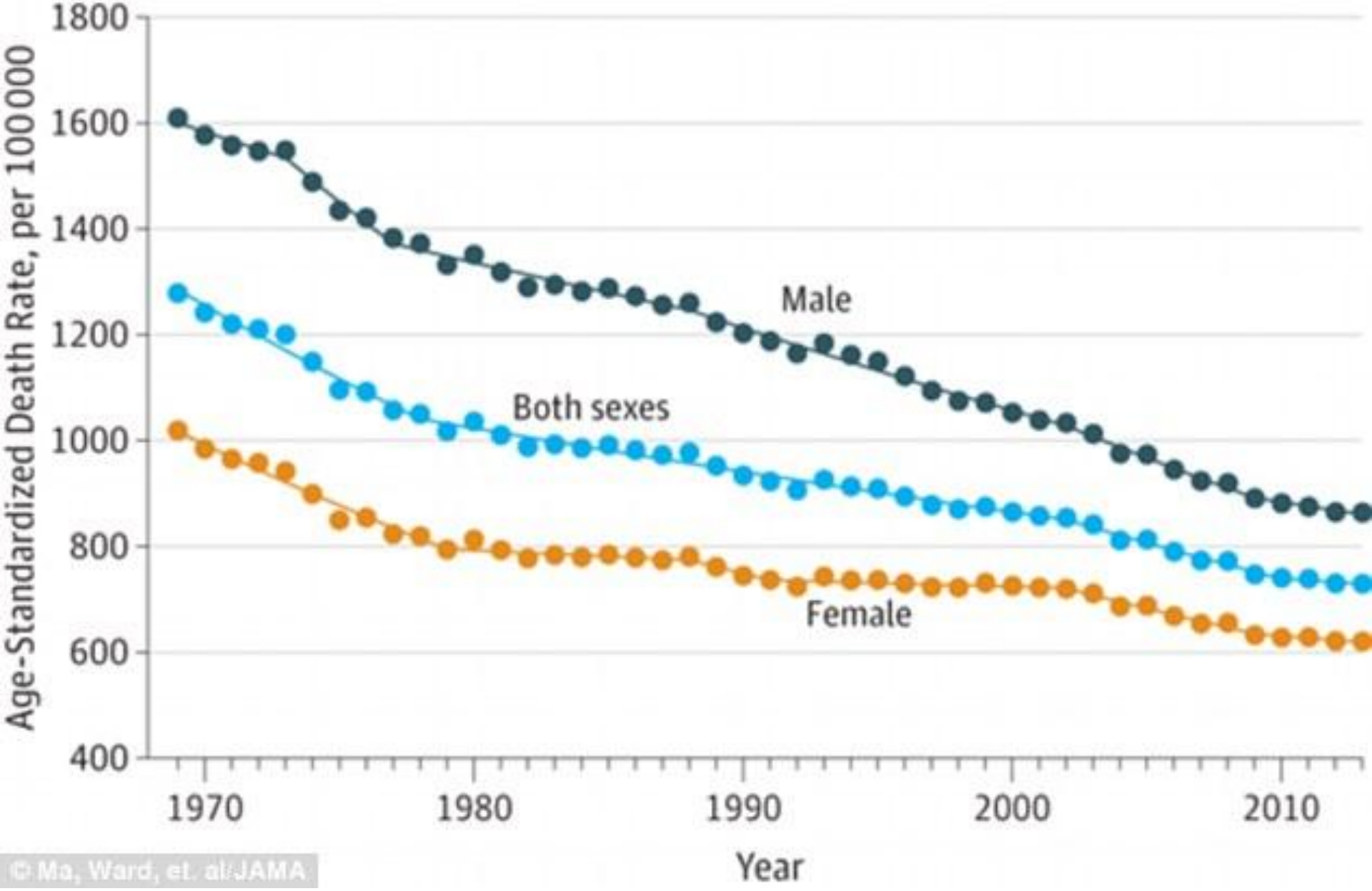
Embolic Stroke

Dr. Hemang Shah

12-12-2019

Misconceptions

- If MRI is negative – it is not a stroke.
- If MRI (DWI) is positive – it is a stroke. (demyelination, abscess)
- If symptoms resolve – it was a TIA. (migraine, seizure, TGA, metabolic, vestibulopathy)
- If symptoms persist – it was a stroke.
- CT showed stroke but than MRI did not show it.
- If you had old stroke – it will show up on MRI.
- Nothing can be done for stroke.



DEFINITIONS

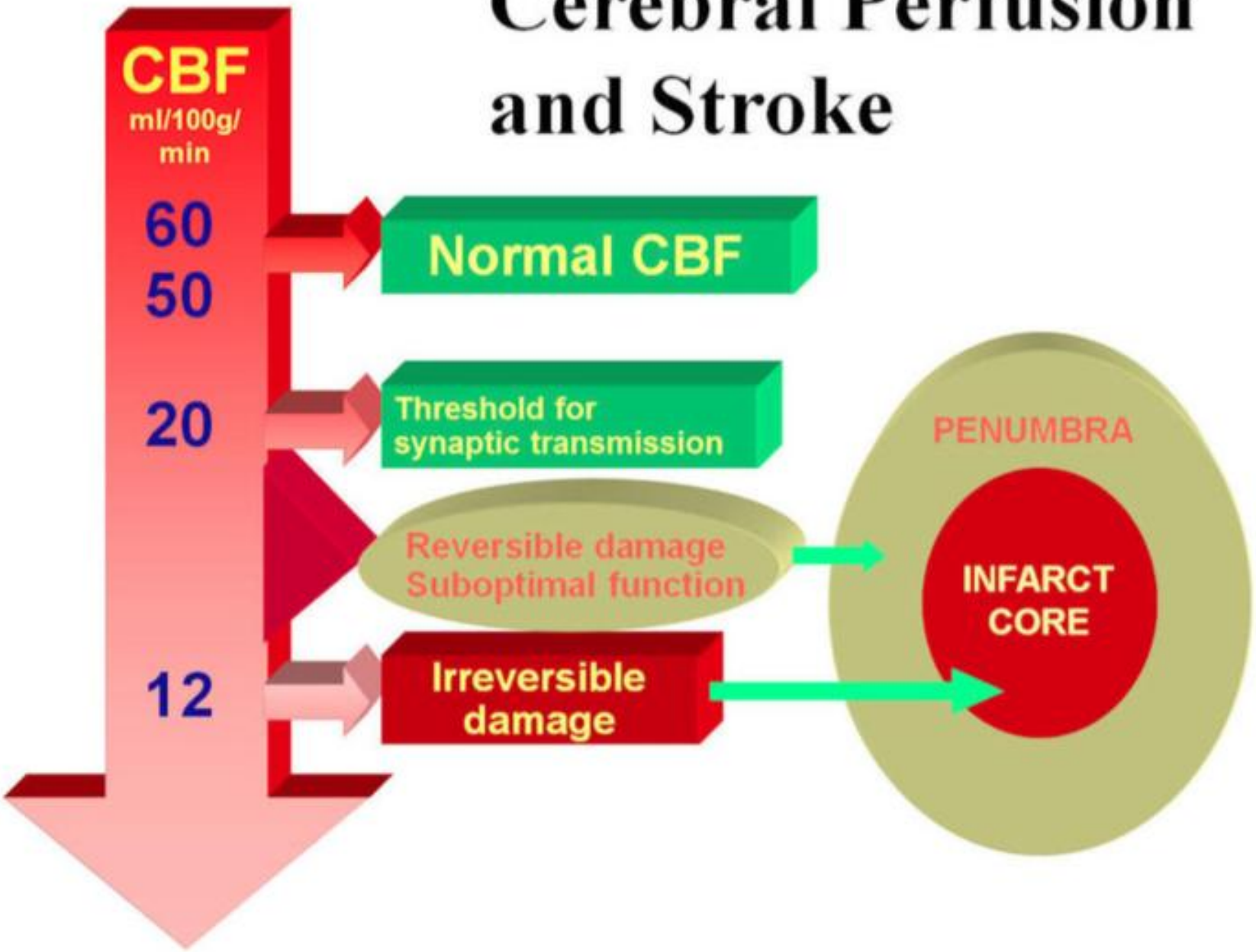
- Ischemic stroke → brain ischemia due to thrombosis, embolism, or systemic hypoperfusion; 80% of all strokes are ischemic, 20% hemorrhagic

- Transient Ischemic Attack[1,2] → sudden onset of a focal neurologic symptom/sign lasting <~~24h brought~~ on by a transient decrease in blood supply
    - WITHOUT acute infarction on imaging, regardless of time (tissue-based definition)

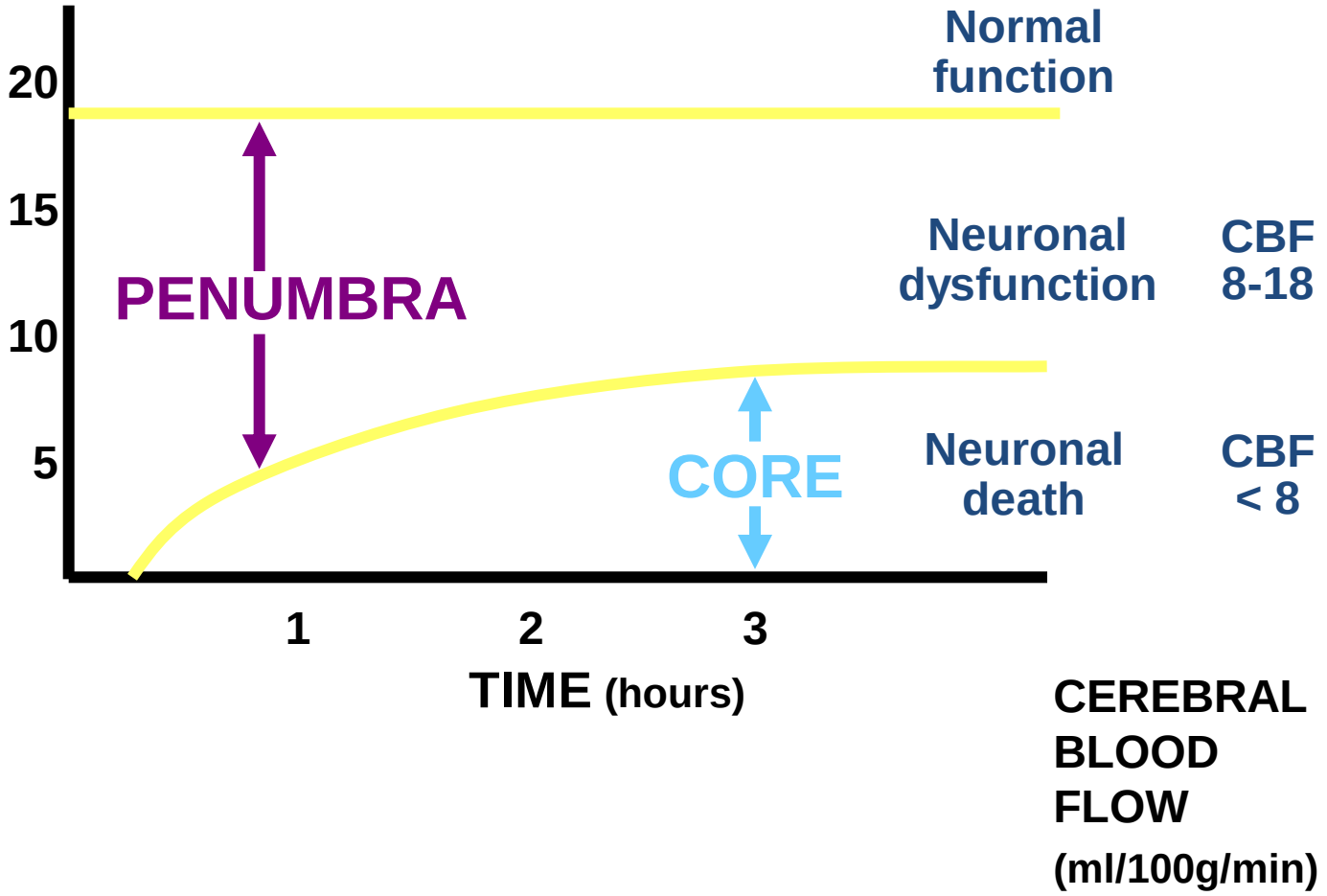
1-Easton JD, Saver JL, Albers GW, et al. Definition and evaluation of transient ischemic attack: a scientific statement for healthcare professionals from the American Heart Association/American Stroke Association Stroke Council; Council on Cardiovascular Surgery and Anesthesia; Council on Cardiovascular Radiology and Intervention; Council on Cardiovascular Nursing; and the Interdisciplinary Council on Peripheral Vascular Disease. The American Academy of Neurology affirms the value of this statement as an educational tool for neurologists. Stroke 2009; 40:2276.

2-Kernan WN, Ovbiagele B, Black HR, et al. Guidelines for the prevention of stroke in patients with stroke and transient ischemic attack: a guideline for healthcare professionals from the American Heart Association/American Stroke Association. Stroke 2014; 45:2160.

Cerebral Perfusion and Stroke



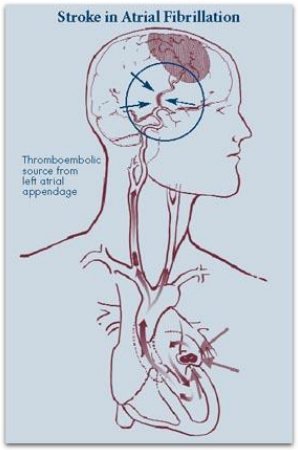
Save the Penumbra!!



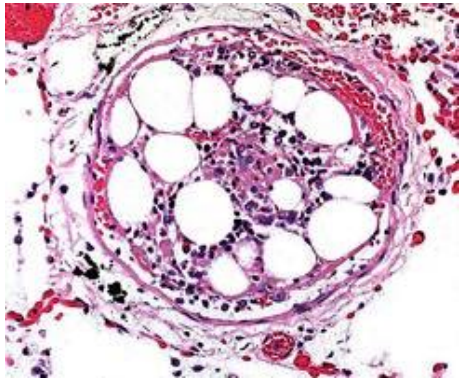
www.acponline.org/about_acp/chapters/ok/gordon.ppt

Embolic stroke

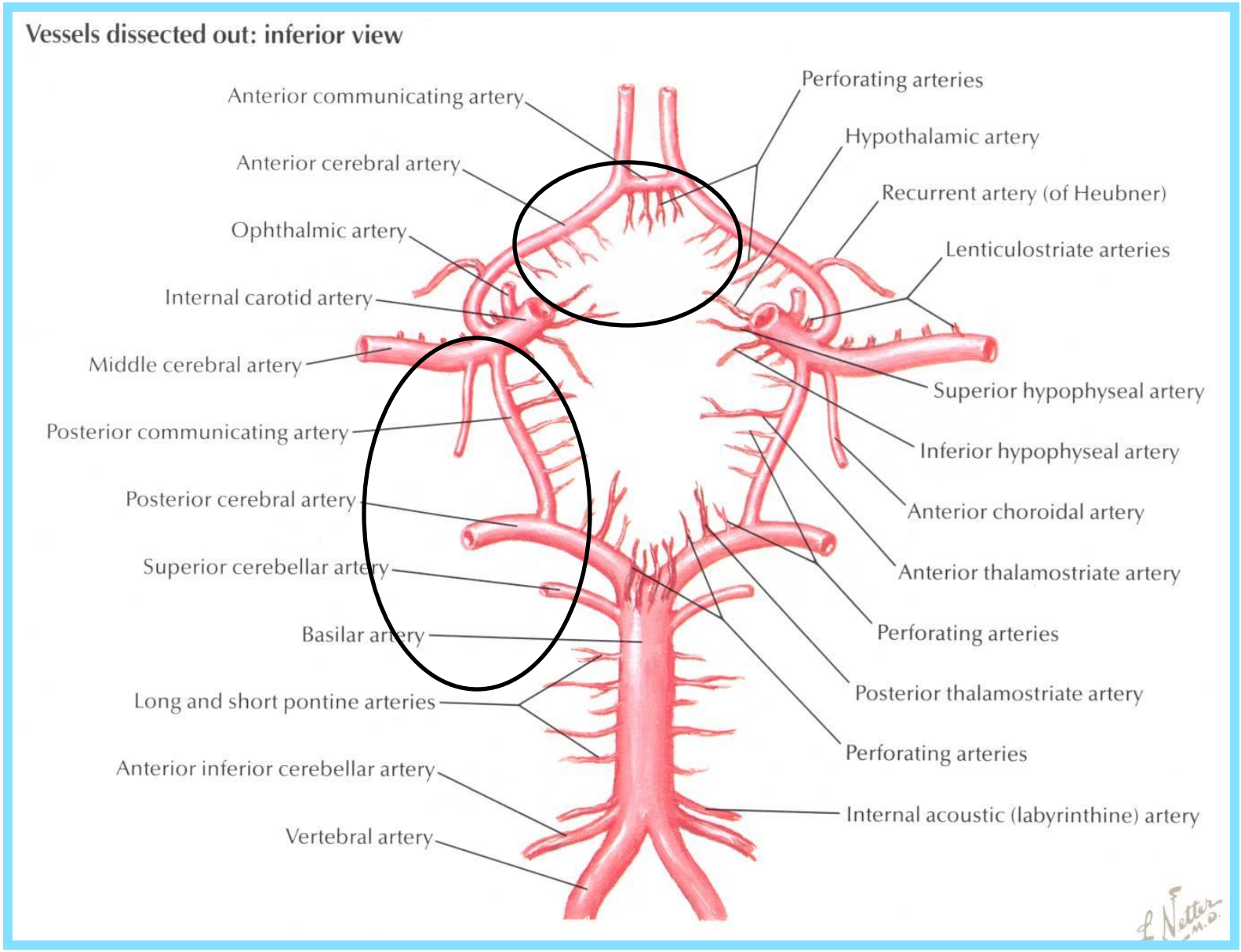
- blockage of an artery by an embolus



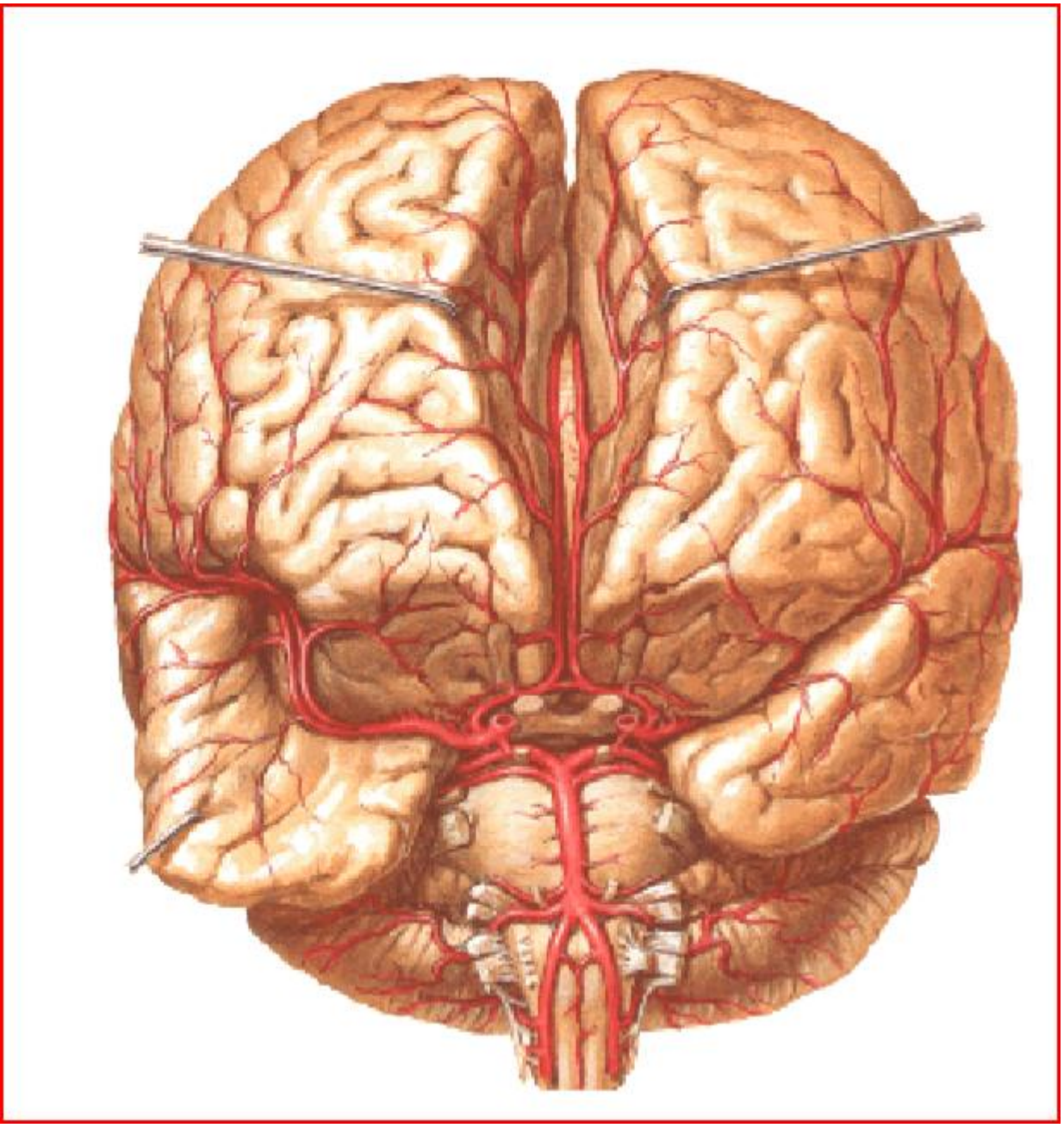
An embolus is...



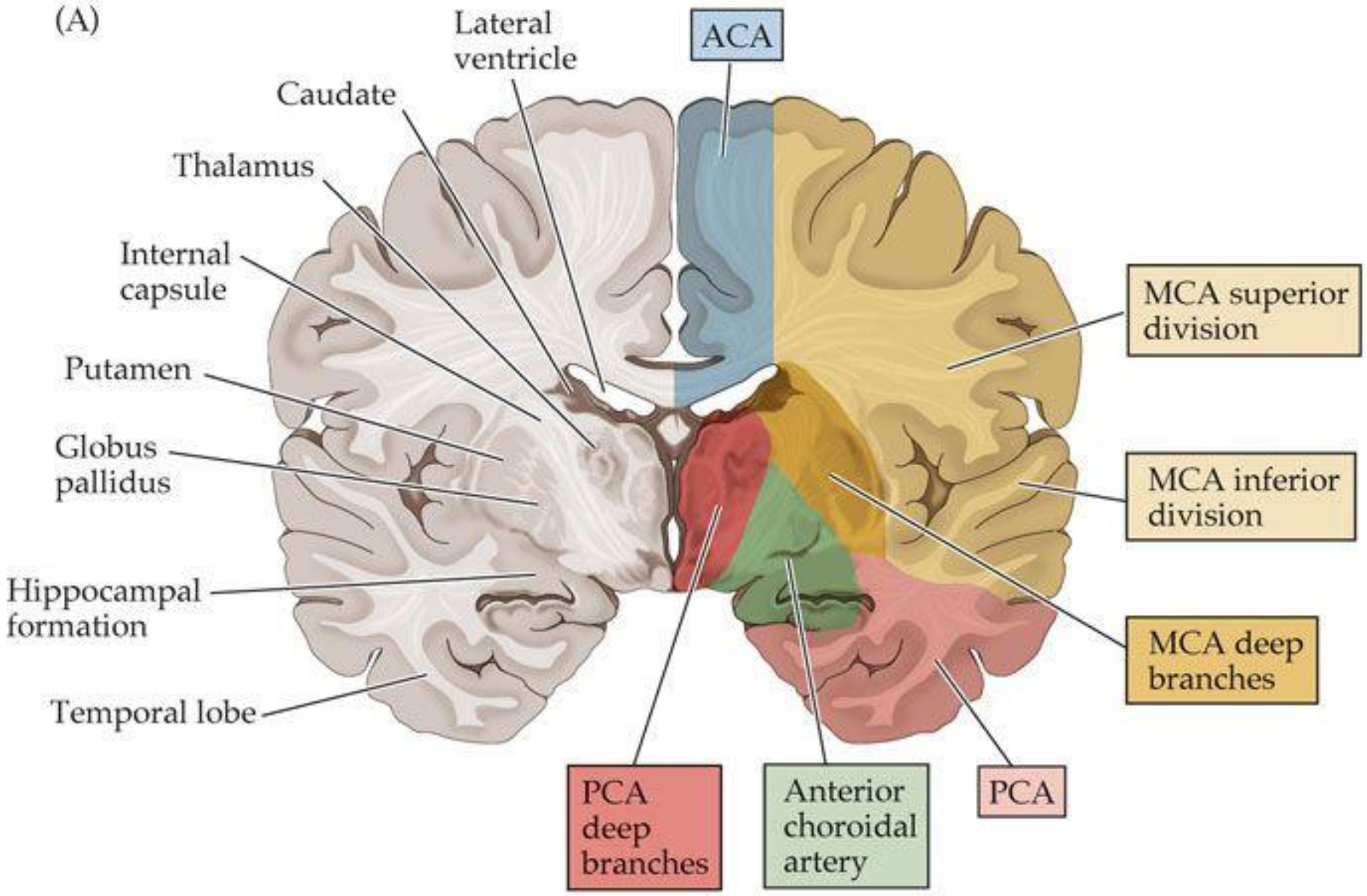
- thrombus
- fat
- air
- cancer cells
- clumps of bacteria
- amniotic fluid

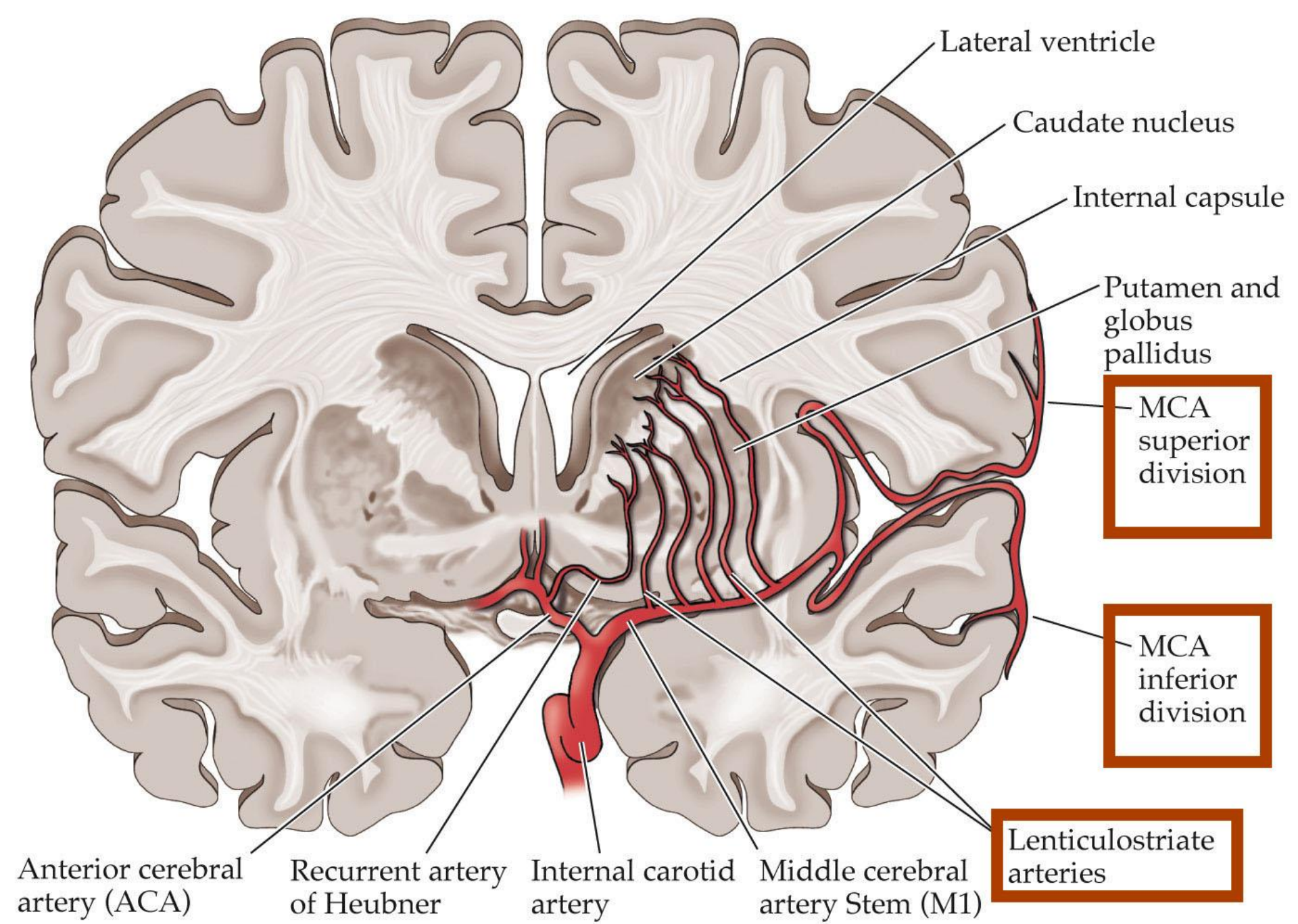


- Bil ACA infract with unilateral stenosis
- PCA infract from ICA stenosis (persistent fetal origin of PCA)
- Top of the basilar (thalamus and occipital lobe infracts)

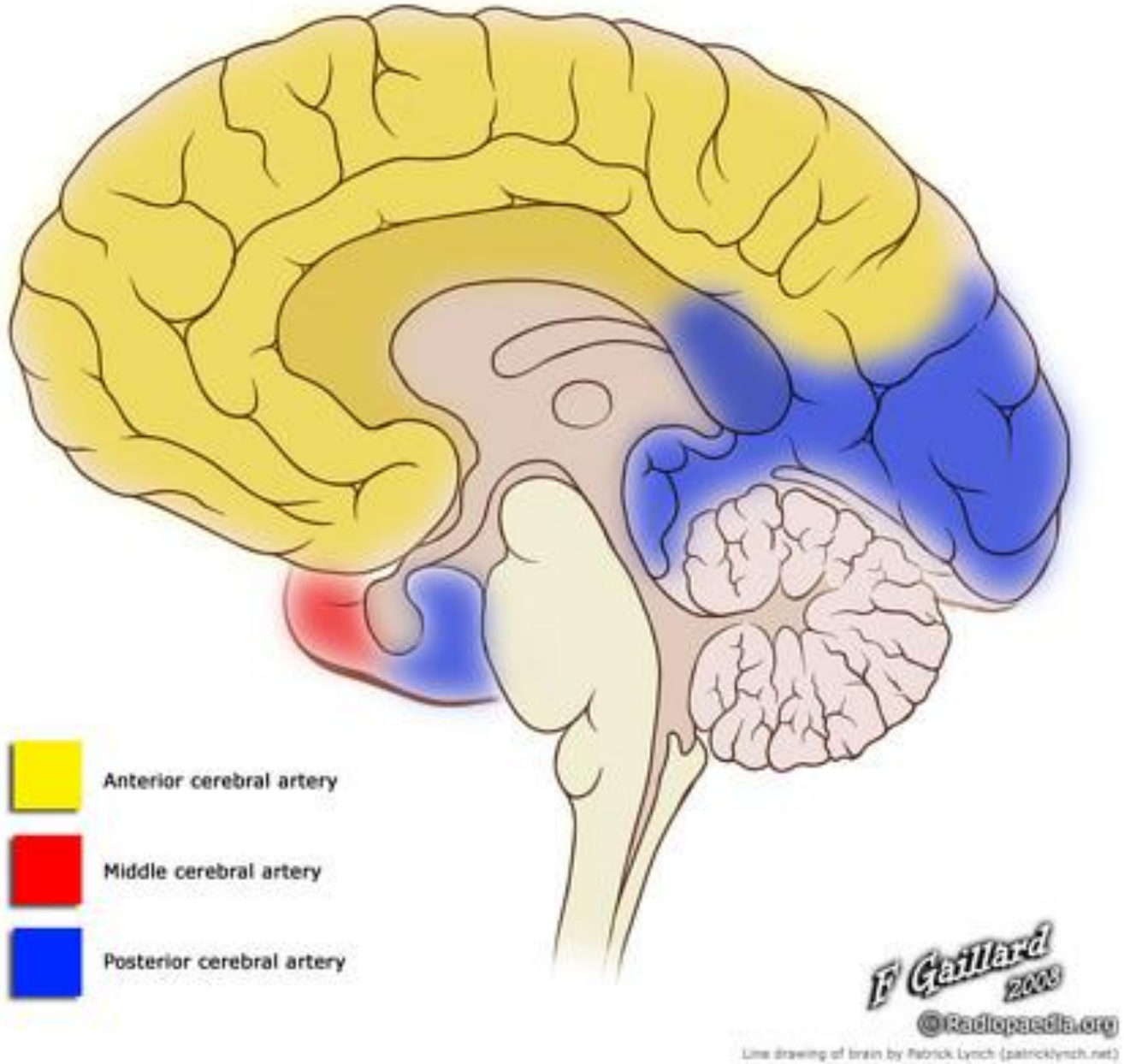


- The mean **ICA diameter** measure ment for the total population was 4.62 +/- 0.68 mm.
- MCA mean diameter was 3.49 mm
- Average diameter of ACA at origin was 2.61 +/- 0.34 mm
- Average diameter of cortical branches diameter ranged from 0.79 +/- 0.27 mm to 1.84 +/- 0.3 mm

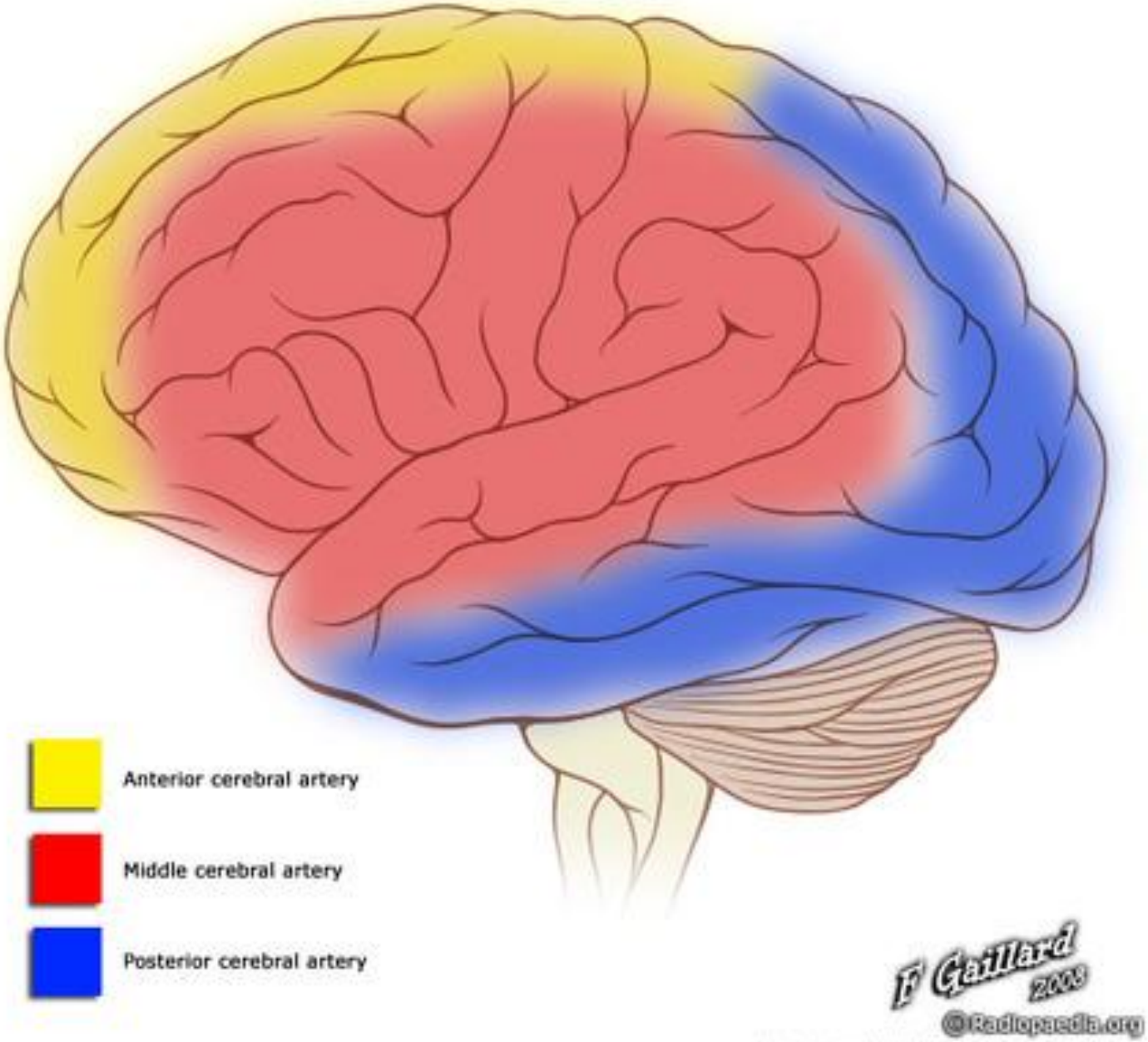




Cortical vascular territories



Cortical vascular territories



Clinically Confirmed Stroke With Negative Diffusion-Weighted Imaging Magnetic Resonance Imaging

Longitudinal Study of Clinical Outcomes, Stroke Recurrence, and Systematic Review

Stephen D.J. Makin, Fergus N. Doubal, Martin S. Dennis, and Joanna M. Wardlaw

Originally published 29 Sep 2015 | https://doi.org/10.1161/STROKEAHA.115.010665 | Stroke. 2015;46:3142–3148

Other version(s) of this article

Abstract

Background and Purpose—

We sought to establish whether the presence (versus absence) of a lesion on magnetic resonance imaging (MRI) with diffusion weighting (DWI-MRI) at presentation with acute stroke is associated with worse clinical outcomes at 1 year.

Methods—

We recruited consecutive patients with a nondisabling ischemic stroke and performed DWI-MRI. Patients were followed up at 1 year to establish stroke recurrence (clinical or on MRI), cognitive impairment (Addenbrooke Cognitive Assessment Revised,<88) and modified Rankin Scale.

Results—

A median of 4 days post stroke, one third (76/264; 29%) of patients did not have a DWI lesion (95% confidence interval, 23%–35%). There was no statistically significant difference between those with and without a DWI lesion with respect to age or vascular risk factors. Patients without a lesion were more likely to be women or have previous stroke. At 1 year, 11 of 76 (14%) patients with a DWI-negative index stroke had a clinical diagnosis of recurrent stroke or transient ischemic attack, 33% had cognitive impairment (Addenbrooke Cognitive Assessment Revised <88), and 40% still had modified Rankin Scale >1, no different from DWI-positive patients; DWI-positive patients were more likely to have a new lesion on MRI (14%), symptomatic or asymptomatic, than DWI-negative patients (2%; *P*=0.02). Our data were consistent with 6 other studies (total n=976), pooled proportion of DWI-negative patients was 21% (95% confidence interval, 12%–32%).

Conclusions—

Nearly one third of patients with nondisabling stroke do not have a relevant lesion on acute DWI-MRI. Patients with negative DWI-MRI had no better prognosis than patients with a lesion. DWI-negative stroke patients should receive secondary prevention.

November 2015
Vol 46, Issue 11

Article Information

Metrics

Blogged by **1**
Tweeted by **23**
On **3** Facebook pages
68 readers on Mendeley

See more details

Sources of Funding

The study was funded by the Wellcome Trust ref. 088134/Z/09/A.

Disclosures

Drs Wardlaw and Dennis received funding from The Wellcome Trust to perform the study (funding for scanning, image analysis, SM salary support).

ETIOLOGY

- TOAST Classification[1]:
  - Large artery atherosclerosis
  - Cardioembolism
  - Small vessel occlusion
  - Stroke of other determined etiology
  - Stroke of undetermined etiology ("cryptogenic") – 30%

1- Adams HP Jr, Bendixen BH, Kappelle LJ, et al. Classification of subtype of acute ischemic stroke. Definitions for use in a multicenter clinical trial. TOAST. Trial of Org 10172 in Acute Stroke Treatment. Stroke 1993; 24:35.

Historical Work Up

- CT head in ER (no bleed)
- MRI brain
- Extracranial Doppler (carotid and vertebral)
- TTE
- In patient Telemetry monitoring (?)
- Labs – lipid panel, A1c, metabolic causes

ADMISSION WORKUP/TESTING

- IMAGING
  - MRI Brain without contrast + MRA head without contrast + MRA neck **WITH** and without contrast
    - If vessel imaging cannot be done in timely fashion with MR, CTA head and neck with and without contrast should be performed within first 12-24h of admission if not done in ED
  - If MRI cannot be done for whatever reason, repeating CTH ~24-28 hours is reasonable

ADMISSION WORKUP/TESTING

- CARDIAC EVALUATION
  - EKG, telemetry, TTE
  - When TEE?

    ≤ 45yo without known CV disease, AF with ?LAA thrombus, mechanical heart valvles, suspected aortic pathology, “cryptogenic stroke”, high pretest probability of cardiac embolic source

ADMISSION WORKUP/TESTING

- LAB TESTING
  - CBC, PT, aPTT, BMP
  - A1c, lipid panel (mostly for LDL)
  - Hypercoag panel when suspected or with cryptogenic stroke/young patients

New things since 2016

- PFO a paradigm shift (before 2016, 3 trials with no benefits and complications – 4 newer trials showing benefits)
- Prolonged rhythm monitoring helps detect more paroxysmal afib. (how long to monitor and is it really clinically relevant?)
- Empiric treatment of cryptogenic stroke (ESUS – Embolic Stroke of Undermined Source - 2014)

Lancet Neurol. 2014 Apr;13(4):429-38. doi: 10.1016/S1474-4422(13)70310-7.

Embolic strokes of undetermined source: the case for a new clinical construct.

Hart RG[1], Diener HC[2], Coutts SB[3], Easton JD[4], Granger CB[5], O'Donnell MJ[6], Sacco RL[7], Connolly SJ[8]; Cryptogenic Stroke/ESUS International Working Group.

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Abstract

Cryptogenic (of unknown cause) ischaemic strokes are now thought to comprise about 25% of all ischaemic strokes. Advances in imaging techniques and improved understanding of stroke pathophysiology have prompted a reassessment of cryptogenic stroke. There is persuasive evidence that most cryptogenic strokes are thromboembolic. The thrombus is thought to originate from any of several well established potential embolic sources, including minor-risk or covert cardiac sources, veins via paradoxical embolism, and non-occlusive atherosclerotic plaques in the aortic arch, cervical, or cerebral arteries. Accordingly, we propose that embolic strokes of undetermined source are a therapeutically relevant entity, which are defined as a non-lacunar brain infarct without proximal arterial stenosis or cardioembolic sources, with a clear indication for anticoagulation. Because emboli consist mainly of thrombus, anticoagulants are likely to reduce recurrent brain ischaemia more effectively than are antiplatelet drugs. Randomised trials testing direct-acting oral anticoagulants for secondary prevention of embolic strokes of undetermined source are warranted.

- Clot morphology of ESUS looks exactly same as clot morphology in cardio-embolic stroke

October 2017

Incidence of Previously Undiagnosed Atrial Fibrillation Using Insertable Cardiac Monitors in a High-Risk Population

CHA2DS2-VASc Score 3 or more

The REVEAL AF Study

James A. Reiffel, MD[1]; Atul Verma, MD[2]; Peter R. Kowey, MD[3]; et al

» Author Affiliations | Article Information

JAMA Cardiol. 2017;2(10):1120-1127. doi:10.1001/jamacardio.2017.3180

Editorial Comment

- Longer you monitor – more patients you find – is it relevant to that patient?
- 2 days holter followed by 30 days loop monitoring
- A.fib just a biomarker for atrial pathology
-20 to 40% of ESUS has paroxysmal afib
- why wait – just anticoagulate

Key Points

Question Will insertable cardiac monitors identify a high incidence of previously undiagnosed atrial fibrillation (AF) in patients at high risk for AF and stroke?

Findings In this study of 446 patients, the rate of AF detection was 29.3% and 40.0% at 18 and 30 months, respectively, and often resulted in prescription of oral anticoagulation.

The NEW ENGLAND JOURNAL of MEDICINE

BACK TO ARTICLE

ORIGINAL ARTICLE FREE PREVIEW

Rivaroxaban for Stroke Prevention after Embolic Stroke of Undetermined Source

Robert G. Hart, M.D., Mukul Sharma, M.D., Hardi Mundl, M.D., Scott E. Kasner, M.D., Shrikant I. Bangdiwala, Ph.D., Scott D. Berkowitz, M.D., Balakumar Swaminathan, M.Sc., Pablo Lavados, M.D., Yongjun Wang, M.D., Yilong Wang, M.D., Antonio Davalos, M.D., Nikolay Shamalov, M.D., et al., for the NAVIGATE ESUS Investigators*

June 7, 2018
N Engl J Med 2018; 378:2191-2201
DOI: 10.1056/NEJMoa1802686

Abstract

BACKGROUND Embolic strokes of undetermined source represent 20% of ischemic strokes and are associated with a high rate of recurrence. Anticoagulant treatment with rivaroxaban, an oral factor Xa inhibitor, may result in a lower risk of recurrent stroke than aspirin.

METHODS We compared the efficacy and safety of rivaroxaban (at a daily dose of 15 mg) with aspirin (at a daily dose of 100 mg) for the prevention of recurrent stroke in patients with recent ischemic stroke that was presumed to be from cerebral embolism but without arterial stenosis, lacune, or an identified cardioembolic source. The primary efficacy outcome was the first recurrence of ischemic or hemorrhagic stroke or systemic embolism in a time-to-event analysis; the primary safety outcome was the rate of major bleeding.

CONCLUSIONS

Rivaroxaban was not superior to aspirin with regard to the prevention of recurrent stroke after an initial embolic stroke of undetermined source and was associated with a higher risk of bleeding. (Funded by Bayer and Janssen Research and Development; NAVIGATE ESUS ClinicalTrials.gov number, NCT02313909. opens in new tab.)

The NEW ENGLAND JOURNAL of MEDICINE

BACK TO ARTICLE

ORIGINAL ARTICLE FREE PREVIEW

Dabigatran for Prevention of Stroke after Embolic Stroke of Undetermined Source

Hans-Christoph Diener, M.D., Ph.D., Ralph L. Sacco, M.D., J. Donald Easton, M.D., Christopher B. Granger, M.D., Richard A. Bernstein, M.D., Ph.D., Shinichiro Uchiyama, M.D., Jörg Kreuzer, M.D., Lisa Cronin, M.D., Daniel Cotton, M.S., Claudia Grauer, Ph.D., Martina Brueckmann, M.D., Marina Chernyatina, M.D., Ph.D., et al., for the RE-SPECT ESUS Steering Committee and Investigators*

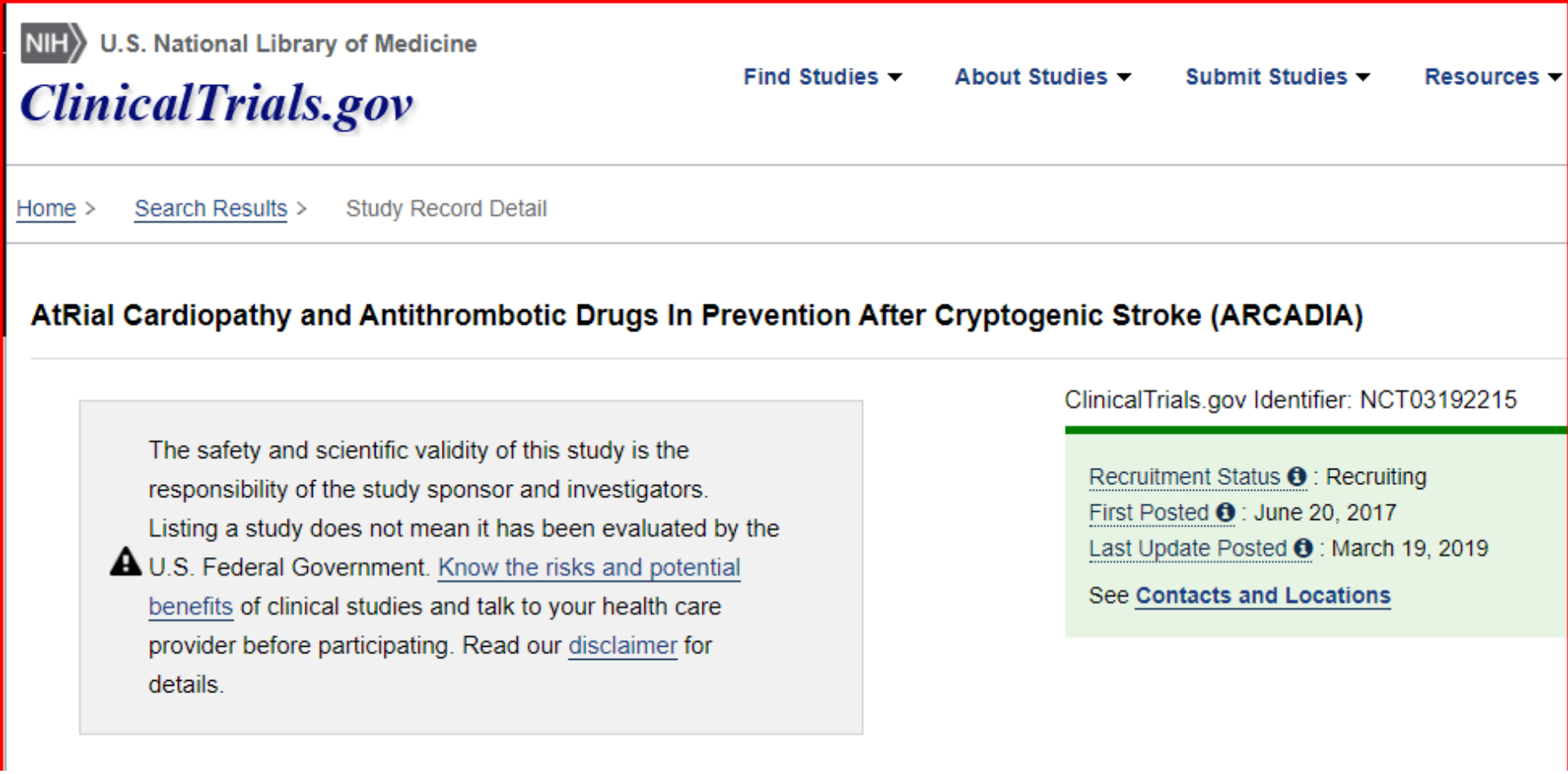
May 16, 2019
N Engl J Med 2019; 380:1906-1917
DOI: 10.1056/NEJMoa1813959

Abstract

BACKGROUND Cryptogenic strokes constitute 20 to 30% of ischemic strokes, and most cryptogenic strokes are considered to be embolic and of undetermined source. An earlier randomized trial showed that rivaroxaban is no more effective than aspirin in preventing recurrent stroke after a presumed embolic stroke from an undetermined source. Whether dabigatran would be effective in preventing recurrent strokes after this type of stroke was unclear.

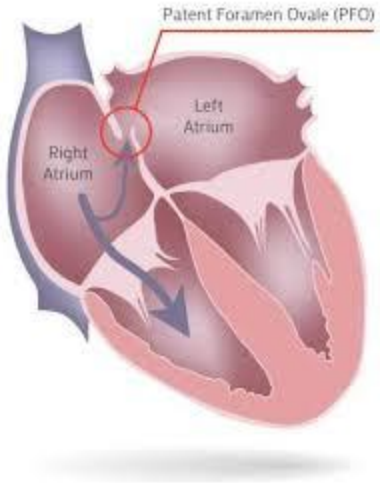
METHODS We conducted a multicenter, randomized, double-blind trial of dabigatran at a dose of 150 mg or 110 mg twice daily as compared with aspirin at a dose of 100 mg once daily in patients who had

- **CONCLUSIONS**
- In patients with a recent history of embolic stroke of undetermined source, dabigatran was not superior to aspirin in preventing recurrent stroke. The incidence of major bleeding was not greater in the dabigatran group than in the aspirin group, but there were more clinically relevant nonmajor bleeding events in the dabigatran group. (Funded by Boehringer Ingelheim; RE-SPECT ESUS ClinicalTrials.gov number, NCT02239120. opens in new tab.)



- Primary: To test the hypothesis that apixaban is superior to aspirin for the prevention of recurrent stroke in patients with cryptogenic ischemic stroke and atrial cardiopathy (enlarged atrium, higher NT-proBNP, etc.
- Secondary: To test the hypothesis that the relative efficacy of apixaban over aspirin increases with the severity of atrial cardiopathy.

PFO



- 25% of worlds population
- PFO more frequent in ESUS patients > cryptogenic stroke
- Just a passage or thrombogenic in itself?
- 3 neg trials.

CLOSURE I

ORIGINAL ARTICLE

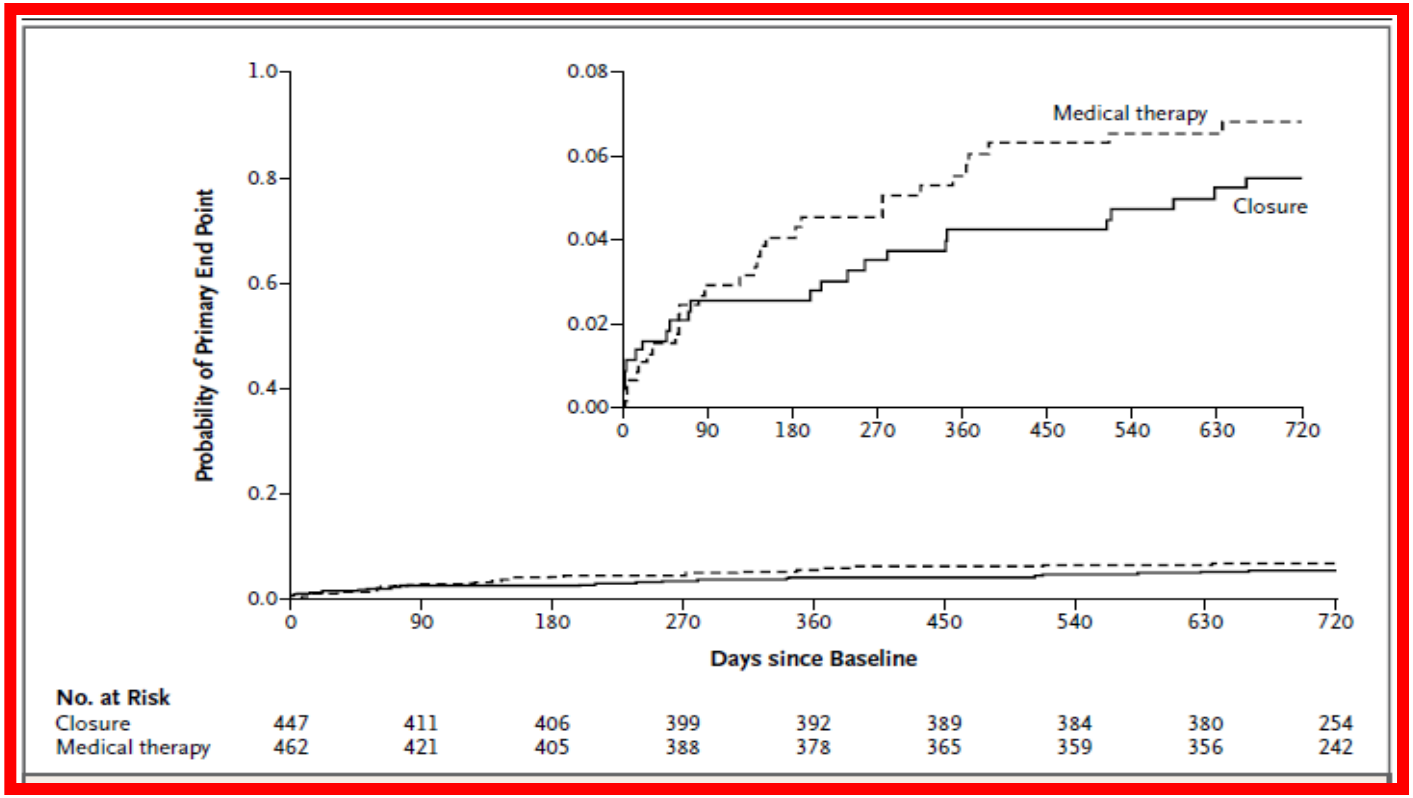
Closure or Medical Therapy for Cryptogenic Stroke with Patent Foramen Ovale

Anthony J. Furlan, M.D., Mark Reisman, M.D., Joseph Massaro, Ph.D., Laura Mauri, M.D., Harold Adams, M.D., Gregory W. Albers, M.D., Robert Felberg, M.D., Howard Herrmann, M.D., Saibal Kar, M.D., Michael Landzberg, M.D., Albert Raizner, M.D., and Lawrence Wechsler, M.D., for the CLOSURE I Investigators*

ABSTRACT

- Multicenter, randomized, open label trial comparing percutaneous PFO device closure to medical therapy
- Cryptogenic stroke or transient ischemic attack (TIA) in patients 18-60 y/o
- Primary Endpoint- Stoke/TIA during 2 year followup, death from any cause during first 30 days, neurologic death to two years

Results



Primary Endpoint- 5.5% in device closure group

6.8% in medical therapy group

P=0.37

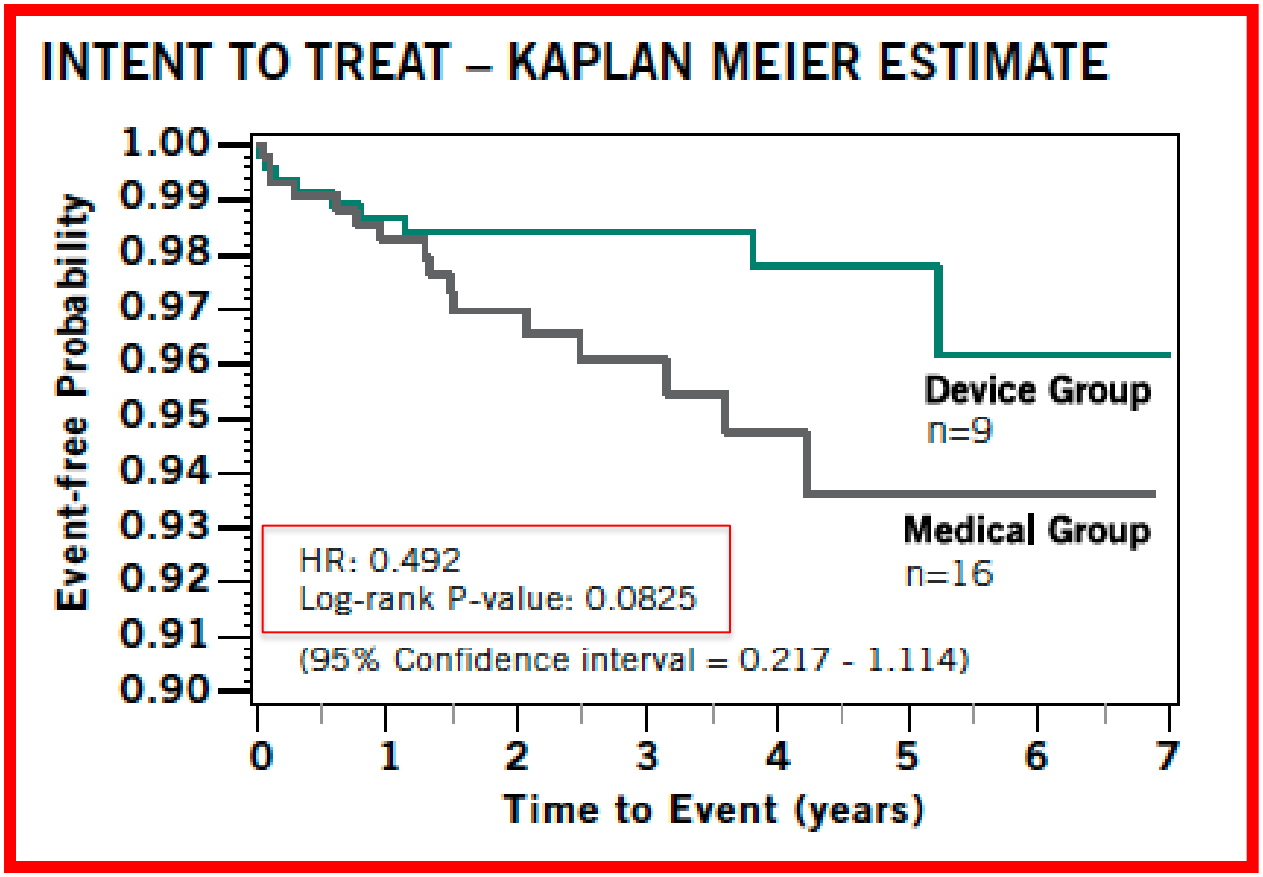
RESPECT
CLINICAL TRIAL

Randomized Evaluation of Recurrent Stroke Comparing PFO Closure to Established Current Standard of Care Treatment

- Multicenter: 69 Sites (62 US, 7 Canada)
  - Prospective, 1:1 Randomized
    - Closure with the AGA AMPLATZER™ PFO Occluder plus medical therapy
    - Medical Treatment Regimens: Aspirin, Warfarin, Clopidogrel, Aspirin + Dipyridomole, Aspirn + Clopidogrel (removed from protocol in 2006)
- 980 patients enrolled with clinical stroke confirmed by CT/MRI imaging age 18-60 within 9 months
- TEE documented PFO

RESPECT
CLINICAL TRIAL

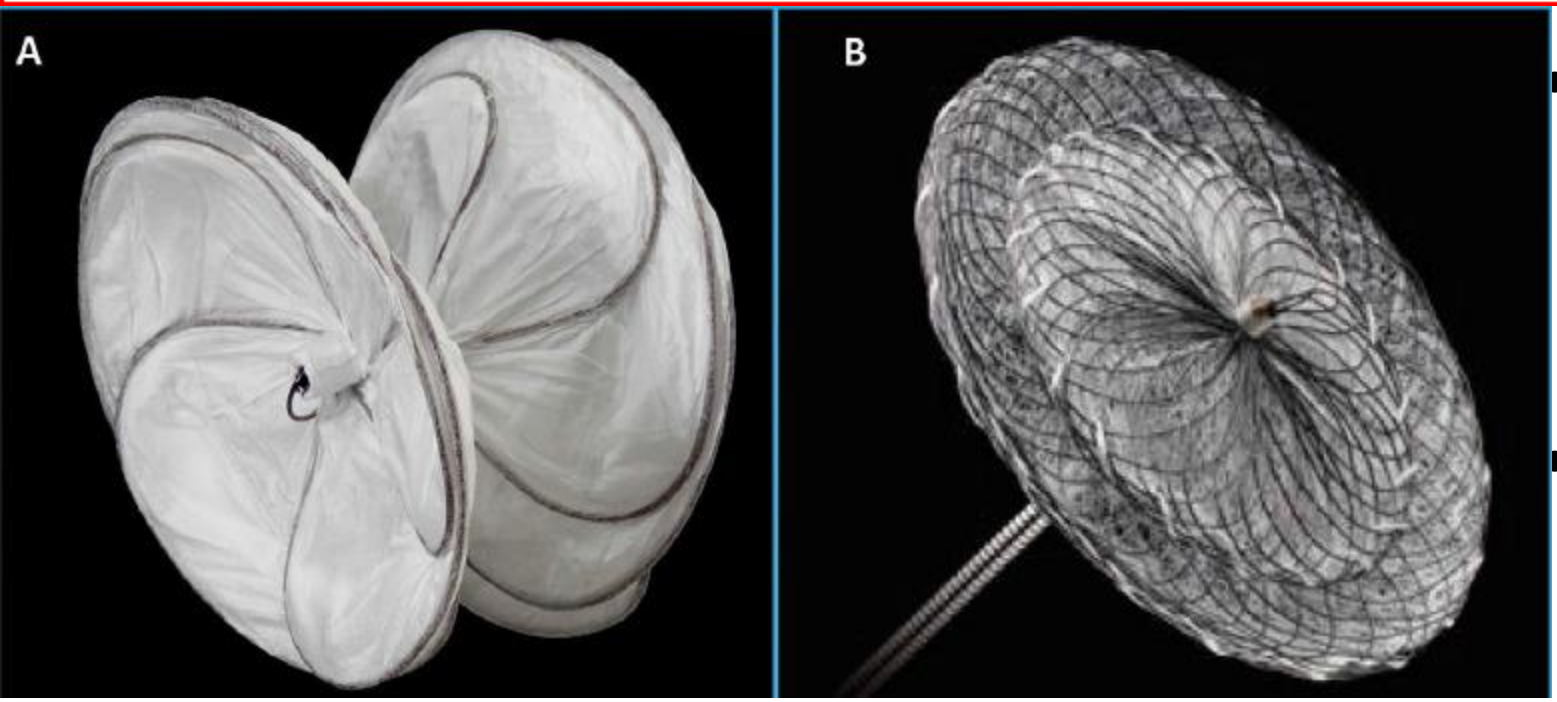
Results



REDUCE

- Multicenter prospective randomized trial
  - 2:1 Randomization
    - Closure with Gore Helex device
    - Standardized medical therapy

GORE REDUCE[15]	Helex Septal Occluder or Cardioform Septal Occluder	664	Co-primary endpoints of clinical stroke and incidence of new brain infarction	Significant reduction in clinical stroke at median follow-up of 3.2 years (HR 0.23; 95% CI [0.09–0.62]; p=0.002). Significant reduction in new brain infarction (relative risk 0.51; 95% CI [0.29–0.91]; p=0.04)	2:1 randomisation to PFO closure
CLOSE[16]	Multiple devices	663	Stroke	Significant reduction in stroke with occlusion compared to antiplatelet therapy only (HR 0.03; 95% CI [0.00–0.26]; p<0.001)	1:1:1 randomisation PFO closure versus antiplatelets versus anticoagulation
DEFENSE PFO[17]	AMPLATZER PFO Occluder	120	Stroke, vascular death or Thrombolysis In Myocardial Infarction-defined major bleeding at 2-year follow-up	Significant reduction in primary endpoint with PFO closure. No events in PFO closure arm versus a 12.9% 2-year event rate in medication-only arm (p=0.013)	



- (A) The Gore Cardioform septal occluder.
- (B) The AMPLATZER PFO Occluder

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SHARE April 18, 2017; 88 (16 Supplement) APRIL 28, 2017

Long-term Risk of Complications after Percutaneous Transcatheter Closure of Patent Foramen Ovale (S51.003)

Alexander Merkler, Gino Gialdini, Shadi Yaghi, Peter Okin, Costantino Iadecola, Babak Navi, Hooman Kamel

First published April 17, 2017,

- Approximately 1 in 6 patients who undergo percutaneous transcatheter closure of PFO after stroke or transient ischemic attack experience a serious complication or death within 5 years.

2019 AHA/ACC/HRS Focused Update of the 2014 AHA/ACC/HRS Guideline for the Management of Patients With Atrial Fibrillation

Developed in Collaboration With the Society of Thoracic Surgeons

Table 1. Applying Class of Recommendation and Level of Evidence to Clinical Strategies, Interventions, Treatments, or Diagnostic Testing in Patient Care*

(Updated August 2015)

CLASS (STRENGTH) OF RECOMMENDATION

CLASS I (STRONG) — **Benefit >>> Risk**

Suggested phrases for writing recommendations:
- Is recommended
- Is indicated/useful/effective/beneficial
- Should be performed/administered/other
- Comparative-Effectiveness Phrases†:
  - Treatment/strategy A is recommended/indicated in preference to treatment B
  - Treatment A should be chosen over treatment B

CLASS IIa (MODERATE) — **Benefit >> Risk**

Suggested phrases for writing recommendations:
- Is reasonable
- Can be useful/effective/beneficial
- Comparative-Effectiveness Phrases†:
  - Treatment/strategy A is probably recommended/indicated in preference to treatment B
  - It is reasonable to choose treatment A over treatment B

CLASS IIb (WEAK) — **Benefit ≥ Risk**

Suggested phrases for writing recommendations:
- May/might be reasonable
- May/might be considered
- Usefulness/effectiveness is unknown/unclear/uncertain or not well established

CLASS III: No Benefit (MODERATE) — **Benefit = Risk**

(Generally, LOE A or B use only)

Suggested phrases for writing recommendations:
- Is not recommended
- Is not indicated/useful/effective/beneficial
- Should not be performed/administered/other

CLASS III: Harm (STRONG) — **Risk > Benefit**

Suggested phrases for writing recommendations:
- Potentially harmful
- Causes harm
- Associated with excess morbidity/mortality
- Should not be performed/administered/other

LEVEL (QUALITY) OF EVIDENCE‡

LEVEL A
- High-quality evidence‡ from more than 1 RCT
- Meta-analyses of high-quality RCTs
- One or more RCTs corroborated by high-quality registry studies

LEVEL B-R (Randomized)
- Moderate-quality evidence‡ from 1 or more RCTs
- Meta-analyses of moderate-quality RCTs

LEVEL B-NR (Nonrandomized)
- Moderate-quality evidence‡ from 1 or more well-designed, well-executed nonrandomized studies, observational studies, or registry studies
- Meta-analyses of such studies

LEVEL C-LD (Limited Data)
- Randomized or nonrandomized observational or registry studies with limitations of design or execution
- Meta-analyses of such studies
- Physiological or mechanistic studies in human subjects

LEVEL C-EO (Expert Opinion)

Consensus of expert opinion based on clinical experience

COR and LOE are determined independently (any COR may be paired with any LOE).

A recommendation with LOE C does not imply that the recommendation is weak. Many important clinical questions addressed in guidelines do not lend themselves to clinical trials. Although RCTs are unavailable, there may be a very clear clinical consensus that a particular test or therapy is useful or effective.

* The outcome or result of the intervention should be specified (an improved clinical outcome or increased diagnostic accuracy or incremental prognostic information).

† For comparative-effectiveness recommendations (COR I and IIa; LOE A and B only), studies that support the use of comparator verbs should involve direct comparisons of the treatments or strategies being evaluated.

‡ The method of assessing quality is evolving, including the application of standardized, widely used, and preferably validated evidence grading tools; and for systematic reviews, the incorporation of an Evidence Review Committee.

COR indicates Class of Recommendation; EO, expert opinion; LD, limited data; LOE, Level of Evidence; NR, nonrandomized; R, randomized; and RCT, randomized controlled trial.

Anticoagulation Regimen – Balancing Risks and Benefits

Recommendations for Selecting an Anticoagulant Regimen—Balancing Risks and Benefits		
COR	**LOE**	**Recommendations**
I	A B B B B-R	**For patients with AF and an elevated CHA_2DS_2-VASc score of 2 or greater in men or 3 or greater in women, oral anticoagulants are recommended.** **Options include:** • **Warfarin (LOE: A)** • **Dabigatran (LOE: B)** • **Rivaroxaban (LOE: B)** • **Apixaban (LOE: B) or** • **Edoxaban (LOE: B-R)** **MODIFIED**: This recommendation has been updated in response to the approval of edoxaban, a new factor Xa inhibitor. More precision in the use of CHA_2DS_2-VASc scores is specified in subsequent recommendations. The LOEs for warfarin, dabigatran, rivaroxaban, and apixaban have not been updated for greater granularity as per the new LOE system. (Section 4.1. in the 2014 AF Guideline) The original text can be found in Section 4.1 of the 2014 AF guideline. Additional information about the comparative effectiveness and bleeding risk of NOACs can be found in Section 4.2.2.2.

Anticoagulation Regimen – Balancing Risks and Benefits

Recommendations for Selecting an Anticoagulant Regimen—Balancing Risks and Benefits		
COR	**LOE**	**Recommendations**
I	**A**	**NOACs (dabigatran, rivaroxaban, apixaban, and edoxaban) are recommended over warfarin in NOAC-eligible patients with AF (except with moderate-to-severe mitral stenosis or a mechanical heart valve).** **NEW**: Exclusion criteria are now defined as moderate-to-severe mitral stenosis or a mechanical heart valve. When the NOAC trials are considered as a group, the direct thrombin inhibitor and factor Xa inhibitors were at least noninferior and, in some trials, superior to warfarin for preventing stroke and systemic embolism and were associated with lower risks of serious bleeding.

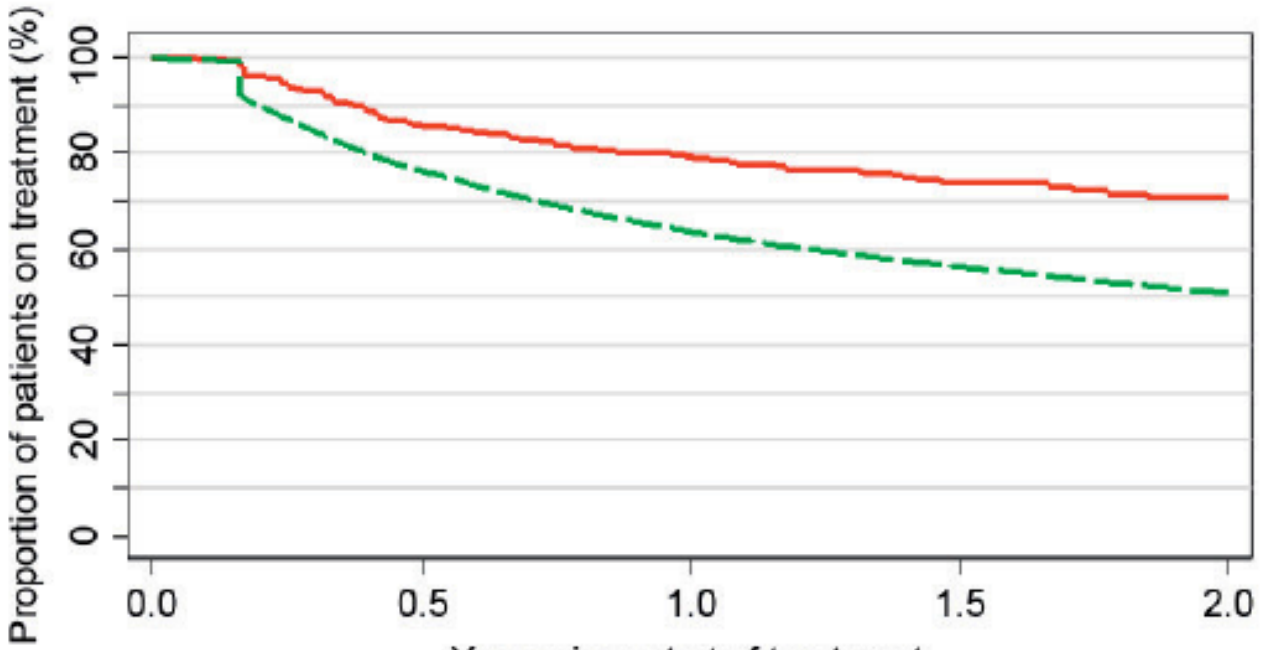
Percutaneous Approaches to Occlude the LAA

Recommendation for Percutaneous Approaches to Occlude the LAA		
COR	**LOE**	**Recommendation**
IIb	**B-NR**	**Percutaneous LAA occlusion may be considered in patients with AF at increased risk of stroke who have contraindications to long-term anticoagulation.** **NEW**: Clinical trial data and FDA approval of the Watchman device necessitated this recommendation.

Despite NOAC Adoption and Ability to Switch NOACs, Adherence to Anticoagulation Remains a Challenge

WATCHMAN™
LEFT ATRIAL APPENDAGE
CLOSURE DEVICE

~30% of NOAC patients stop taking any drug at 2 years



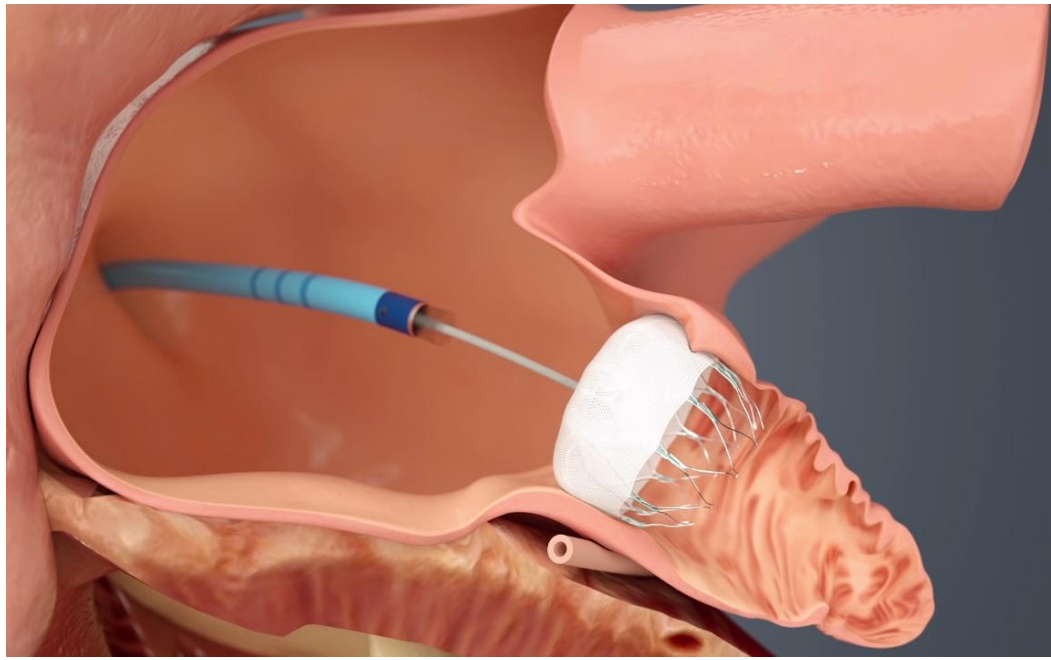
NOAC	914	651	342	139	41
VKA	12307	8453	5762	3915	2506

Source: Martinez C, et al. Therapy Persistence in Newly Diagnosed Non-Valvular Atrial Fibrillation Treated with Warfarin or NOAC. A Cohort Study. Thromb Haemost. 2015 Dec 22;115(1):31-9. doi: 10.1160/TH15-04-0350.

WATCHMAN™ Left Atrial Appendage Closure (LAAC) Device Procedure

WATCHMAN™
LEFT ATRIAL APPENDAGE
CLOSURE DEVICE

- One-time implant that does not need to be replaced
- Performed in a cardiac cath lab/EP suite, does not need hybrid OR
- Performed by a Heart Team
  - IC/EP or IC&EP, TEE, General Anesthesia, Surgical Back- up, WATCHMAN Clinical Specialist
- Transfemoral Access: Catheter advanced to the LAA via the femoral vein
  (Does not require open heart surgery)
- General anesthesia*
- 1 hour procedure*
- 1-2 day hospital stay*



* Typical to patient treatment in U.S. clinical trials

- Anticoagulants
  - NO indication for urgent AC in acute stroke -- **NO heparin gtts unless pt with partial occlusive disease/subocclusive thrombus and fluctuating symptoms
  - In patients with AF and acute stroke, NOACs safer than warfarin and better secondary stroke prevention if no contraindication to using, these are preferred (**apixaban > rivaroxaban > dabigatran)
  - Timing of initiation depends on size, presence of hemorrhagic transformation or not, severity of deficits (**so small strokes <3ml, no HT can start 2-4d); to be on safe side, most strokes without hemorrhage can be started on NOAC at 14d

Final thoughts

- Consider more prolonged cardiac monitoring (not everyone needs Linq device, but almost)
- TEE more often for cryptogenic stroke / ESUS
- PFO closure or not
- Watchman device or not