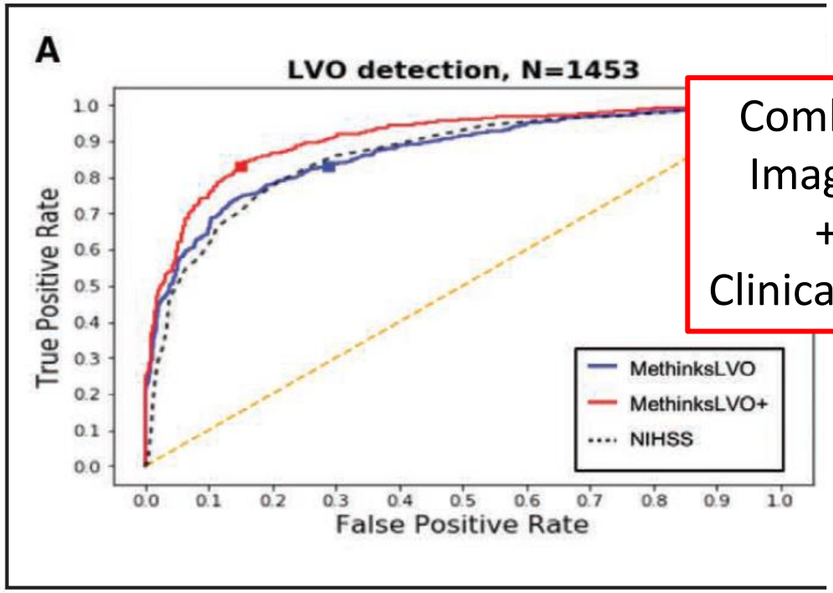
Stroke

BRIEF REPORT

Deep Learning Based Software to Identify Large Vessel Occlusion on Noncontrast Computed Tomography

Marta Olive-Gadea, MD; Carlos Crespo, BS; Cristina Granes, BS; Maria Hernandez-Perez, MD; Natalia Pérez de la Ossa, MD, PhD; Carlos Laredo, MSc; Xabier Urra, MD, PhD; Juan Carlos Soler, MD; Alexander Soler, MD; Paloma Puyalto, MD, PhD; Patricia Cuadras, MD, PHD; Cristian Marti, BS; Marc Ribo, MD, PhD

Stroke. 2020;51:00–00. DOI: 10.1161/STROKEAHA.120.030326

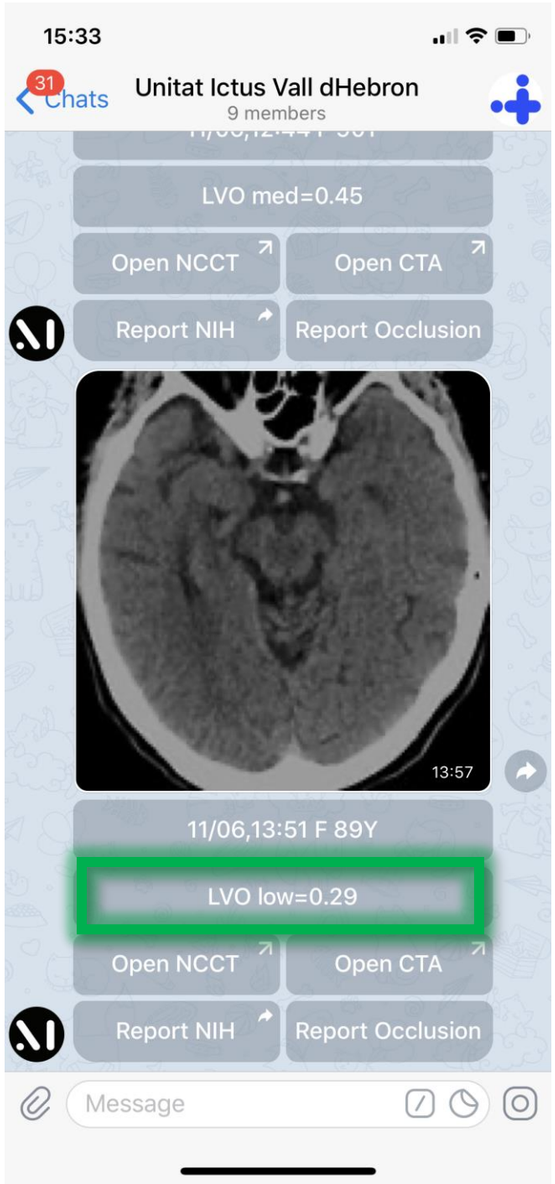


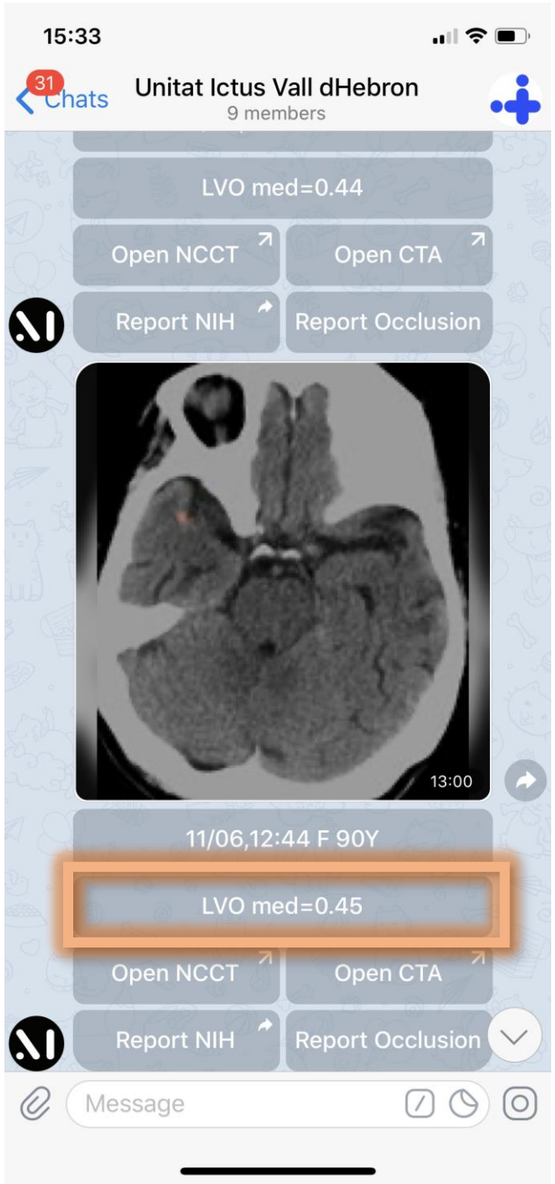
Combine
Imaging
+
Clinical data

Table 2. Performance of Methinks Software in Detecting LVO for the Indicated Vessel Occlusion Locations

	MethinksLVO		MethinksLVO+	
	True Positive	False Negative	True Positive	False Negative
ICA	146 (82%)	30 (17%)	153 (86%)	23 (13%)
MCA-M1	422 (27%)	59 (12%)	417 (86%)	64 (13%)
MCA-M2	96 (76%)	29 (23%)	92 (73%)	33 (26%)
Basilar	14 (51%)	13 (48%)	19 (70%)	8 (29%)
Other	7 (50%)	7 (50%)	3 (21%)	11 (78%)

Data are N (%). ICA indicates internal carotid artery; LVO, large vessel occlusion; and MCA, middle cerebral artery.


15:33
31 Chats
Unitat Ictus Vall dHebron
9 members
LVO med=0.45
Open NCCT
Open CTA
Report NIH
Report Occlusion
13:57
11/06,13:51 F 89Y
LVO low=0.29
Open NCCT
Open CTA
Report NIH
Report Occlusion
Message


15:33
31 Chats
Unitat Ictus Vall dHebron
9 members
LVO med=0.44
Open NCCT
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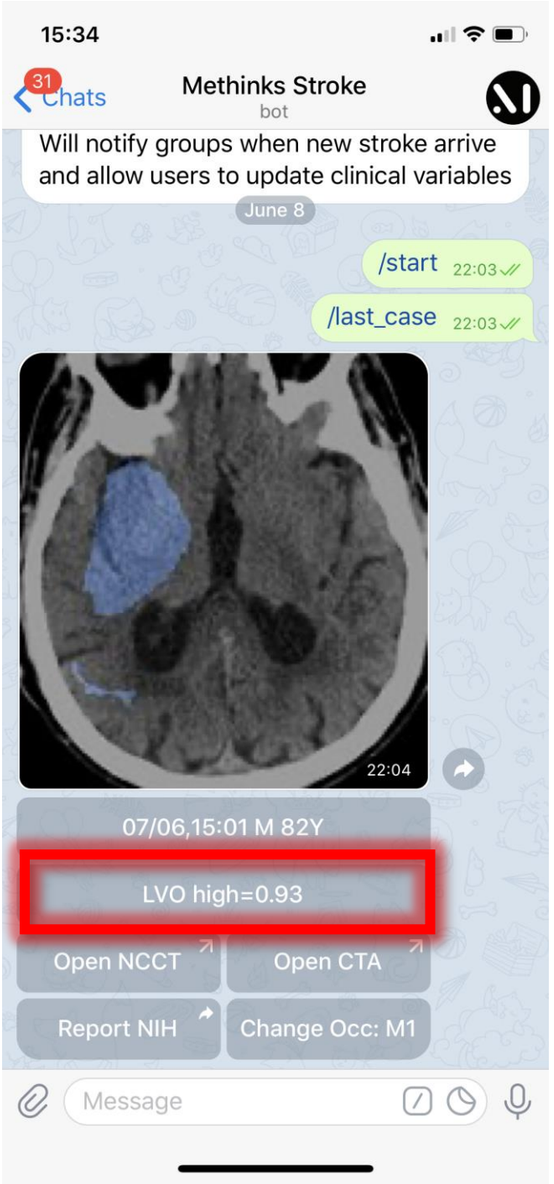
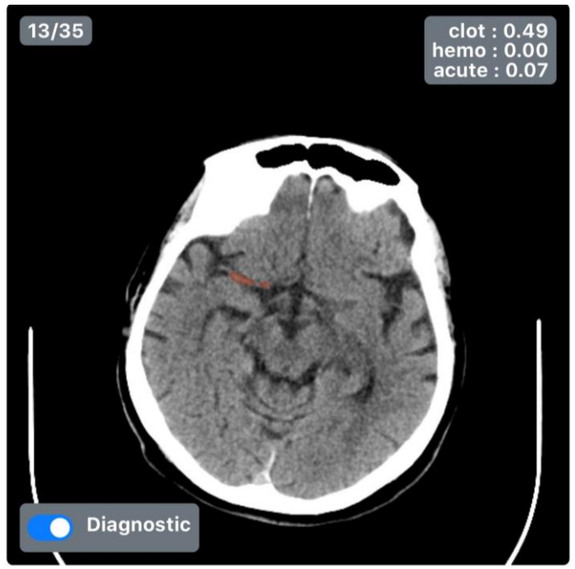
Report NIH
Report Occlusion
13:00
11/06,12:44 F 90Y
LVO med=0.45
Open NCCT
Open CTA
Report NIH
Report Occlusion
Message


15:34
31 Chats
Methinks Stroke
bot
Will notify groups when new stroke arrive and allow users to update clinical variables
June 8
/start 22:03
/last_case 22:03
22:04
07/06,15:01 M 82Y
LVO high=0.93
Open NCCT
Open CTA
Report NIH
Change Occ: M1
Message

American Stroke Association.
A division of the American Heart Association.

Stroke



CLINICAL AND POPULATION SCIENCES

Clot-Based Radiomics Predict a Mechanical Thrombectomy Strategy for Successful Recanalization in Acute Ischemic Stroke

Jeremy Hofmeister, MD, MSc; Gianmarco Bernava, MD; Andrea Rosi, MD; Maria Isabel Vargas, MD; Emmanuel Carrera, MD; Xavier Montet, MD; Simon Burgermeister, MD; Pierre-Alexandre Poletti, MD; Alexandra Platon, MD; Karl-Olof Lovblad, MD; Paolo Machi, MD, PhD

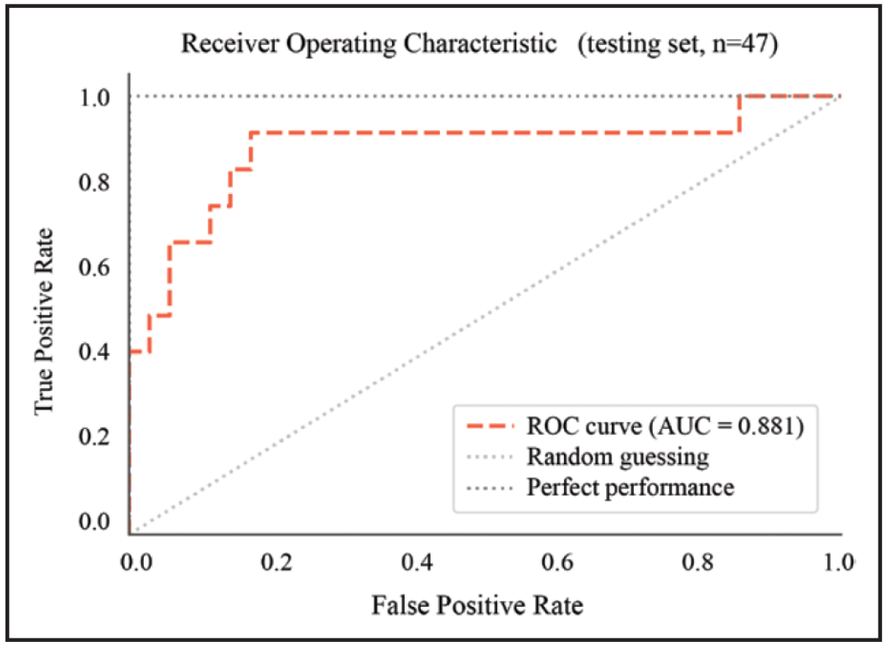


Figure 2. Receiver operating characteristic curve (ROC)–area under the curve (AUC) for the identification of patients with first-attempt recanalization with the direct aspiration first pass technique strategy in the validation cohort.

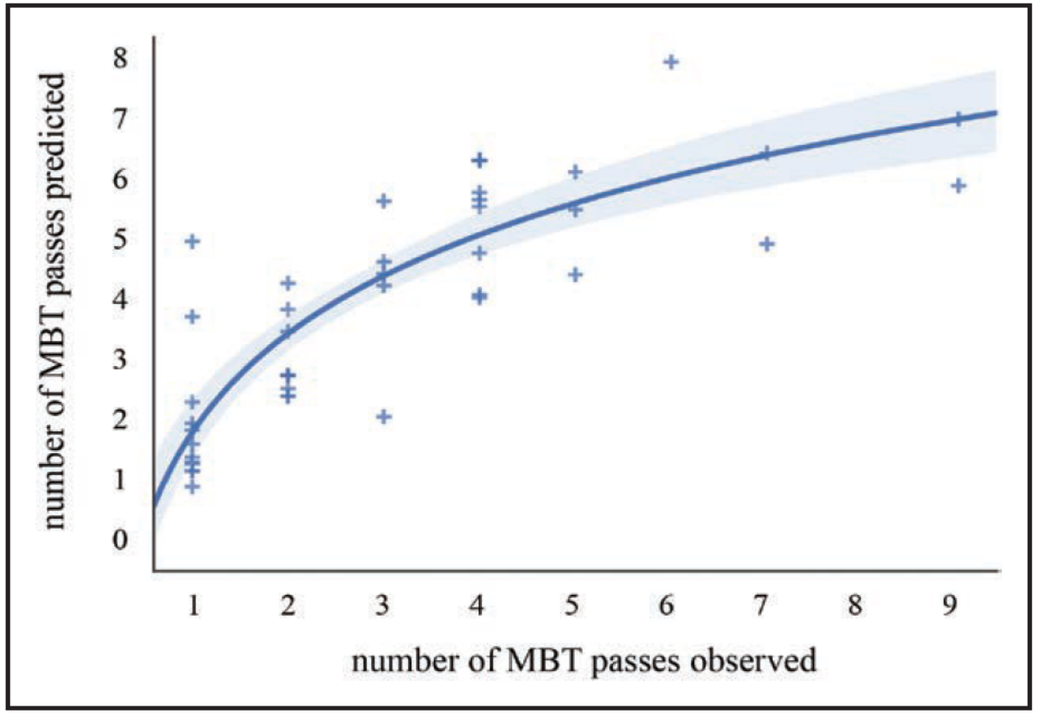
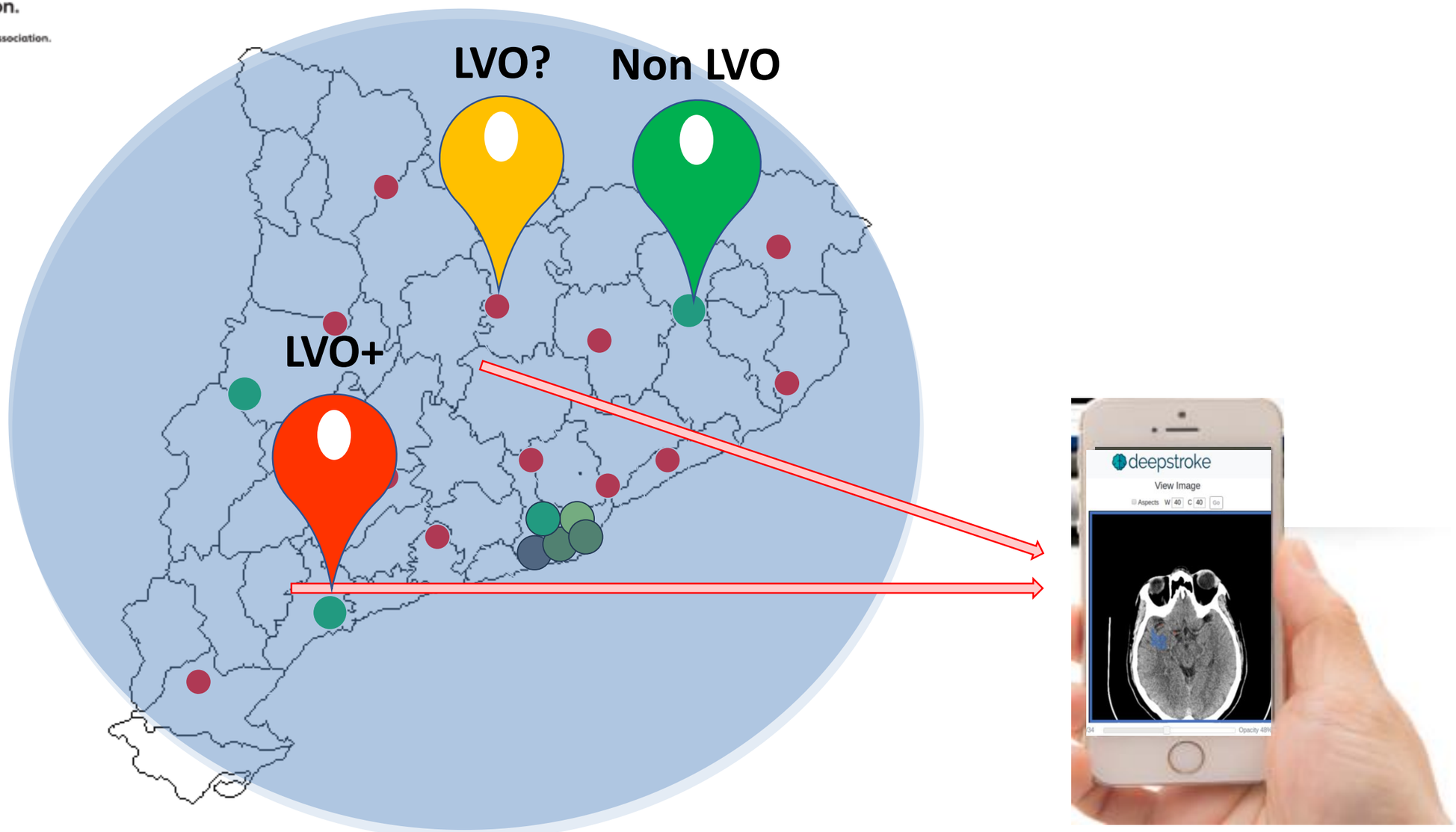


Figure 3. Number of passages with a mechanical thrombectomy (MTB) device predicted and observed.


LVO?
Non LVO
LVO+
deepstroke
View Image

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A division of the American Heart Association.

SVIN
Society of Vascular and Interventional Neurology

THANK YOU

American Stroke Association.
A division of the American Heart Association.

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SOCIETY OF VASCULAR AND INTERVENTIONAL NEUROLOGY

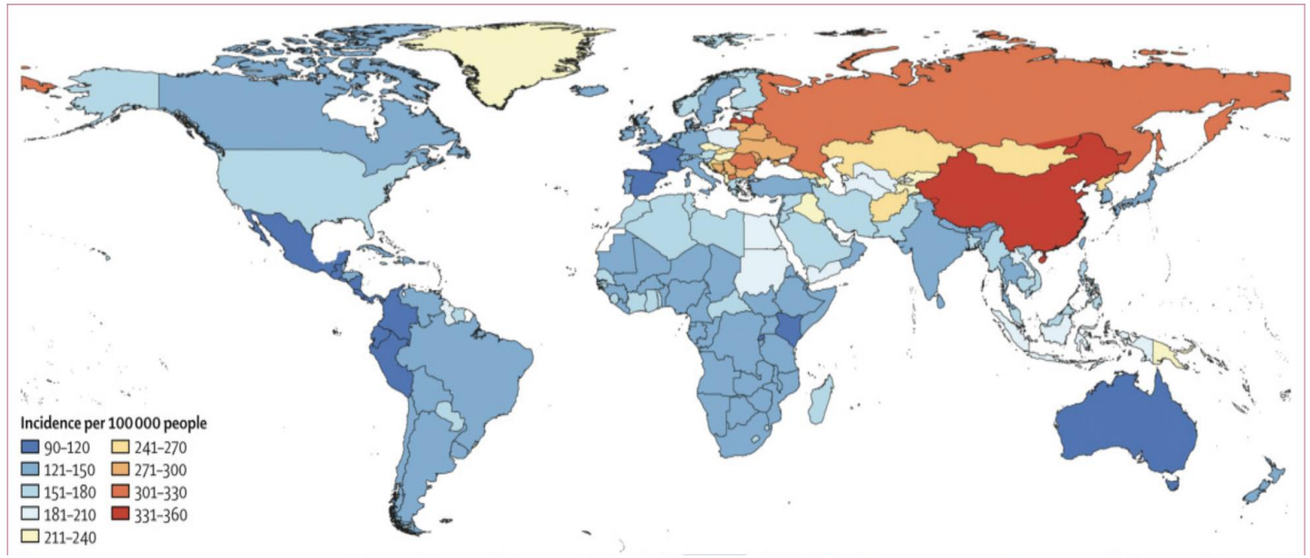
Diagnosis – Imaging and Resource Utilization for Stroke Patients in Asia

Thomas W Leung

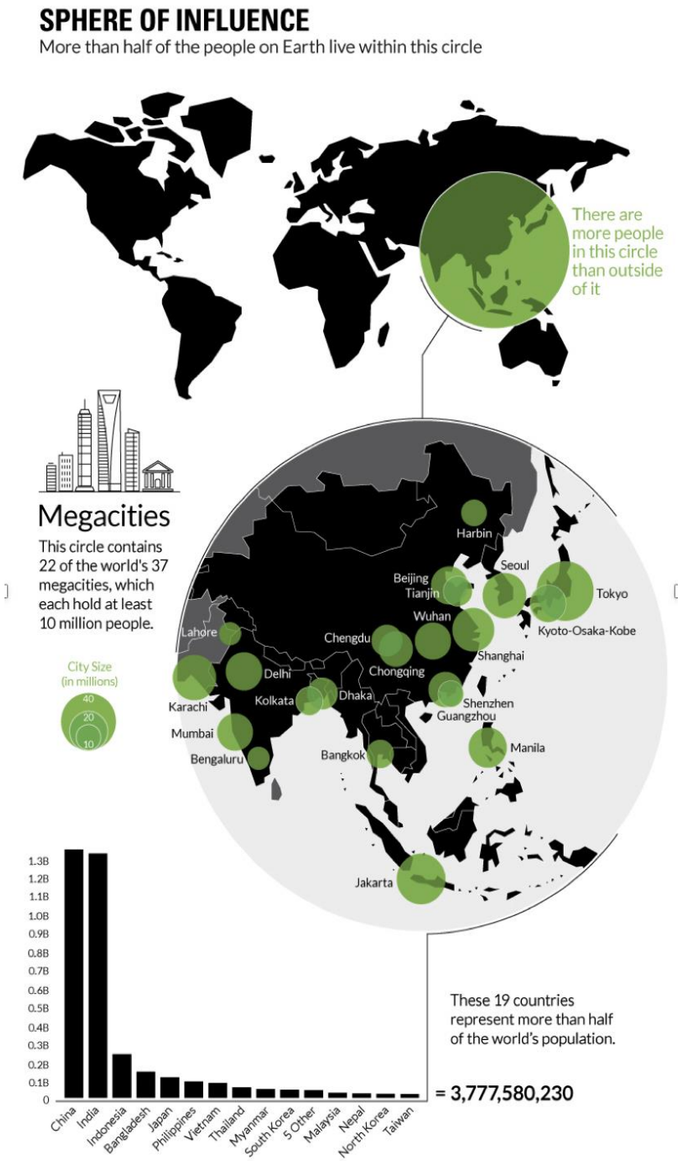
Lee Quo Wei Professor of Neurology
Honorary Consultant and Director, Acute Stroke Unit, The Prince of Wales Hospital
The Chinese University of Hong Kong

Outline

- Stroke 'ecosystem' in Asia: disparities between the East and the West
- Stroke etiology in Asia
- The what, where and when of the imaging scan: Etiology-based, accessible, prioritized, interpretable (and transmissible)



Lancet Neurol. 2019;18:439-458.



MORTALITY due to STROKE alone

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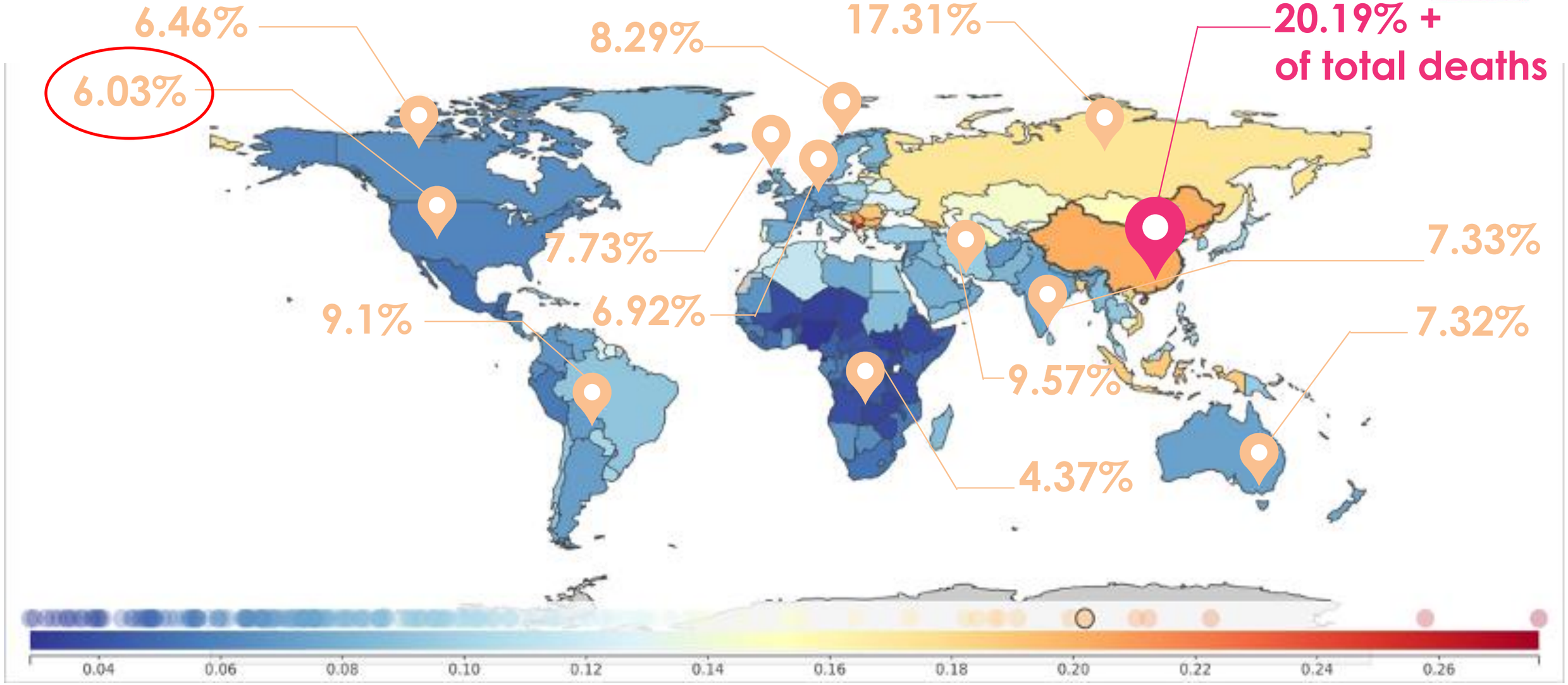
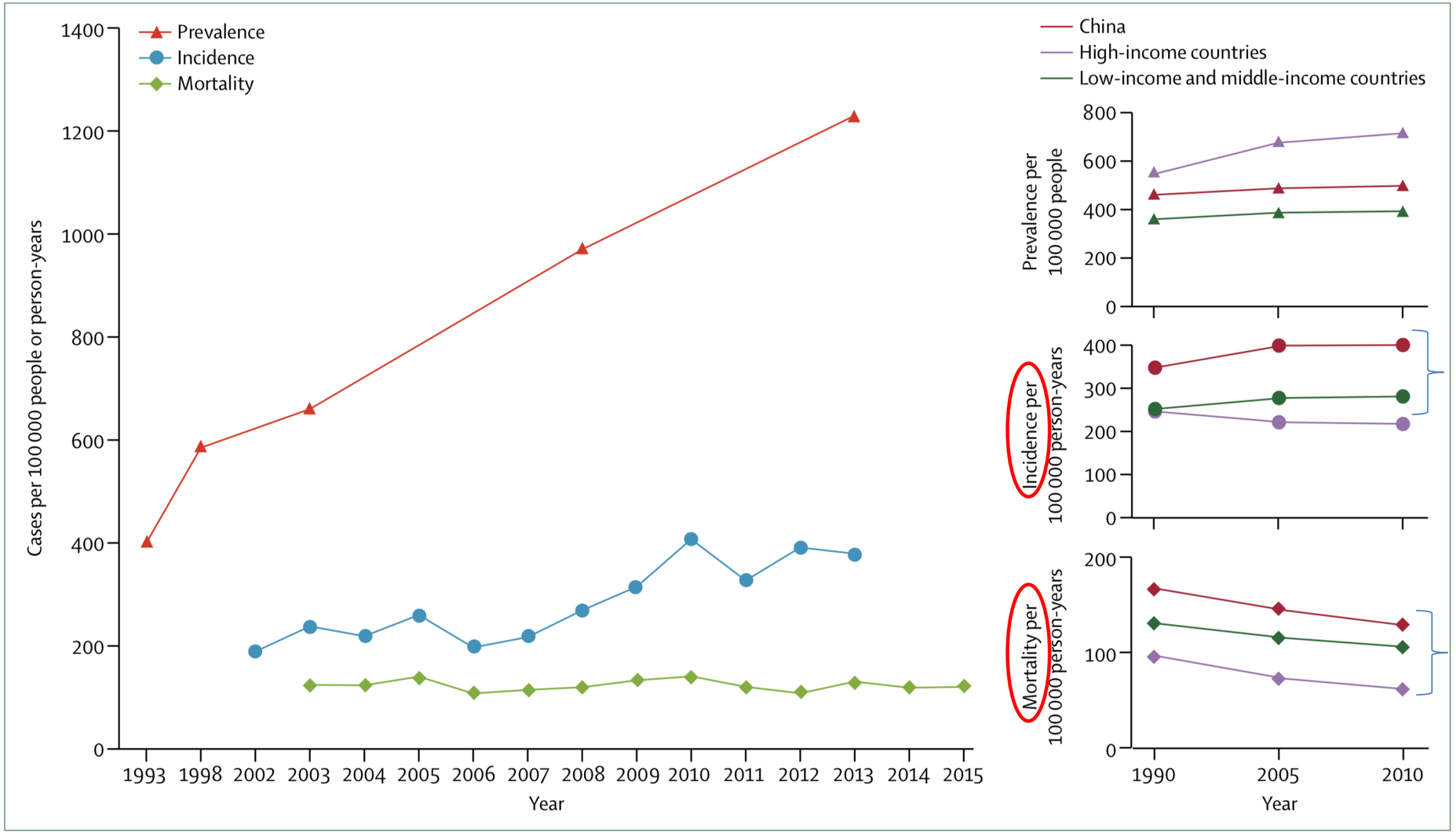


Stroke in China



Lancet Neurol 2019;18:394-405

Dimensions of Stroke Disparity

- Race/ethnicity (Ethnic minorities vs White)
- Sex (Females disadvantaged)
- Age (Elderly vs young patients)
- Stroke disability
- Socioeconomic status (per capita income)
- Geographic location (Urban vs Rural)

Socioeconomic status is critical:

- Low/middle-income countries bear > 80% of the global stroke burden despite about 20% of the total economic resources.
- Stroke occurs 15 years of age earlier: at the peak of their productive lives.
- Because of low health literacy, improving socioeconomic status is associated with increases in stroke risk and mortality.

Global Burden of Disease Study 2017. *Lancet. 2018 Nov 10;392(10159):1789-1858.*

Geographic location is a determinant

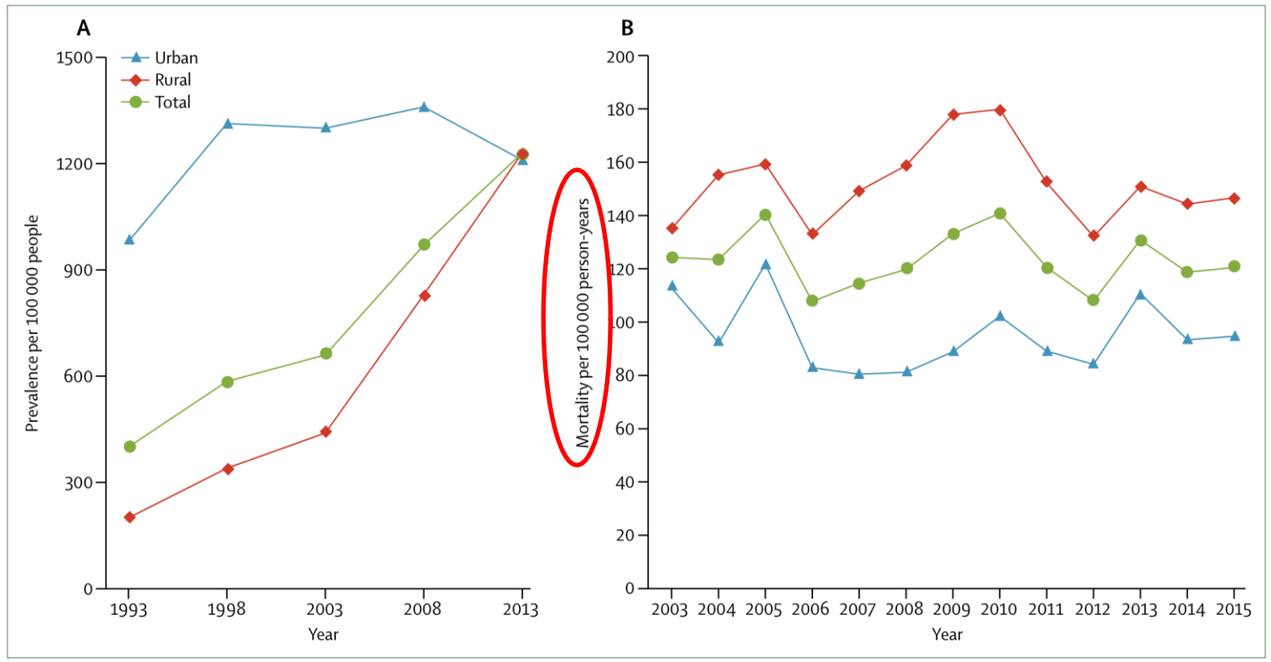


Figure 2: Prevalence and mortality of stroke in urban and rural areas of China

Lancet Neurol 2019;18:394-405

Disparities occur in risk factor control, acute care, and rehabilitation even within the same country

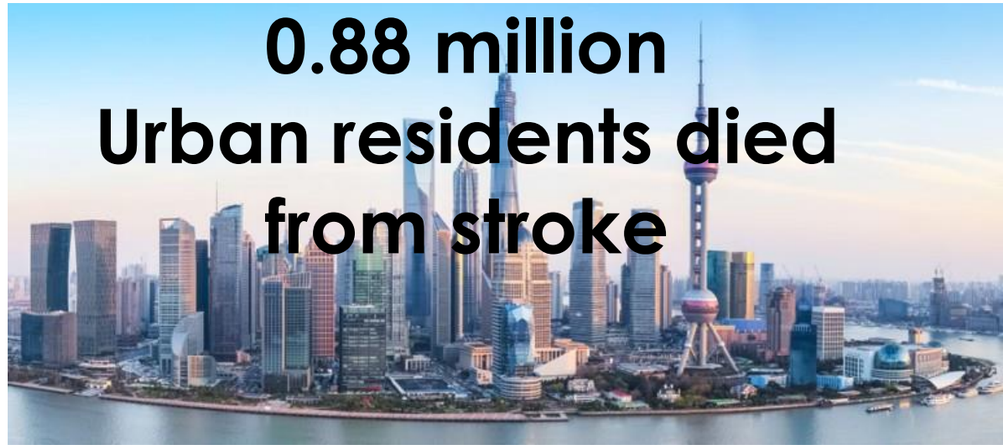
The NEW ENGLAND JOURNAL of MEDICINE

ESTABLISHED IN 1812 MAY 21, 2020 VOL. 382 NO. 21

Endovascular Thrombectomy with or without Intravenous Alteplase in Acute Stroke

P. Yang, Yongwei Zhang, L. Zhang, Yongxin Zhang, K.M. Treurniet, W. Chen, Y. Peng, H. Han, J. Wang, S. Wang, C. Yin, S. Liu, P. Wang, Q. Fang, Hongchao Shi, J. Yang, C. Wen, C. Li, C. Jiang, J. Sun, X. Yue, M. Lou, M. Zhang, H. Shu, D. Sun, H. Liang, Tong Li, F. Guo, K. Ke, H. Yuan, G. Wang, W. Yang, Huaizhang Shi, Tianxiao Li, Z. Li, P. Xing, P. Zhang, Y. Zhou, H. Wang, Y. Xu, Q. Huang, T. Wu, R. Zhao, Q. Li, Y. Fang, Laixing Wang, J. Lu, Y. Li, J. Fu, X. Zhong, Y. Wang, Longde Wang, M. Goyal, D.W.J. Dippel, B. Hong, B. Deng, Y.B.W.E.M. Roos, C.B.L.M. Majoie, and J. Liu, for the DIRECT-MT Investigators*

In 2017



American Stroke Association.
A division of the American Heart Association.

JoS JOURNAL OF STROKE

Journal of Stroke 2020;22(3):345-356
https://doi.org/10.5853/jos.2020.02383

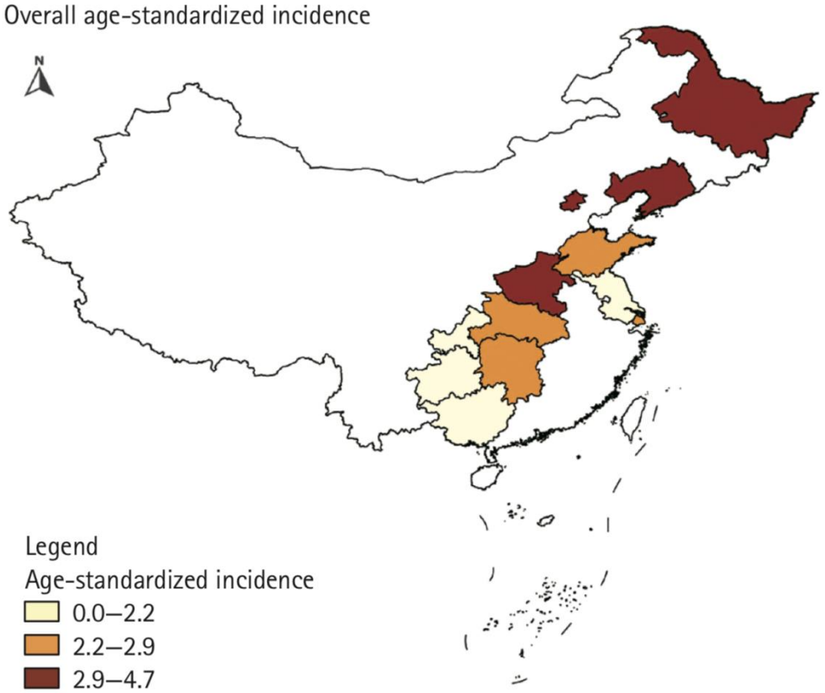
Original Article

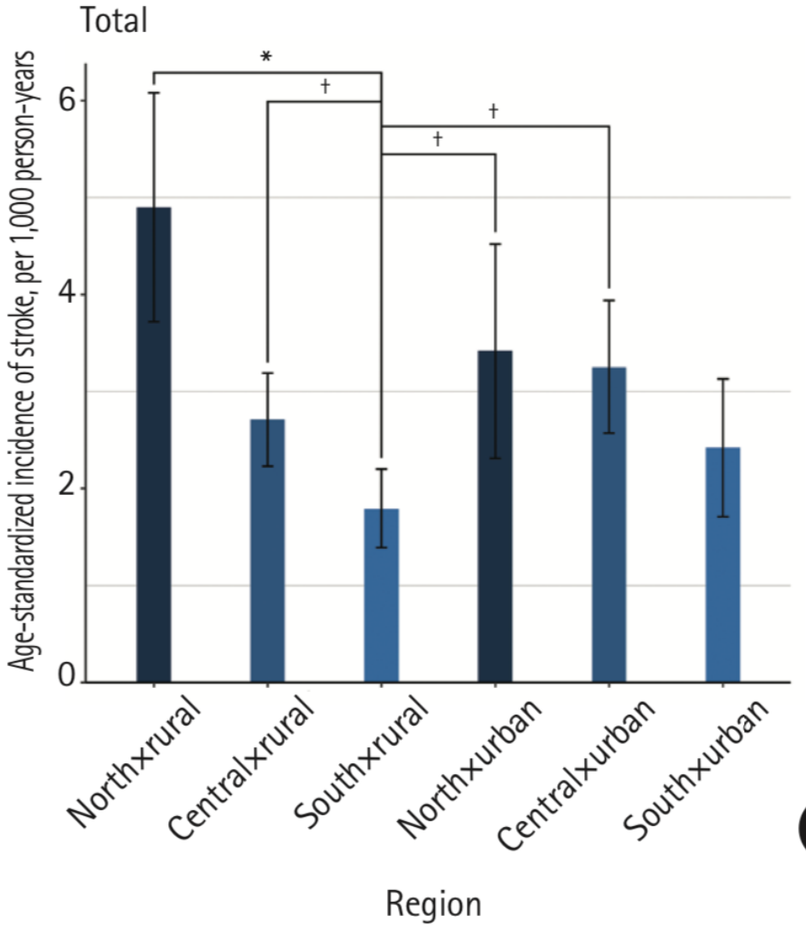
SVIN Society of Vascular and Interventional Neurology

Geographic Variations of Stroke Incidence in Chinese Communities: An 18-Year Prospective Cohort Study from 1997 to 2015

Fan Xia,[a,*] Xuexin Yu,[b,*] Yunke Li,[a,*] Yuqi Chen,[a] Wei Zhang,[b] Chao You,[a] Xin Hu[a]

[a]Department of Neurosurgery, West China Hospital, Sichuan University, Chengdu, China
[b]West China Biomedical Big Data Center, West China Hospital, Sichuan University, Chengdu, China





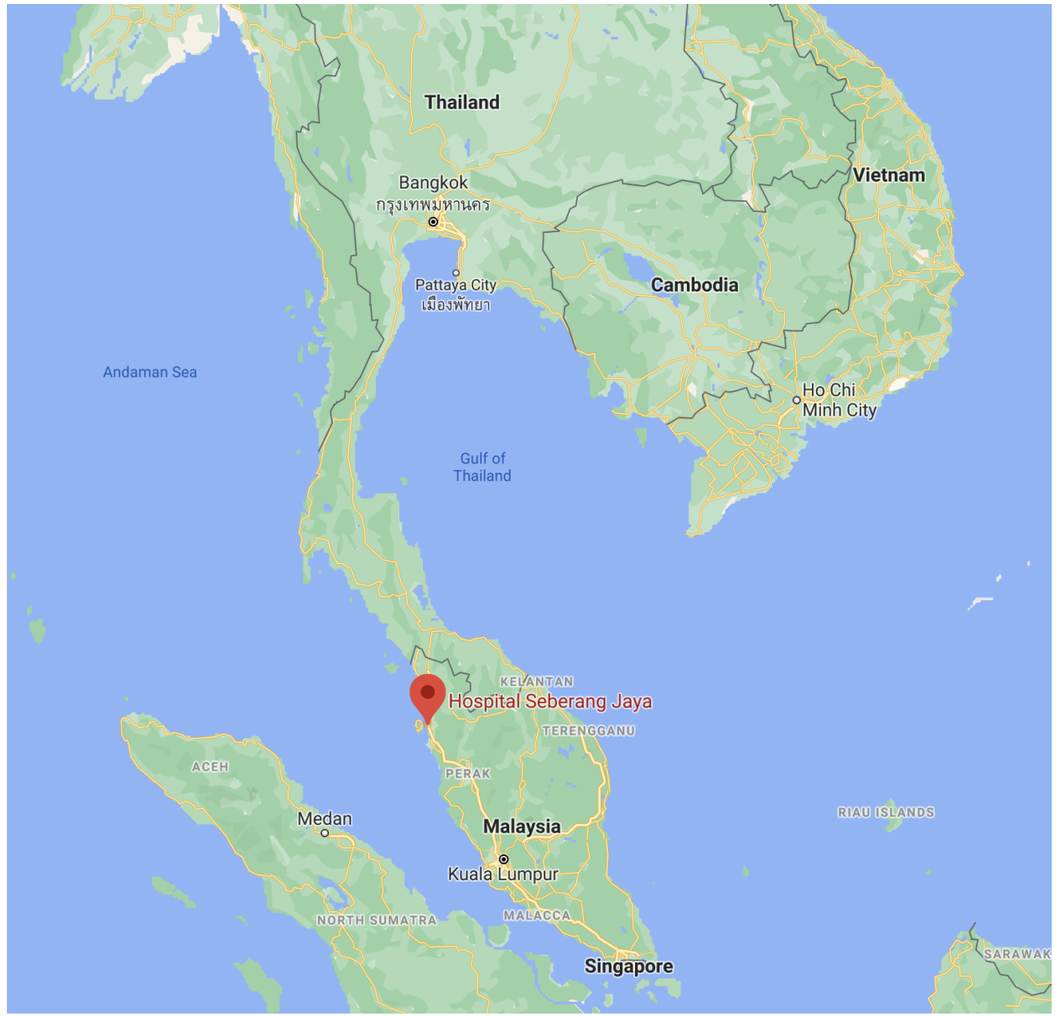
- Failed translation of evidence-based stroke prevention and treatment into global impact
- Guidelines are from data of high income countries
- Developing countries have different risk factors, pathophysiology and management opportunities.

1.1. Prehospital Systems

1.1. Prehospital Systems	COR	LOE
1. Public health leaders, along with medical professionals and others, should design and implement public education programs focused on stroke systems and the need to seek emergency care (by calling 9-1-1) in a rapid manner. These programs should be sustained over time and designed to reach racially/ethnically, age, and sex diverse populations.	I	B-NR
2. Such educational programs should be designed to specifically target the public, physicians, hospital personnel, and emergency medical services (EMS) personnel to increase use of the 9-1-1 EMS system, to decrease stroke onset to emergency department (ED) arrival times, and to increase timely use of thrombolysis and thrombectomy.	I	C-EO
Early stroke symptom recognition is essential for seeking timely care. Unfortunately, knowledge of stroke warning signs and risk factors in the United States remains poor. Blacks and Hispanics particularly have lower stroke awareness than the general population and are at increased risk of prehospital delays in seeking care.[20] These factors may contribute to the disparities in stroke outcomes. Available evidence suggests that public awareness interventions are variably effective by age, sex, and racial/ethnic minority status.[21] Thus, stroke education campaigns should be designed in a targeted manner to optimize their effectiveness.[21]		
3. Activation of the 9-1-1 system by patients or other members of the public is strongly recommended. 9-1-1 dispatchers should make stroke a priority dispatch, and transport times should be minimized.	I	B-NR

Stroke. 2019 Dec;50(12):e344-e418.

Socio-demographics and clinical characteristics affecting pre-hospital delays in acute stroke patients: A 6-year registry study from a Malaysian stroke hospital



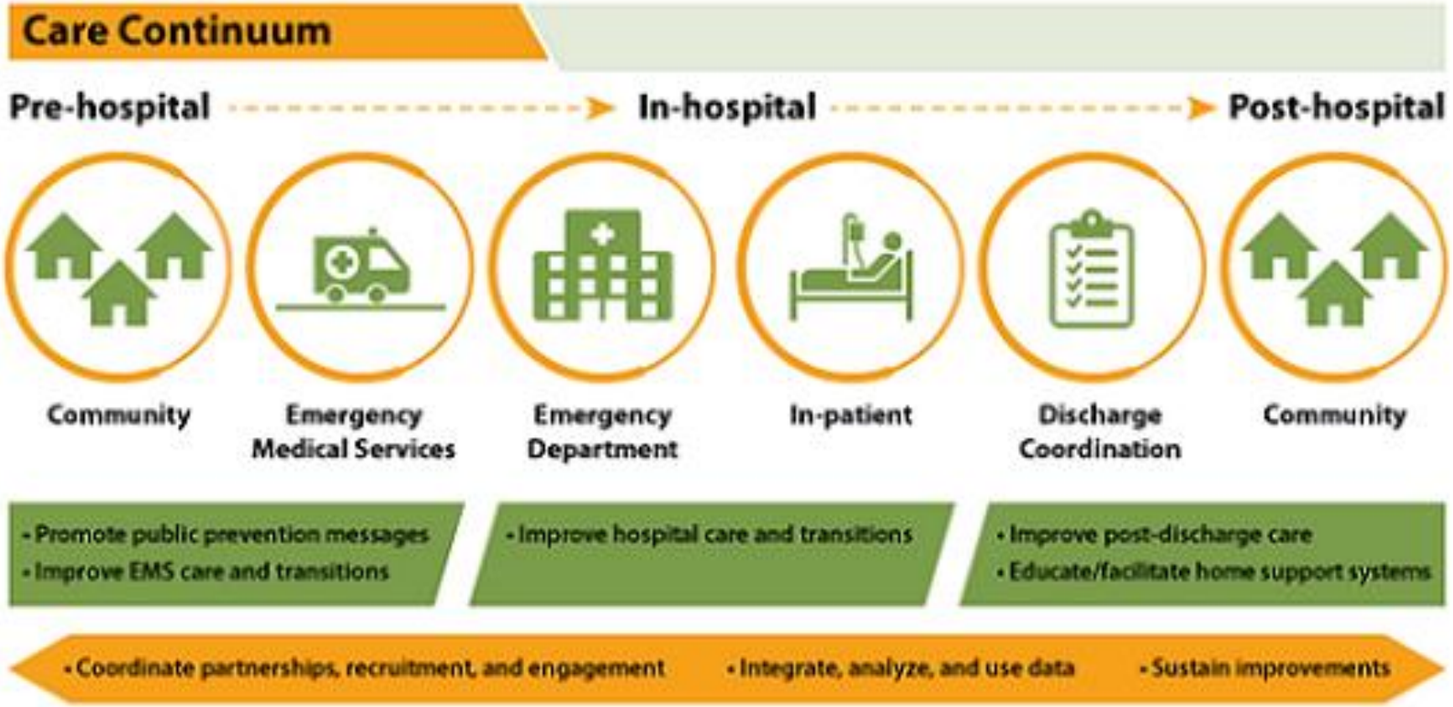
N=932
Jan 2013 – Dec 2018

Neurology Asia *September 2020*

Characteristics	Arrival at hospital		OR	95% CI	p-value
	≥ 3 hours n (%)	< 3 hours n (%)			
Stroke severity					
None to mild stroke	296 (71.3)	119 (28.7)	1		
Moderate stroke	167 (65)	90 (35)	0.8	0.6-1.1	0.085
Moderate to severe stroke	21 (55.3)	17 (44.7)	0.5	0.3-0.9	0.042
Severe stroke	24 (61.5)	15 (38.5)	0.6	0.3-1.3	0.203
Mode of transport					
Own transport	195 (42.5)	264 (57.5)	1		
Ambulance	45 (23.1)	150 (76.9)	0.4	0.3-0.6	<0.001

Neurology Asia 2020; 25(3) : 235 – 243

Understand the Ecosystem of Stroke Engage the stakeholders



Centers for Disease Control and Prevention

- Stroke patients and families
- Healthcare providers/care-givers
- Government and Policy makers
- Tax payers/insurance/ reimbursement scheme
- Implementation partners
- Regional and international stroke advocacy and professional bodies

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Email or phone | Password | Log In

Forgotten account?

SVIN Society of Vascular and Interventional Neurology

MT2020 Mission Thrombectomy

-0:56

MT2020

1 Govt support and state regulations

2 Improve the EMS (ambulance, etc.) services

3 Implement guidelines and protocols for triage to MT

4 Improving awareness among healthcare practitioners for stroke diagnosis and triage

5 Training more physicians for MT

6 Payment schemes for MT

7 More MT capable centers

8 Create hub and spoke mechanisms for stroke centers

9 Improving patient awareness about stroke symptoms

EurekAlert! | AAAS

HOME NEWS RELEASES MULTIMEDIA MEETINGS PORTALS ABOUT

PUBLIC RELEASE: 21-NOV-2016

SVIN announces 'Stroke: Mission thrombectomy 2020'

An initiative to reduce disability from stroke worldwide

SOCIETY OF VASCULAR AND INTERVENTIONAL NEUROLOGY

SHARE PRINT E-MAIL

New York -- Nov.21, 2016 -- The Society of Vascular and Interventional Neurology (SVIN) announced the launch of Mission Thrombectomy 2020, an initiative to enhance global efforts to improve stroke care worldwide by increasing the rate of stroke thrombectomy for eligible patients from less than 100,000 procedures today to 202,000 annually by 2020 and thereby reducing global stroke disability. Stroke Thrombectomy, also known as Mechanical Thrombectomy, is the new highly effective standard of care that reverses paralysis from stroke in over 60% of patients if done by experts within 6 hours of stroke symptoms. The initiative was unveiled at the SVIN 9th Annual Meeting and 4th Annual Stroke Center Workshop, which took place from November 16-19, 2016 in Brooklyn, New York.

SVIN Society of Vascular and Interventional Neurology

IMAGE: THIS IS THE SVIN LOGO. view more ›

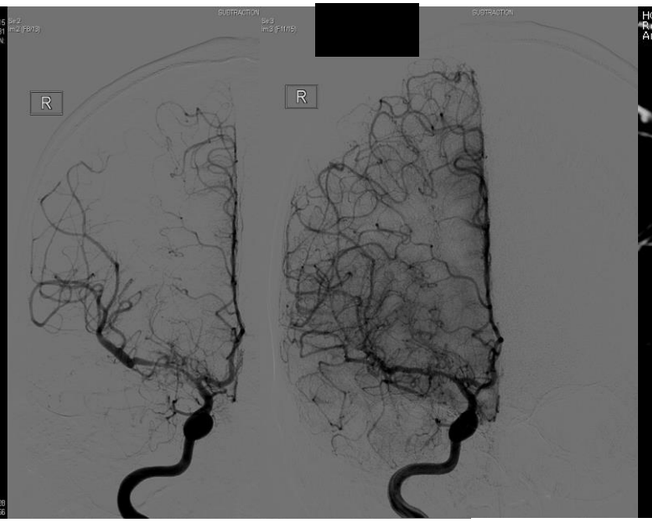
CREDIT: SOCIETY OF VASCULAR AND INTERVENTIONAL NEUROLOGY

https://www.facebook.com/MT2020Stroke/videos/introduction-to-mt2020/329076747757684/

Atherosclerotic vs non-atherosclerotic vasculopathy

Atherosclerosis

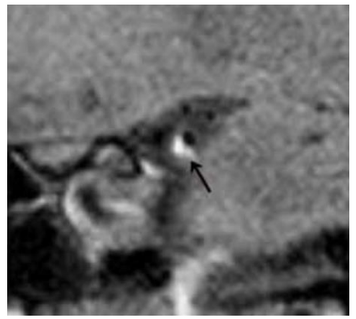
Moyamoya Syndrome (*RNF* 213)



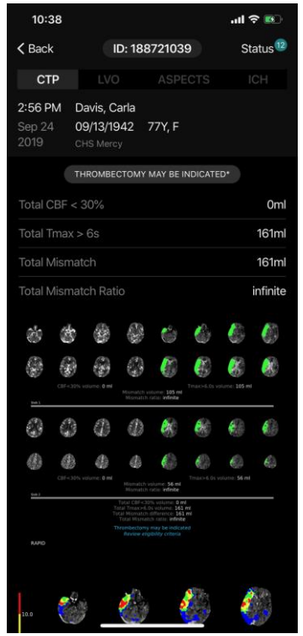
Dissection

CNS Vasculitis

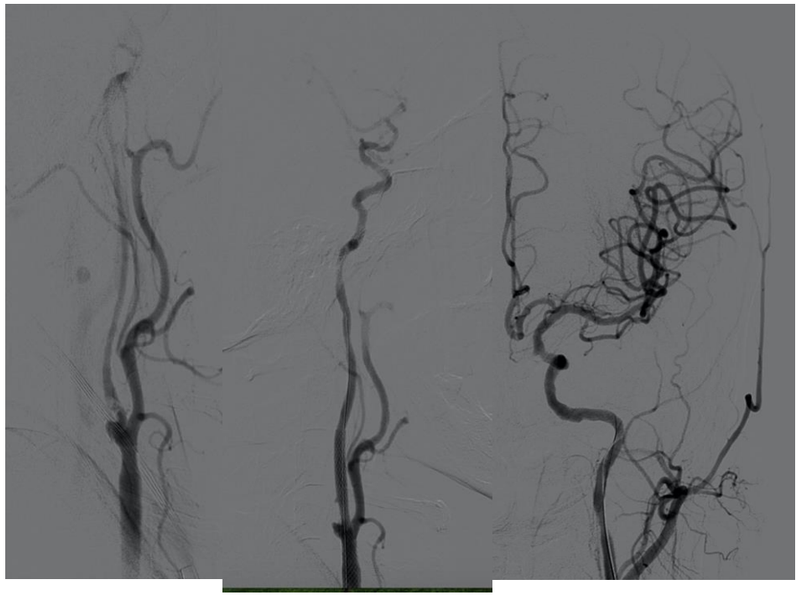
Vascular Anomaly



Cardioembolism

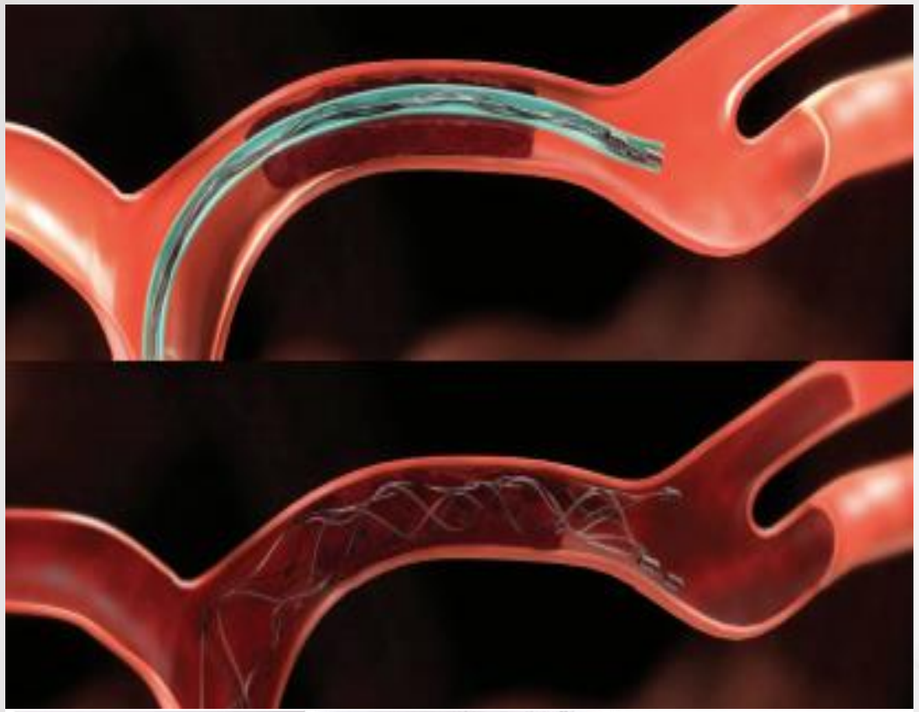


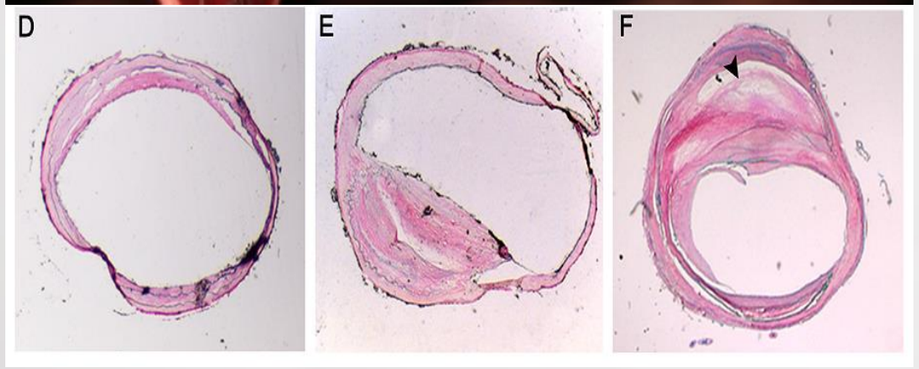
Emboli from proximal ICA



Intrinsic thrombosis of ICAD

Stent retriever (or too deep an aspiration) may lead to endarectomy





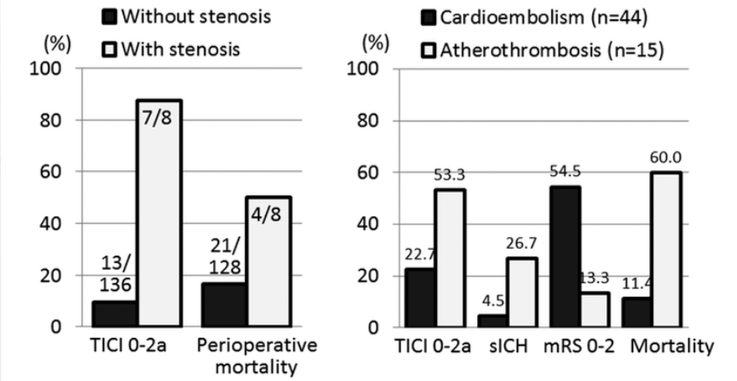


Figure 2. Vascular and clinical outcomes after acute thrombectomy using stent retrievers according to stroke causes. **Right**, The Solitaire was used for all patients (based on results of Reference 39). **Left**, Stent retrievers, mainly the Solitaire, were primarily used for all but 1 cardioembolic patient and 61.5% of atherothrombotic patients. All atherothrombotic patients underwent additional endovascular therapy using other devices (based on results of Reference 40). Thrombolysis in cerebral ischemia (TICI) scale of 0 to 2a indicates unsuccessful recanalization. sICH indicates symptomatic intracerebral hemorrhage.

Toyoda et al, *Stroke*. 2015;46:1474-1481

An etiology-based imaging test in a green channel: priority in terms of accessibility, interpretation (and transmission)

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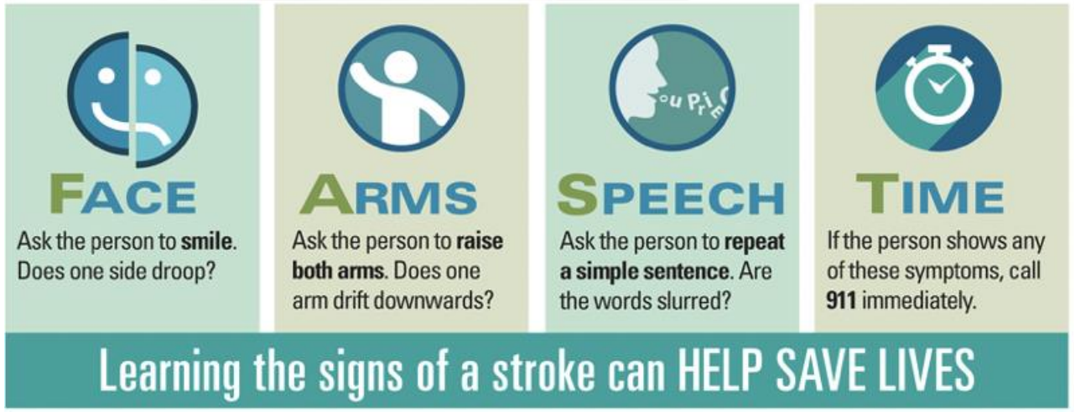
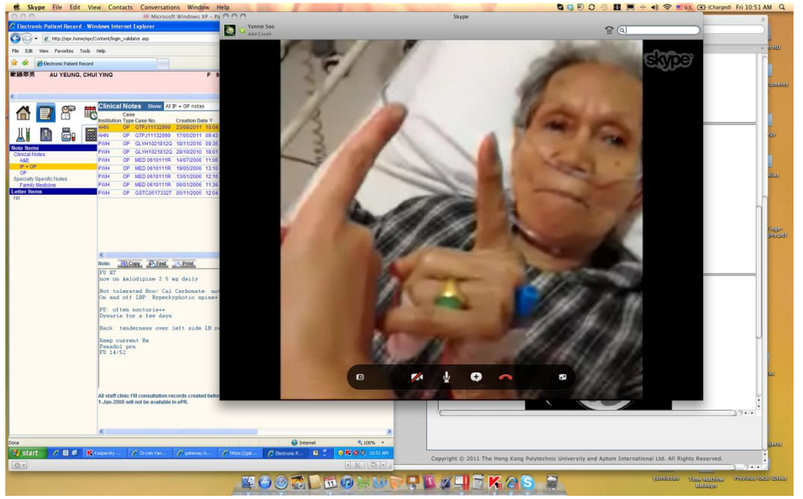
A division of the American Heart Association.

SVIN Society of Vascular and Interventional Neurology

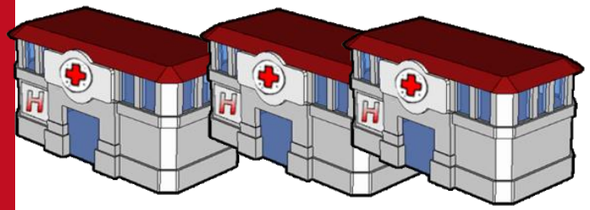
Pre-hospital Identification → **Pre-hospital Notification** → **Be ready before patient arrival**



HUB



Without on-site visit



SPOKE

Medical consultations are beyond hospital boundary

A simple SMS message can be a good reminder for drug compliance!

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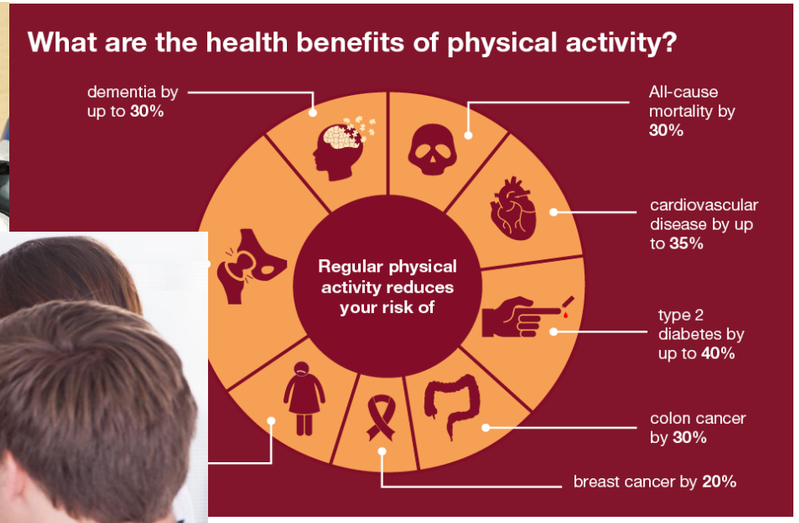
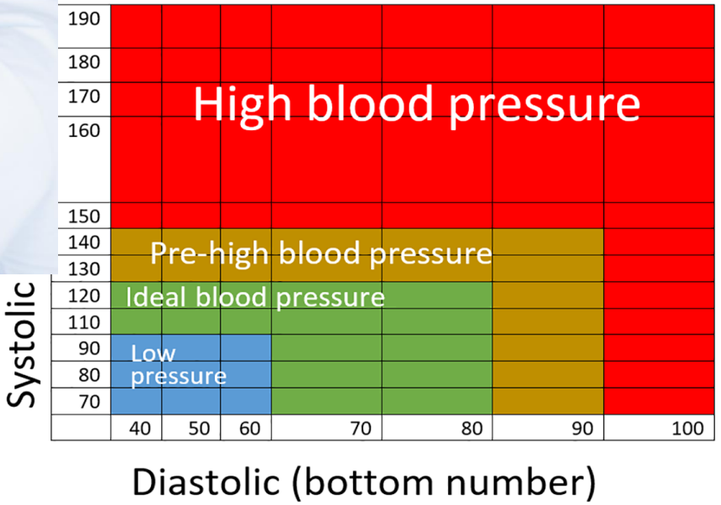
A precious opportunity for training and education





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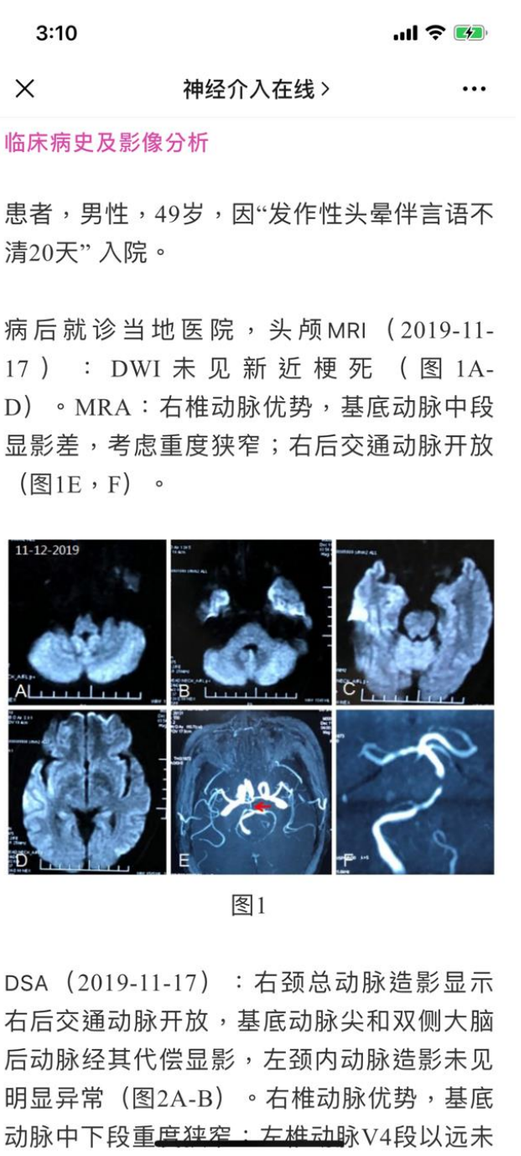
The way to the nearest stroke center

Live conference broadcast and procedure demonstration



Webinar show sharing

SVIN Society of Vascular and Interventional Neurology

Thammasat Hospital Introduces Biplane Hybrid Operation Room

By **Kunnikar** - August 20, 2020

Share on Facebook | Tweet on Twitter | Report Post

Government and hospital investment

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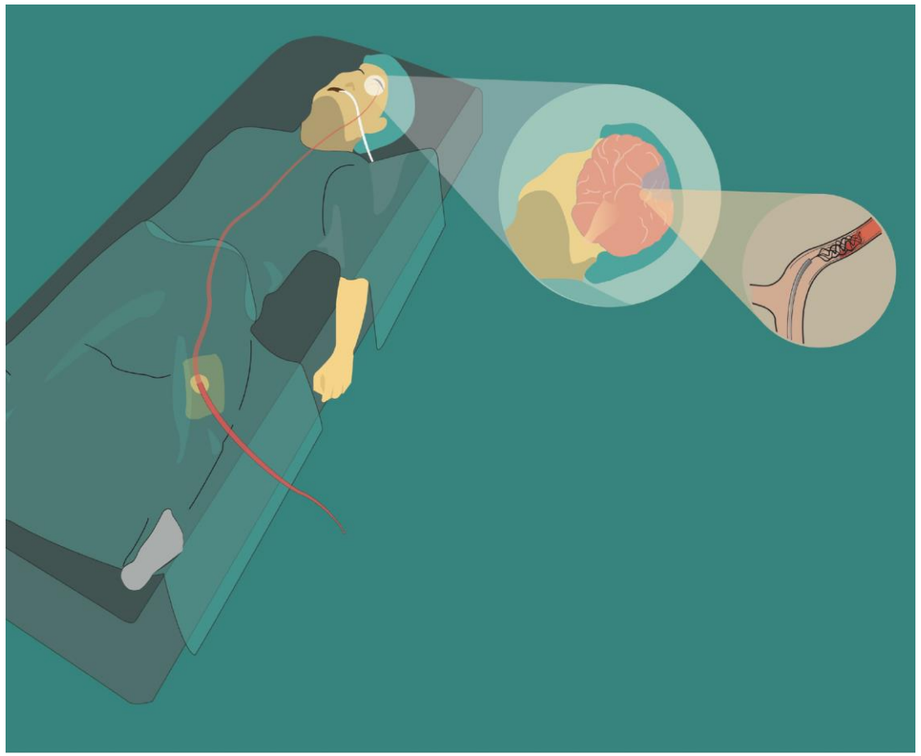
American Heart Association.



STROKE MECHANICAL THROMBECTOMY

Building thrombectomy systems of care in your region; Why and How?

A White Paper

Prepared by
The Society of Vascular and Interventional Neurology (SVIN)

SVIN Society of Vascular and Interventional Neurology
MT2020 Mission Thrombectomy

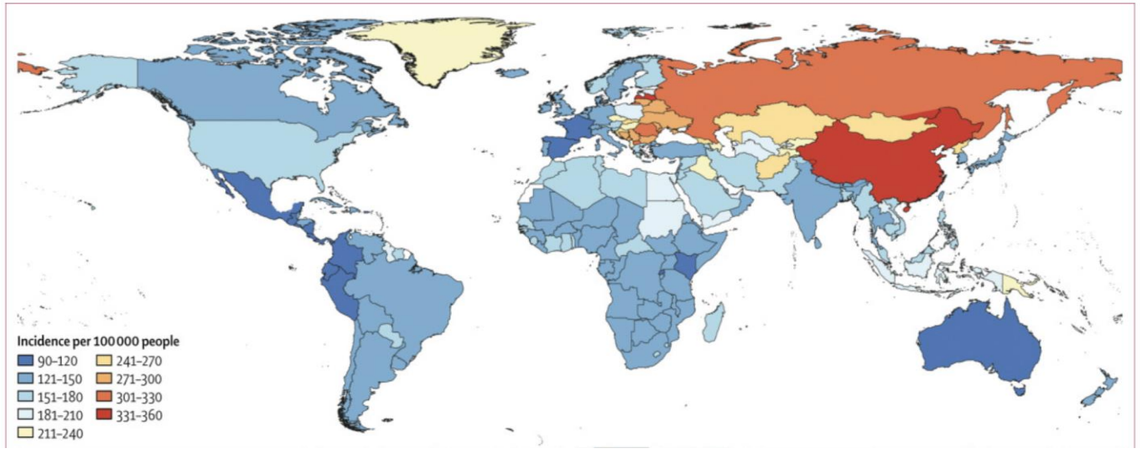
Appendix

SVIN Society of Vascular and Interventional Neurology

To be formally released on the World Stroke Day (29 October 2020)

Take Home Message

- A concerted effort to strive for health equity
- Understand local stroke ecosystem, and identify regional disparities
- Incorporate an accessible imaging test (a multimodal CT scan) in a well-rehearsed triage process
- A priority: Availability and Interpretation.
- Establish evidence-based, uniform, protocol-driven stroke care across the country, guided by time metrics
- Novel solutions for physical and geographic barriers: Mobile apps and broadband



Lancet Neurol. 2019;18:439-458.

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Thank You.

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Panel Discussion

Audience Q & A

To Ask a Question

Upcoming Opportunities

- On-demand viewing

- Remainder of *International Perspectives on Stroke Triage, Diagnosis and Treatment* series
  - Episode 3: Treatment with IV Lytics (October 21)
  - Episode 4: Treatment with Thrombectomy (October 28)

- World Stroke Day (October 29)
  - One CycleNation with ASA
  - Discounted educational opportunities with SVIN

- AHA Scientific Sessions (November 13 – 17)

- SVIN Annual Conference (November 18 – 21)

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SVIN Society of Vascular and Interventional Neurology

Thank You.

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