

XLIX Reunión anual

**SOCIEDAD ESPAÑOLA
DE NEURORRADIOLOGÍA**

TOLEDO
21 - 23 octubre 2021
Palacio de Congresos



INFORME ESTRUCTURADO EN EL CÓDIGO ICTUS

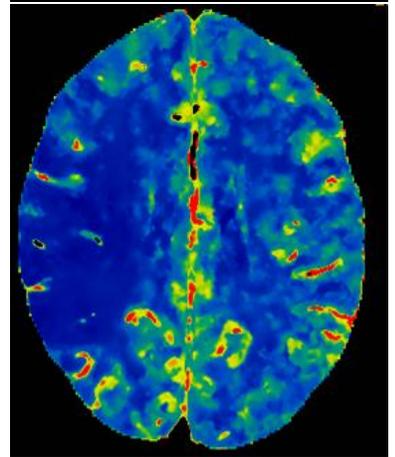
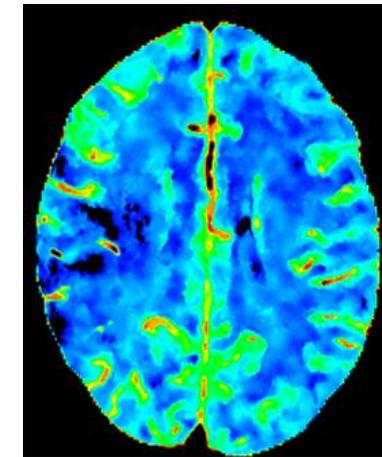
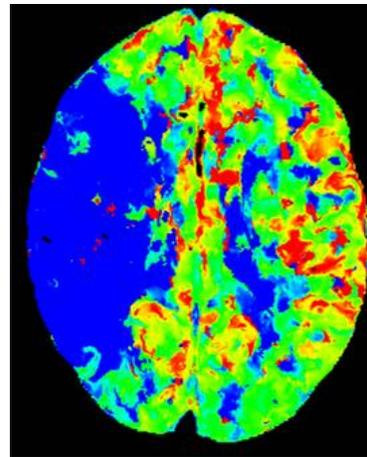
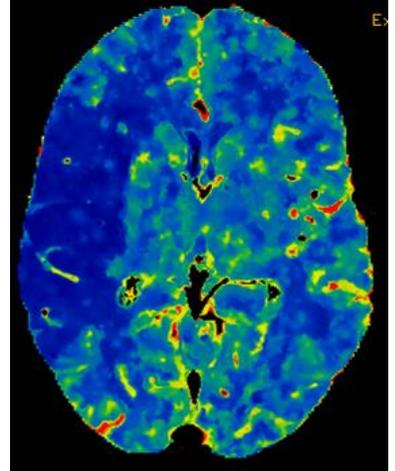
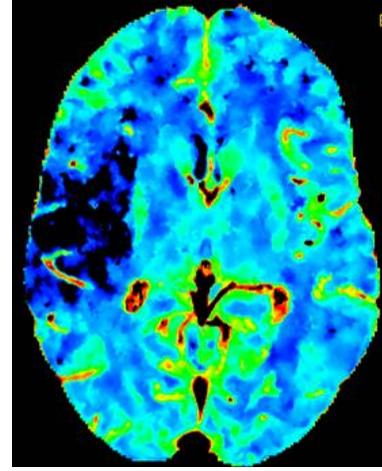
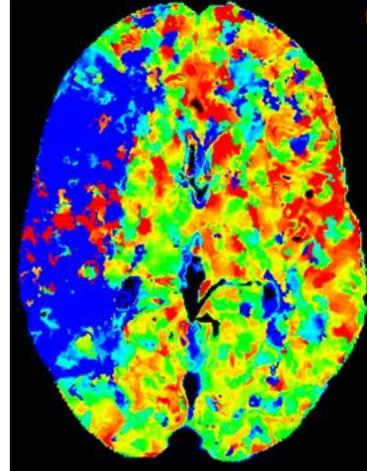
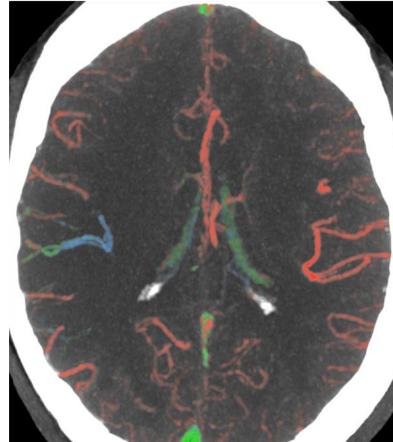
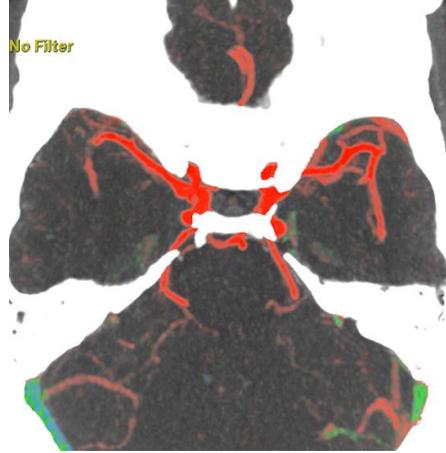
Isabel Herrera Herrera

H.G.U. Gregorio Marañón. Madrid





NIHSS 11 → 18



Tmax

CBV

CBF

OBJETIVO

PROPONER UN INFORME ESTRUCTURADO EN EL CÓDIGO ICTUS ÚTIL PARA TODOS

**SENCILLO
Y RÁPIDO**

- Incidencia del ictus 100-350 casos / 100.000 habitantes por año.
- Tiempo es cerebro.
- En un ICTUS no tratado la mortalidad es del 19% y el riesgo de discapacidad permanente y grave del 55%.

**BASE
CIENTÍFICA**

AHA/ASA Guideline

Guidelines for the Early Management of Patients With Acute Ischemic Stroke: 2019 Update to the 2018 Guidelines for the Early Management of Acute Ischemic Stroke
A Guideline for Healthcare Professionals From the American Heart Association/American Stroke Association

**ADAPTADO
DIVERSIDAD**



OBJETIVO

PROPONER UN INFORME ESTRUCTURADO EN EL CÓDIGO ICTUS ÚTIL PARA TODOS

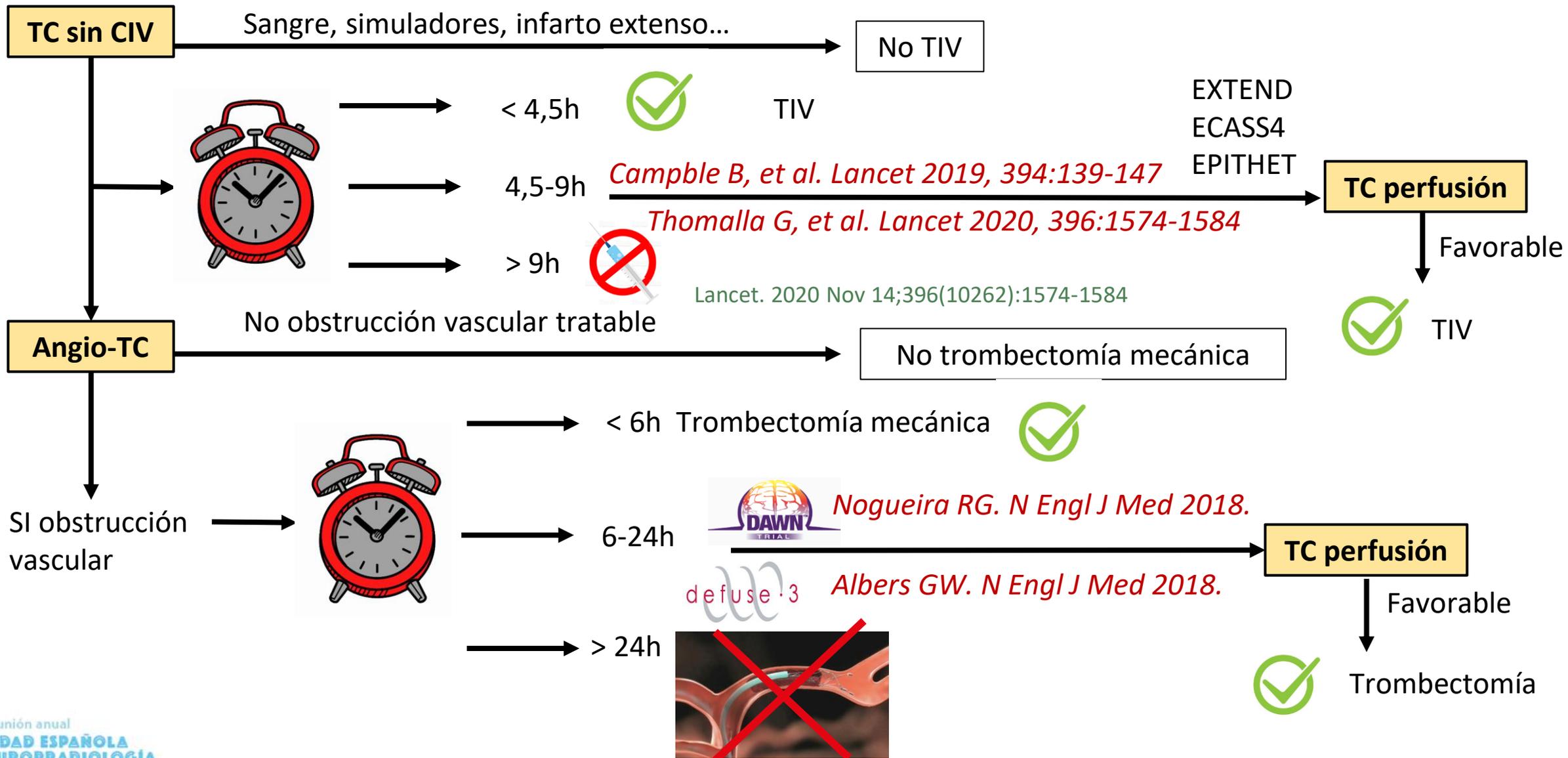
¿Qué técnica de imagen realizamos?

| | RM | TC |
|-----------------------|--|---|
| DISPONIBILIDAD | Menor | Mayor 24h/7d |
| RAPIDEZ | Menor | Mayor |
| INFORMACIÓN | <ul style="list-style-type: none">- DWI proporciona una medida más exacta del infarto establecido | <ul style="list-style-type: none">- Sin contraste- Perfusión- Angio-TC |



Stroke 2015;46:1453-61
Eur J Radiol 2017 Nov; 96: 125-132
Front Neurol 2018 Jan; 8:736
Radiología 2018;60(1):3-9

OBJETIVO : ÚTIL





Motivo de consulta

- Escala **NIHSS** (0-42).
- Sospecha localización.
- Antecedentes importantes como ictus/AIT previo, epilepsia.
- Escala de Rankin modificada.

| 2.2.1. Initial Imaging | COR | LOE |
|--|-----|------|
| 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 |
| 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 |

1.- SANGRE intracraneal: SI /NO

. El 20% de los ictus son por causa no isquémica, de estos, la mayor parte por **ictus hemorrágicos**: sangrado intraparenquimatoso y HSA.

Thom T. Circulation 113 (2006) e85-e151.

. Contraindica la TIV



3. Noncontrast CT (NCCT) is effective to exclude ICH before IV alteplase administration.

| | |
|---|---|
| I | A |
|---|---|

IV alteplase should not be administered to a patient whose CT reveals an acute intracranial hemorrhage. (Class III: Harm; LOE C-EQ)§II

History of intracranial hemorrhage

IV alteplase administration in patients who have a history of intracranial hemorrhage is potentially harmful.† (COR III: Harm; LOE C-EQ)§II

Subarachnoid hemorrhage

IV alteplase is contraindicated in patients presenting with symptoms and signs most consistent with an SAH.† (COR III: Harm; LOE C-EQ)§II

Acute head trauma

Given the possibility of bleeding complications from the underlying severe head trauma, IV alteplase should not be administered in posttraumatic infarction that occurs during the acute in-hospital phase.† (COR III: Harm; LOE C-EQ)§II (Recommendation wording modified to match COR III stratifications.)

2.- SIMULADORES del ICTUS

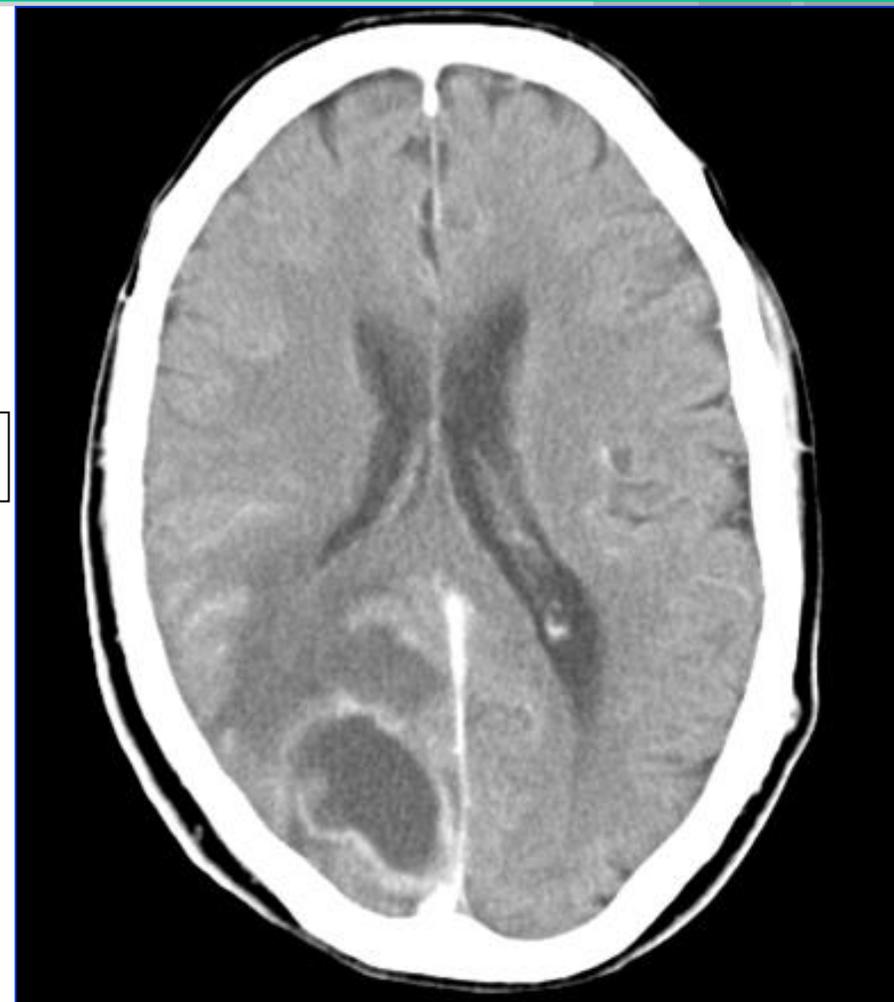
. El 20% ictus son por **causa no isquémica**: neoplasias, malformaciones vasculares, crisis epilépticas, migrañas...

Intra-axial intracranial neoplasm

IV alteplase treatment for patients with AIS who harbor an intra-axial intracranial neoplasm is potentially harmful.† (Class III: Harm; LOE C-EO)‡§

Stroke mimics

The risk of symptomatic intracranial hemorrhage in the stroke mimic population is quite low; thus, starting IV alteplase is probably recommended in preference over delaying treatment to pursue additional diagnostic studies.† (COR IIa; LOE B-NR)§



3.- CONFIRMACIÓN Y EXTENSIÓN DEL ICTUS ISQUÉMICO

- Adecuada **ventana**: W25/C35 UH.
- Reconstrucciones finas (≤ 1 mm) y de 5 mm.
- **Alta especificidad pero baja sensibilidad** para detectar ictus en las primeras horas:
 - . Sensibilidad del 57-71% en las primeras 24h y del 12% en las primeras 3 h.



3.- CONFIRMACIÓN Y EXTENSIÓN DEL ICTUS ISQUÉMICO

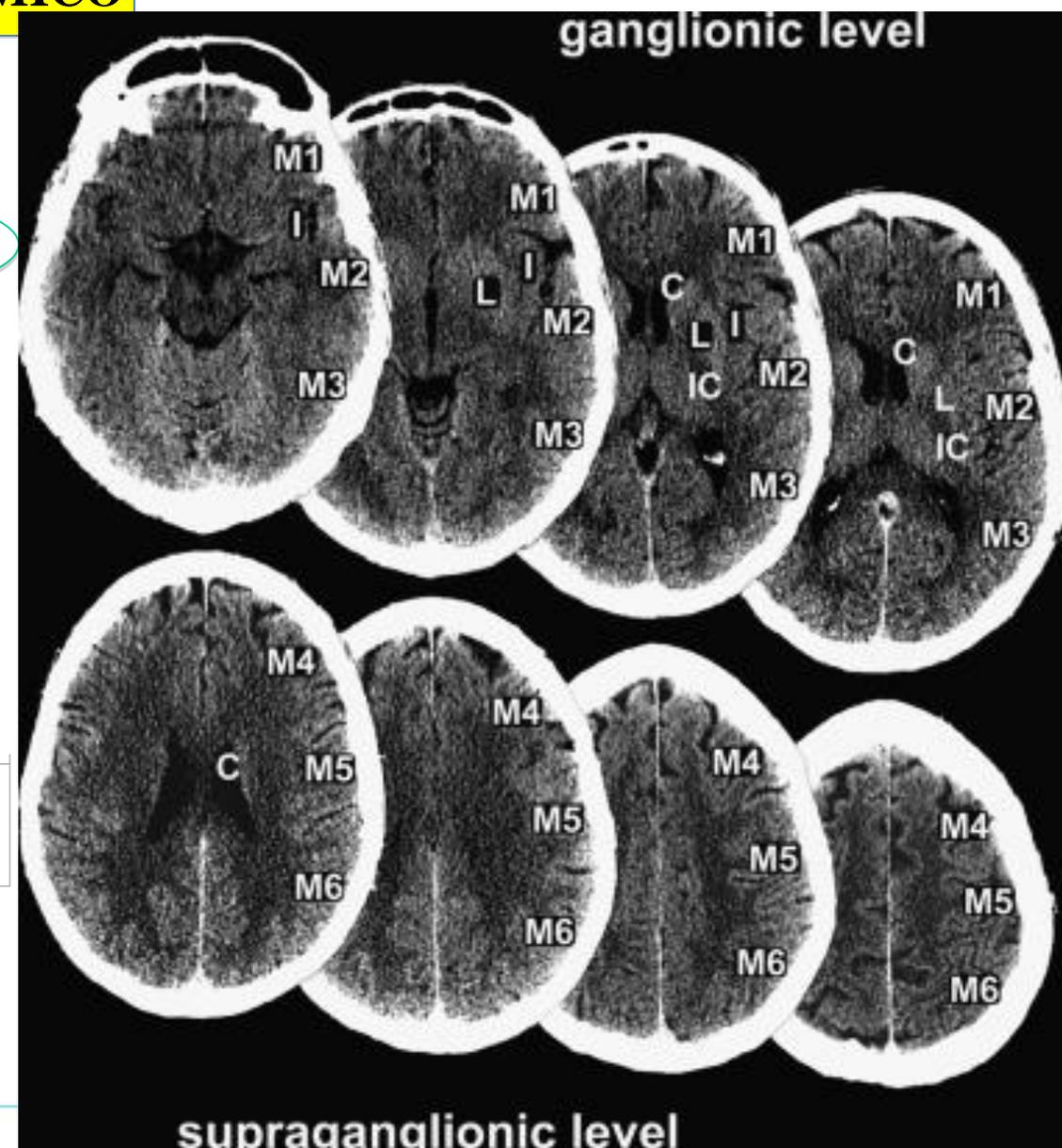
• Escalas semicuantitativas:

- Alberta Stroke Program Early CT Score (**ASPECTS**).

- Pérdida de diferenciación o hipodensidad sustancia gris/blanca. **10 PUNTOS**
- Al menos dos cortes consecutivos

- Si plantea dudas.
- Cortical tumefacta pero no hipodensa.

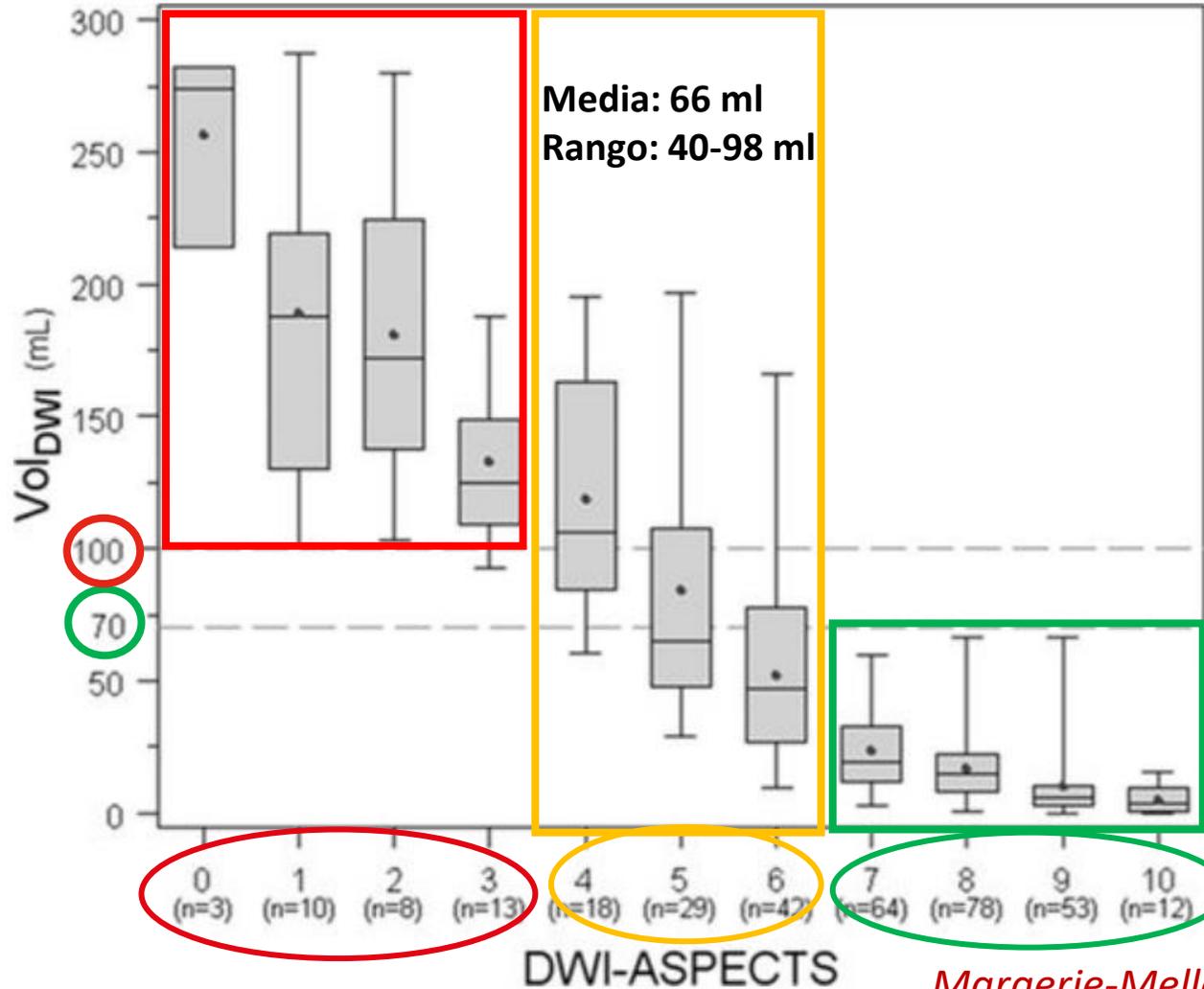
¿Umbrales?



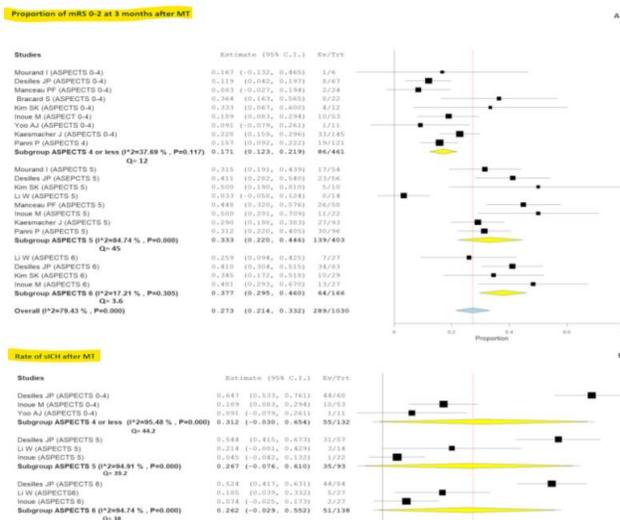
CT There remains insufficient evidence to identify a threshold of hypoattenuation severity or extent that affects treatment response to alteplase. However, administering IV alteplase to patients whose CT brain imaging exhibits extensive regions of clear hypoattenuation is not recommended. These patients have a poor prognosis despite IV alteplase, and severe hypoattenuation defined as obvious hypodensity represents irreversible injury.† (COR III; No Benefit; LOE A)¶

CT IV alteplase administration is recommended in the setting of early ischemic changes on NCCT of mild to moderate extent (other than frank hypodensity).† (COR I; LOE A)

3.- CONFIRMACIÓN Y EXTENSIÓN DEL ICTUS ISQUÉMICO



3.- CONFIRMACIÓN Y EXTENSIÓN DEL ICTUS ISQUÉMICO



ORIGINAL RESEARCH

Mechanical thrombectomy in patients with acute ischemic stroke and ASPECTS ≤6 a meta-analysis

Los pacientes con ASPECTS menor a 6 pueden beneficiarse de la trombectomía mecánica ya que aumenta la independencia funcional:

- ASPECTS 5-6.
- 25 % en ASPECTS 4.
- 14 % en ASPECTS 0-3.

Cagnazzo, et al. J Neurointervent Surg 2020;12:350-55

Location-Specific ASPECTS Paradigm in Acute Ischemic Stroke: A Systematic Review and Meta-Analysis

S.M. Seyedsaadat, A.A. Neuhaus, J.M. Pederson, W. Brinjikji, A.A. Rabinstein, and D.F. Kallmes

Especificar los segmentos afectados, no todos tienen la misma contribución en el pronóstico funcional del paciente: M1, M2, M3, M4, M5, M6, C, CI, L, I.

Seyedsaadat SM, et al. AJNR 2020; Oct 15

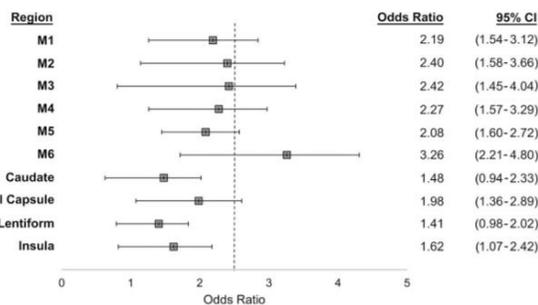
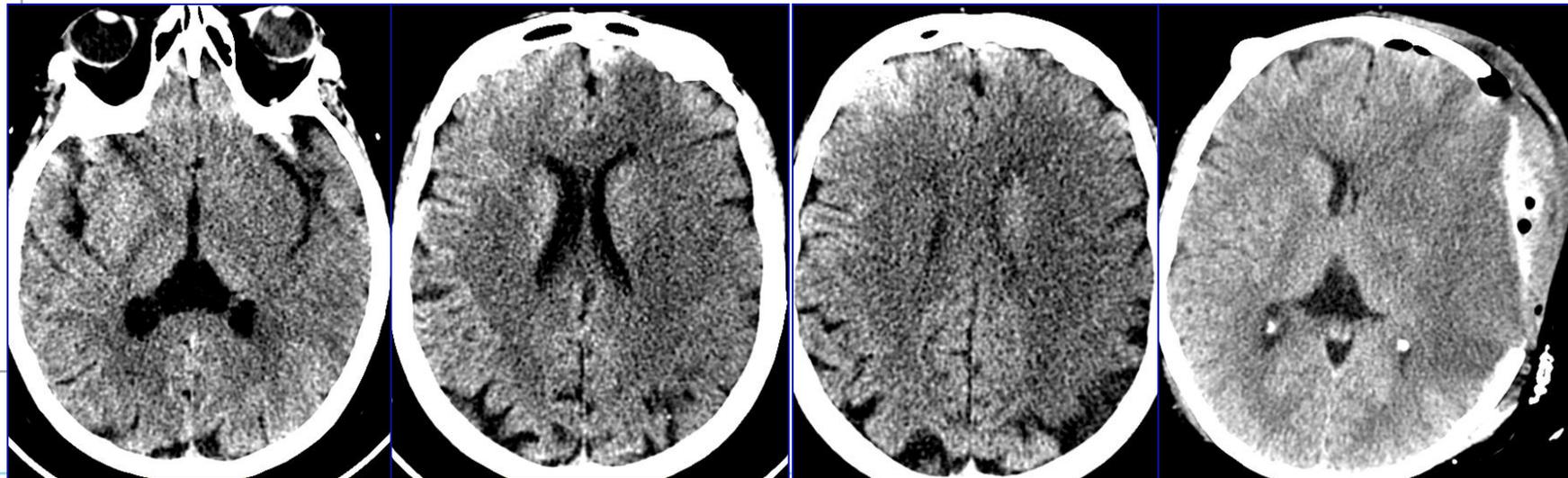
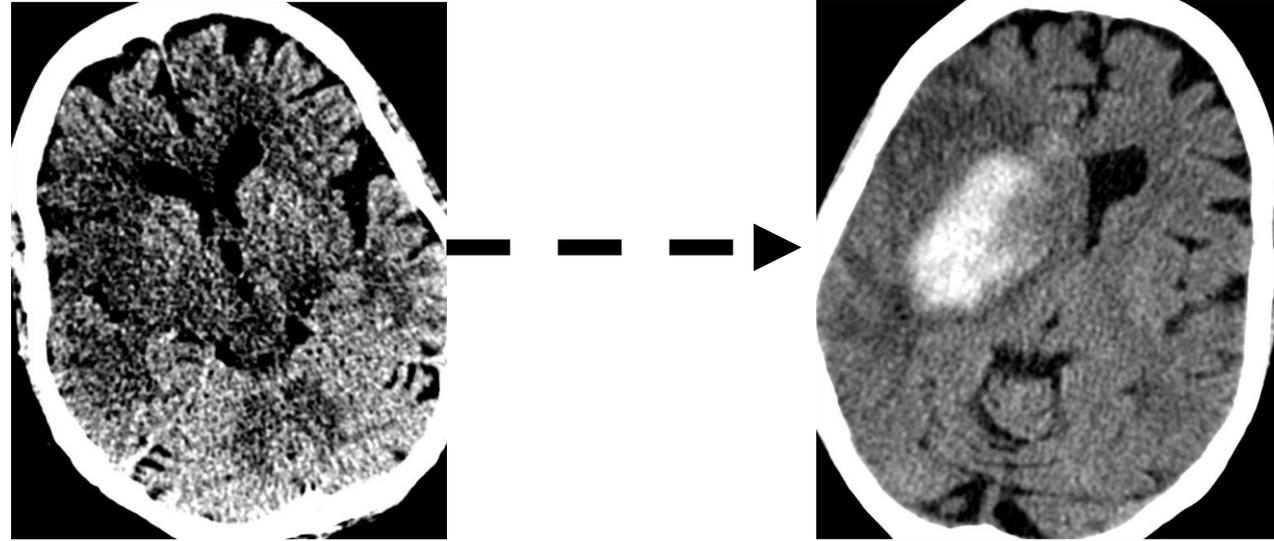


FIG 3. Forest plots demonstrating the contribution of individual ASPECTS regions, with 90-day functional outcome based on collective data of the 9 included studies.

3.- CONFIRMACIÓN Y EXTENSIÓN DEL ICTUS ISQUÉMICO

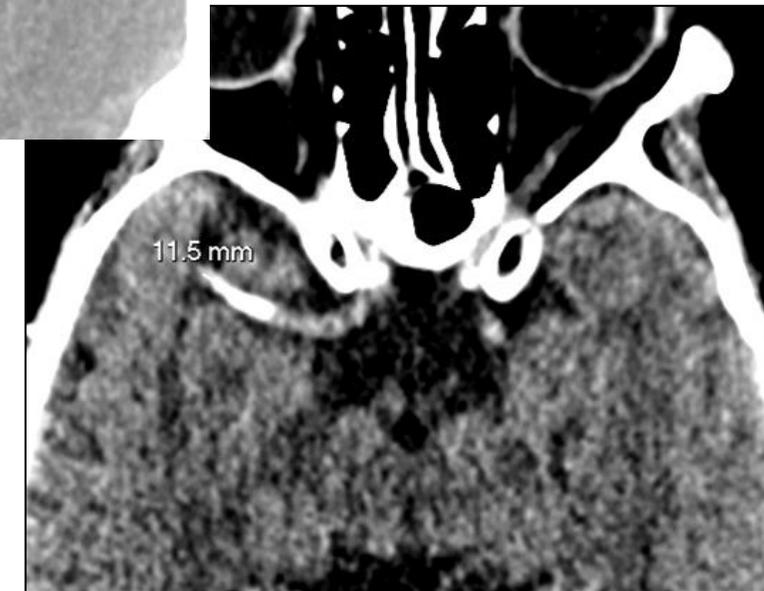
Extensión de los cambios isquémicos:

- **Infartos extensos** se correlacionan con mayor riesgo de transformación hemorrágica y peor resultado clínico.
- Los infartos extensos del territorio de ACM pueden evolucionar a **infarto cerebral maligno**.



4.- TROMBO HIPERDENSO

- Localización y extensión.
- Trombo extenso: implicación pronóstica y terapéutica, es un predictor de mala respuesta al tratamiento únicamente IV.
- Ayuda a realizar una lectura sistemática.



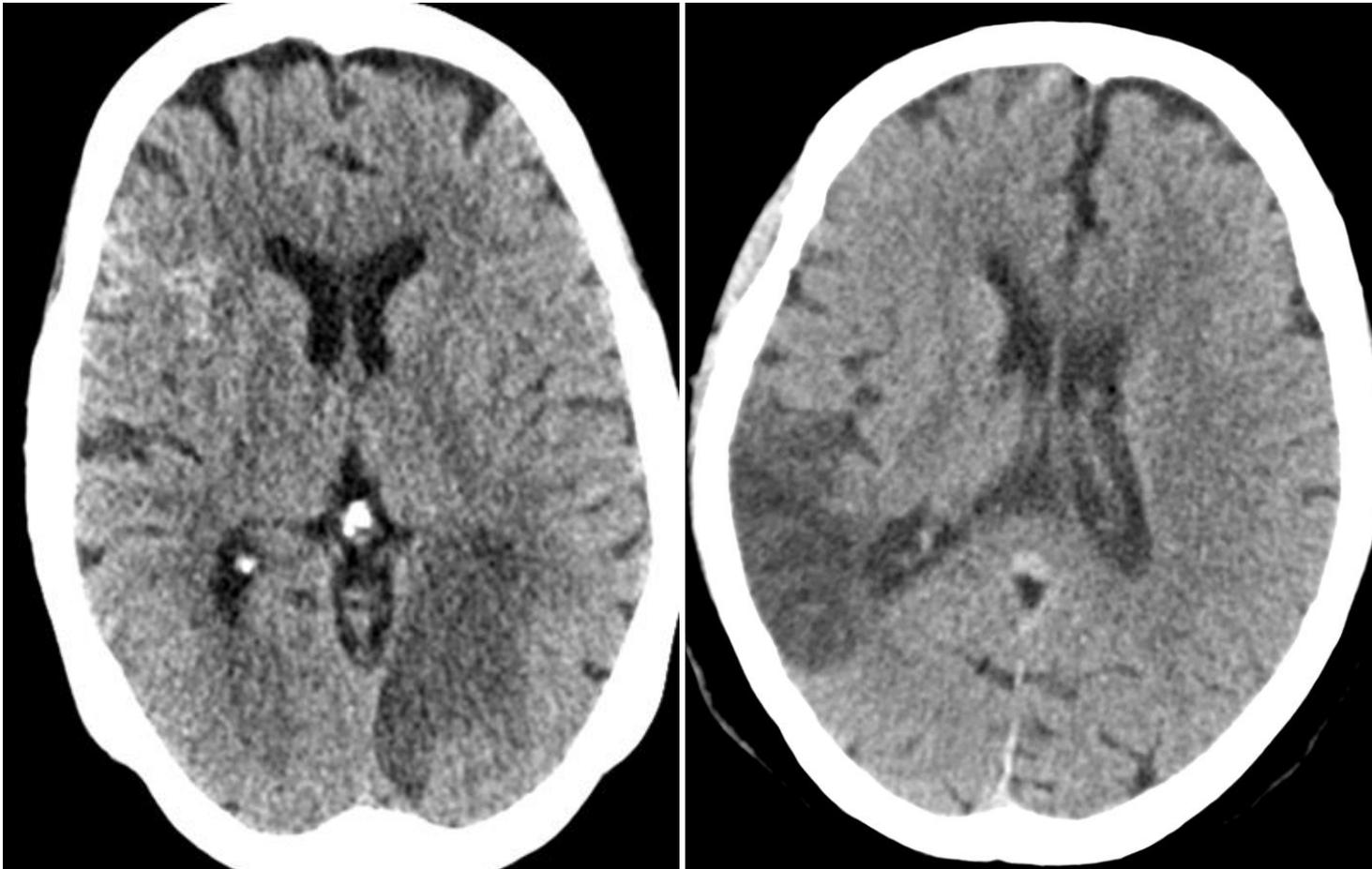
2. In patients with a hyperdense MCA sign, IV alteplase can be beneficial.

Ila

B-NR

New recommendation.

5.- OTRAS LESIONES ISQUÉMICAS

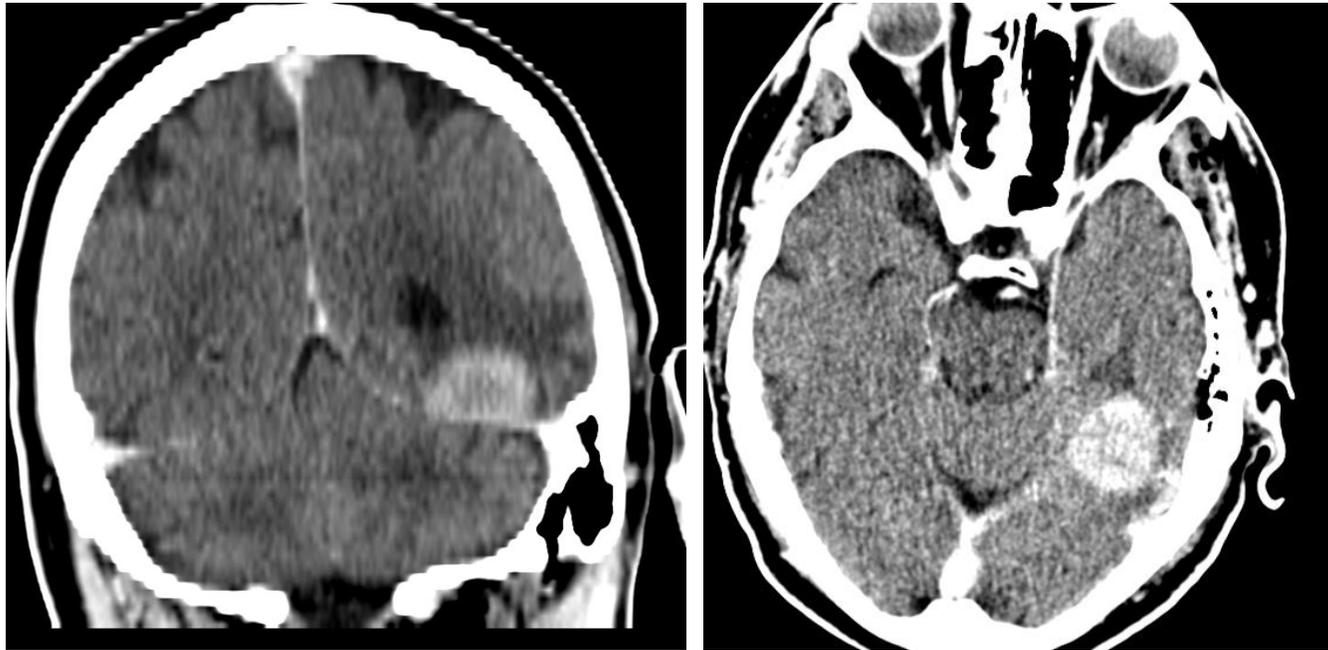


- Lesiones isquémicas subagudas.
- Lesiones isquémicas crónicas.
- Lesiones isquémicas de cronología indeterminada.

Ischemic stroke within 3 mo

Use of IV alteplase in patients presenting with AIS who have had a prior ischemic stroke within 3 mo may be harmful.† (COR III: Harm; LOE B-NR)§||

6.- OTROS HALLAZGOS



Extra-axial intracranial neoplasms

IV alteplase treatment is probably recommended for patients with AIS who harbor an extra-axial intracranial neoplasm.† (Class IIa; LOE C-EO)‡

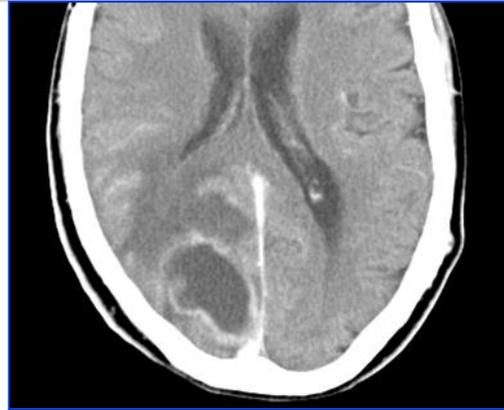
Intra-axial intracranial neoplasm

IV alteplase treatment for patients with AIS who harbor an intra-axial intracranial neoplasm is potentially harmful.† (Class III: Harm; LOE C-EO)‡§

1.- SANGRE intracraneal



2.- SIMULADORES del ICTUS



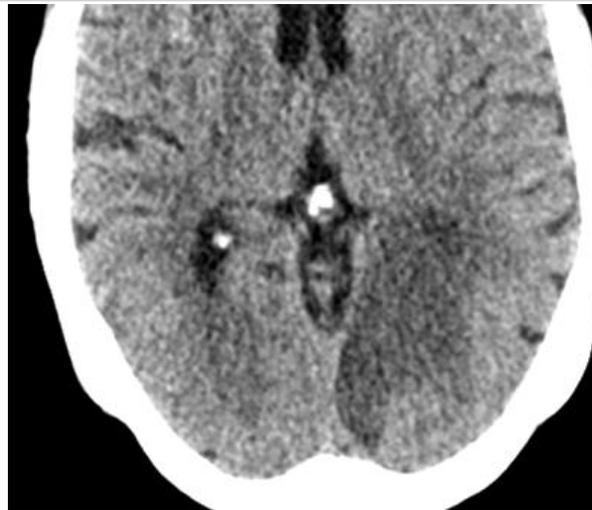
3.- ICTUS isquémico y extensión



4.- TROMBO hiperdenso

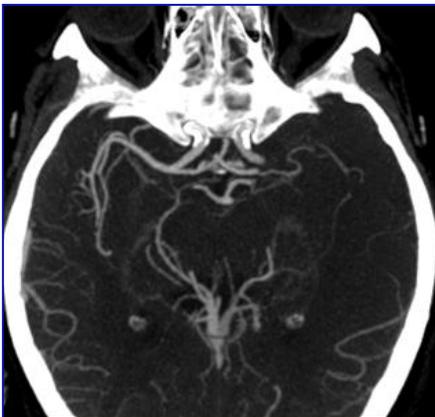


5.- Otras LESIONES ISQUÉMICAS



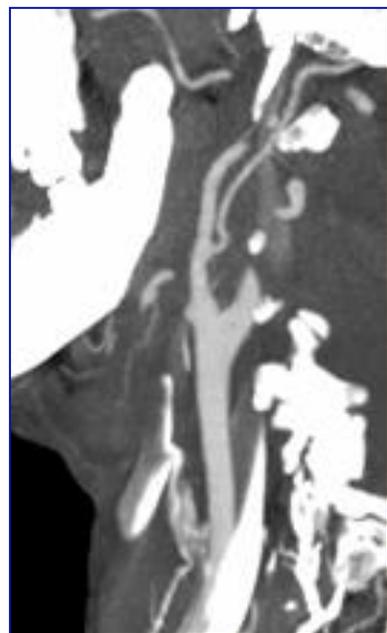
6.- Otros hallazgos





1. Defecto de repleción

2. Colaterales



3. Etiología del ICTUS

4. Otros hallazgos relevantes

8. For patients who otherwise meet criteria for EVT, noninvasive intracranial vascular study is recommended during the initial imaging evaluation of the acute stroke patient, but should not delay IV alteplase if indicated. For patients who qualify for IV alteplase according to guidelines from professional medical societies, initiating IV alteplase before noninvasive vascular imaging is recommended for patients who have not had noninvasive vascular imaging as part of their initial imaging assessment for stroke. Noninvasive intracranial vascular imaging should then be obtained as quickly as possible.

I

A

Recommendation reworded for clarity from 2015 Endovascular. Class and LOE unchanged. See Table LXXXIII in online Data Supplement 1 for original wording.

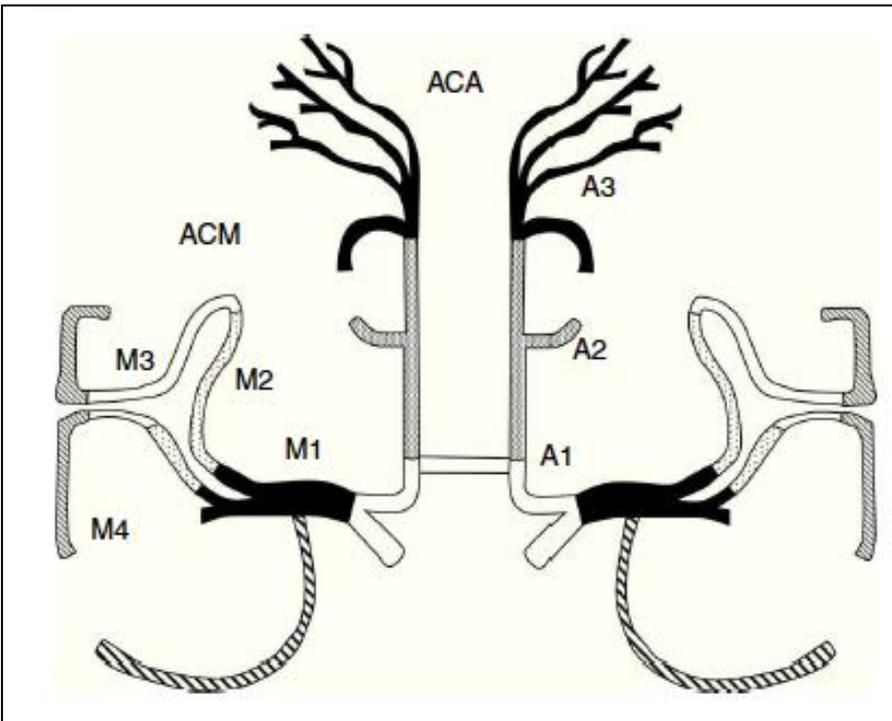
10. In patients who are potential candidates for mechanical thrombectomy, imaging of the extracranial carotid and vertebral arteries, in addition to the intracranial circulation, is reasonable to provide useful information on patient eligibility and endovascular procedural planning.

Ila

C-EO

New recommendation.

1.- DEFECTO DE REPLECIÓN



→EXISTENCIA: En un 19-39% de los ICTUS agudos no se identifica oclusión intracraneal.

→LOCALIZACIÓN.

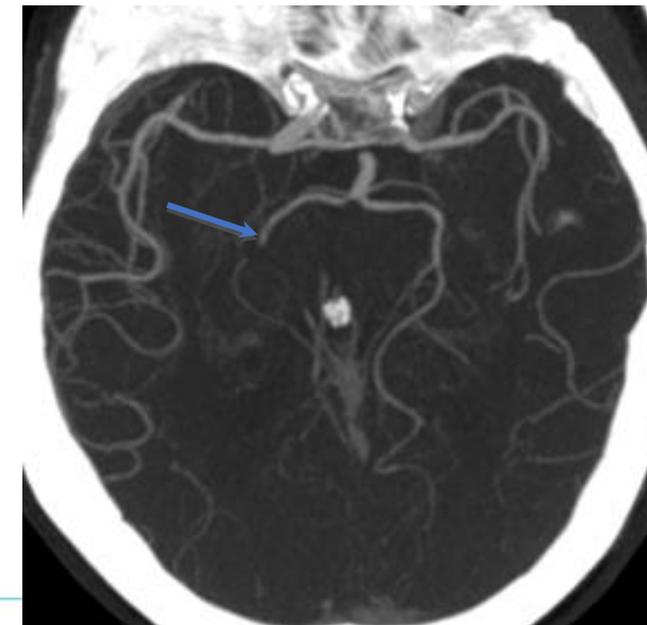
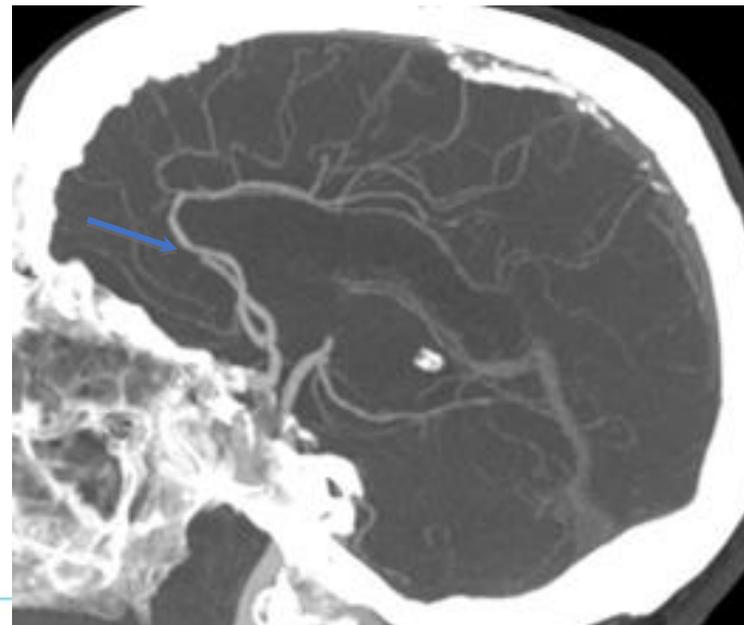
- **Alta sensibilidad y especificidad**, en polígono de Willis, de 83-100% y 99-100%, vs arteriografía.

AJNR 2014;35:1045-51.

- **Vaso mayor:** ACI intracraneal y M1 de ACM.

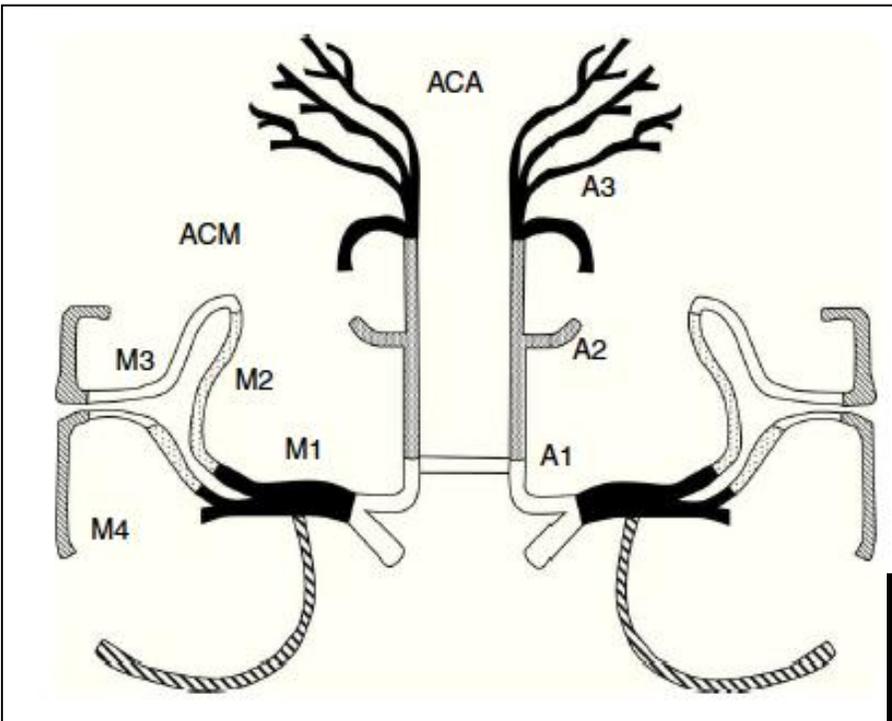
- **Vaso mediano calibre:** ACA, ACM (M2-M4), ACP, ACPI, ACAI, ACS.

Stroke 2020;51:2872-84.



*Mendiñaga Ramos M. y Cabada Giadas T.
Radiología. 2015; 57(2):156-166.*

1.- DEFECTO DE REPLECIÓN



→EXISTENCIA

→LOCALIZACIÓN.

→**LONGITUD.**

Mayor carga trombótica se relaciona con un menor porcentaje de reperfusión, mayor tamaño del infarto final y mayor transformación hemorrágica.

Extenso > 8mm.

Neuroradiology.2015;557:1-9.

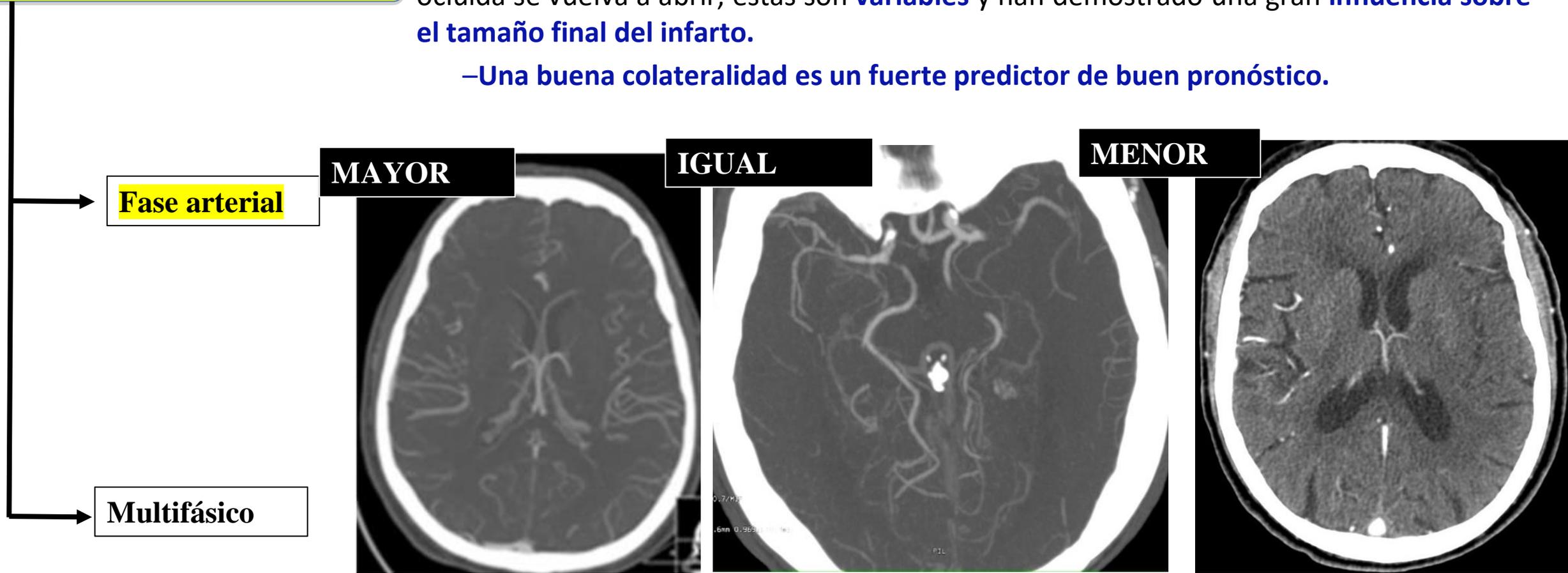
*Mendiñaga Ramos M. y Cabada Giadas T.
Radiología. 2015; 57(2):156-166.*



2.- COLATERALES

El cerebro isquémico depende del flujo sanguíneo de las colaterales hasta que la arteria ocluida se vuelva a abrir, estas son **variables** y han demostrado una gran **influencia sobre el tamaño final del infarto**.

–Una buena colateralidad es un fuerte predictor de buen pronóstico.



Escala de Miteff *AJNR 2015.Feb;36:289-94.*

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

Angio-TC TSA e INTRACRANEAL

2.- COLATERALES



- 1.- Arterial. Desde arco aórtico a vertex.
- 2.- Venoso (+ 4sg) Base de cráneo a vertex.
- 3.-Tardía (+ 4sg). Base de cráneo a vertex.

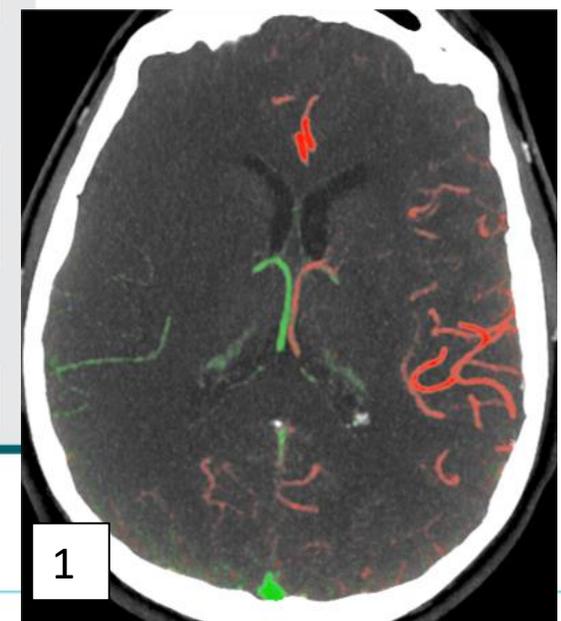
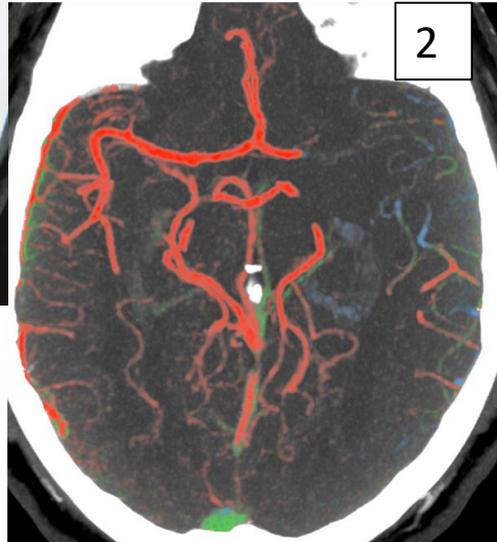


Table 2

Pial Arterial Filling Score within the Symptomatic Ischemic Territory Using Single- and Multiphase CT Angiography

| Score | Single-Phase CT Angiography | Multiphase CT Angiography |
|-------|--|---|
| 5 | When compared with asymptomatic contralateral hemisphere, there is increased or normal prominence and extent of pial vessels within the ischemic territory in the symptomatic hemisphere | When compared with the asymptomatic contralateral hemisphere, there is <u>no delay and normal or increased prominence of pial vessels/normal extent within the ischemic territory in the symptomatic hemisphere</u> |
| 4 | When compared with the asymptomatic contralateral hemisphere, there is slightly reduced prominence and extent of pial vessels within the ischemic territory in the symptomatic hemisphere | When compared with the asymptomatic contralateral hemisphere, there is <u>a delay of one phase in filling in of peripheral vessels, but prominence and extent is the same</u> |
| 3 | When compared with the asymptomatic contralateral hemisphere, there is moderately reduced prominence and extent of pial vessels within the ischemic territory in the symptomatic hemisphere | When compared with the asymptomatic contralateral hemisphere, there is <u>a delay of two phases in filling in of peripheral vessels or there is a one-phase delay and significantly reduced number of vessels in the ischemic territory</u> |
| 2 | When compared with the asymptomatic contralateral hemisphere, there is decreased prominence and extent and regions with no vessels within the ischemic territory in the symptomatic hemisphere | When compared with the asymptomatic contralateral hemisphere, there is <u>a delay of two phases in filling in of peripheral vessels and decreased prominence and extent or a one-phase delay and some ischemic regions with no vessels</u> |
| 1 | When compared with the asymptomatic contralateral hemisphere, there are just a few vessels visible in the occluded vascular territory | When compared with the asymptomatic contralateral hemisphere, <u>there are just a few vessels visible in any phase within the occluded vascular territory</u> |
| 0 | When compared with the asymptomatic contralateral hemisphere, there are no vessels visible within the ischemic territory | When compared with the asymptomatic contralateral hemisphere, there are <u>no vessels visible in any phase within the ischemic vascular territory</u> |

2.- COLATERALES

Multifásico

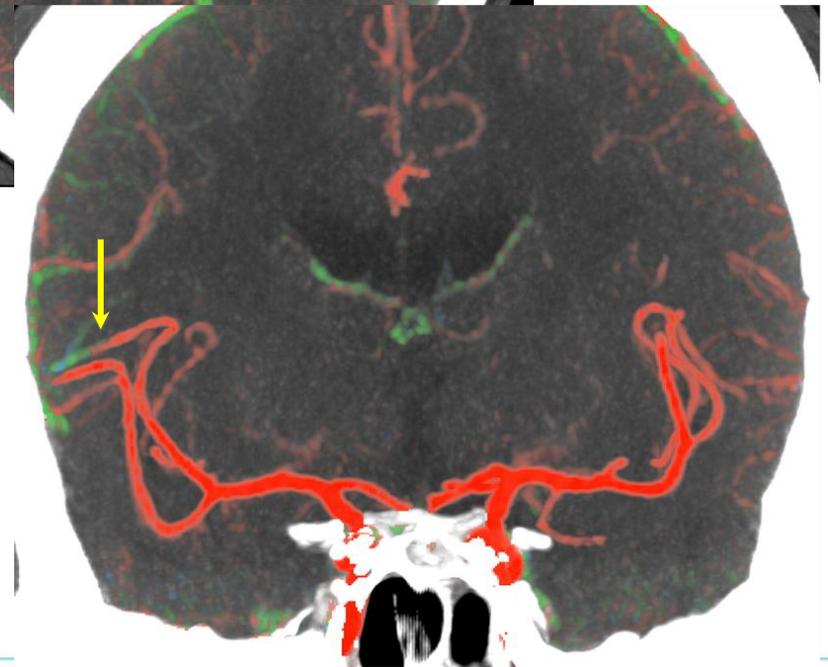
FORTALEZAS.

- Fácil de interpretar.
- No necesita más CIV.
- Mejora la sensibilidad en la detección de la obstrucción vascular tanto en vaso proximal como distal.
- Mejora la caracterización de la longitud del trombo.
- Mejora la caracterización de colaterales: menos afectado por la variabilidad cardíaca, movimiento o técnica subóptima.

LIMITACIONES

- Valor limitado en circulación de fosa posterior.
- Radiación (+ 20% respecto angioTC).
- *Pitfall*: estenosis proximal, mala hemodinámica..

Dundamadappa S, et al. AJNR 2021 Jan,42(2):221-227



3.- TERRITORIO EXTRACRANEAL: ORIGEN DEL TROMBO

- Arteria carótida interna D/I (la afecta primero) extracraneal

Signos de ateromatosis / disección

Permeabilidad (si/no)

Estenosis (no, menor del 70%, 70-90%, 90-99%)] NASCET

Criterios de vulnerabilidad

- **Aorta y segmentos proximales de troncos supraórticos**

- **Arterias vertebrales**

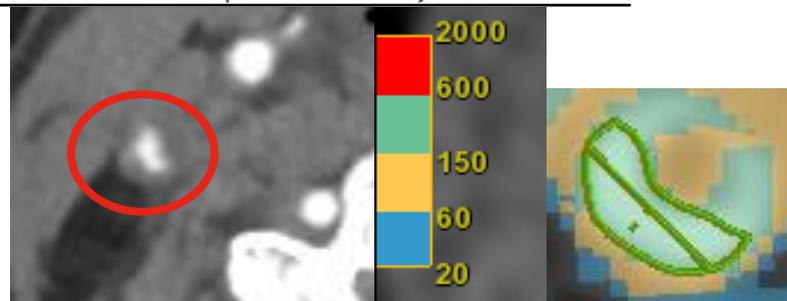


Standard definitions of plaque features

| Plaque Characteristic | Imaging Definition | Histopathologic Correlate |
|-----------------------------------|--|---|
| Calcified plaque | Plaque with increased attenuation of >130 HU | Plaque calcification |
| <u>Soft plaque</u> | Low-attenuation plaque, around 40–50 HU | Intraplaque hemorrhage and lipid-rich necrotic core |
| <u>Plaque ulceration</u> | Extension of contrast material beyond the vascular lumen of the plaque, usually of at least 1 mm | Plaque surface irregularity and ulceration |
| <u>Total plaque thickness</u> | Linear measurement of greatest axial dimension of plaque | Plaque thickness |
| <u>Carotid plaque enhancement</u> | Enhancement of plaque after administration of contrast | Plaque neovascularity |

Sabe L, et al. AJNR 2018 Feb, 39(2):E9-E31.

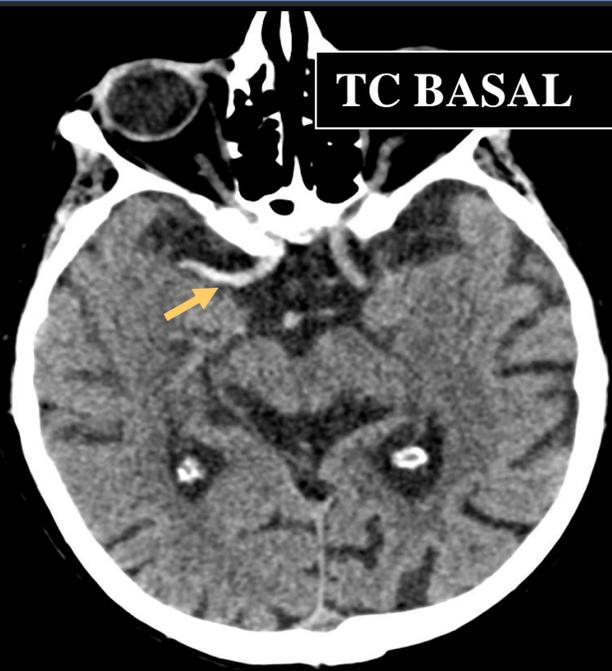
Baradaran H. AJNR 2020 Mar, 41(3):380-386.



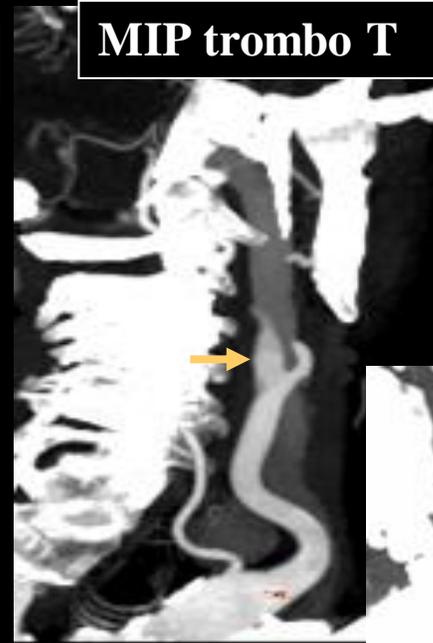
3.- TERRITORIO EXTRACRANEAL: ORIGEN DEL TROMBO



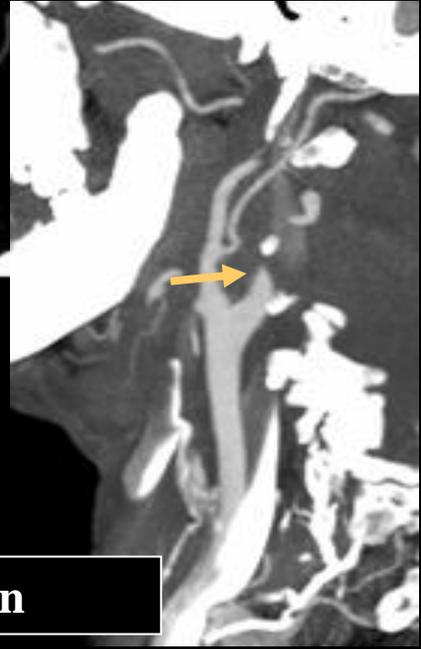
AngioTC VR



TC BASAL



MIP trombo T



MIP disección

Extracranial cervical dissections

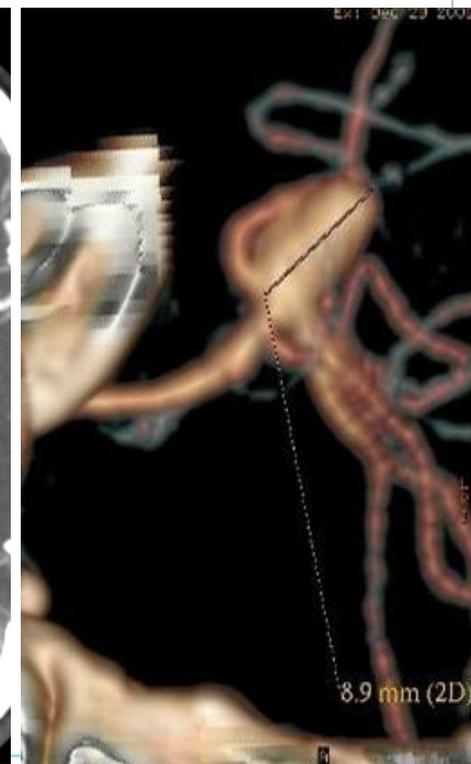
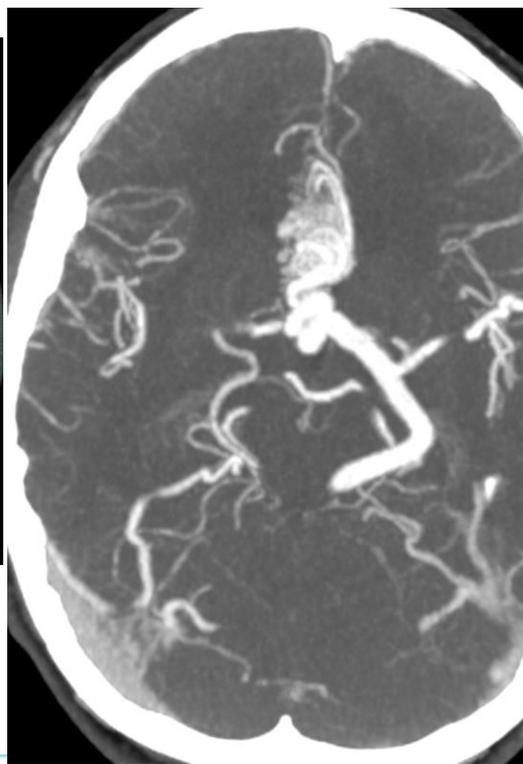
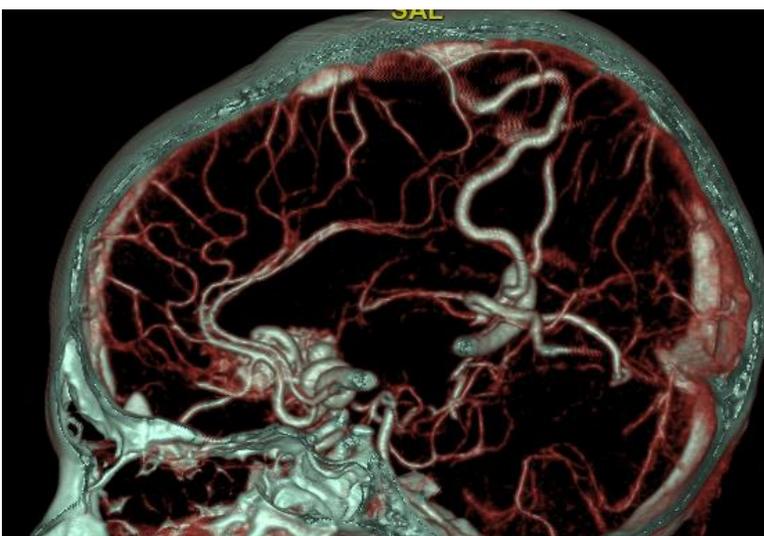
IV alteplase in AIS known or suspected to be associated with extracranial cervical arterial dissection is reasonably safe within 4.5 h and probably recommended.† (COR IIa; LOE C-LD)§

Intracranial arterial dissection

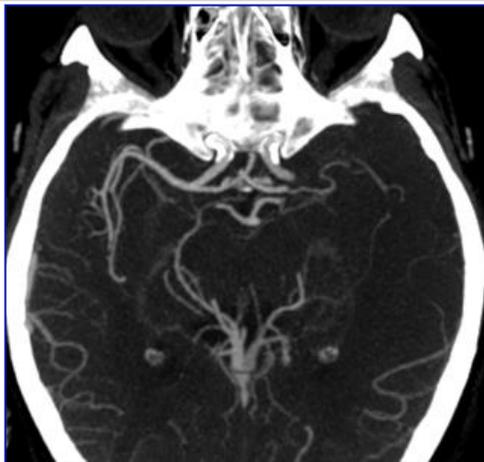
IV alteplase usefulness and hemorrhagic risk in AIS known or suspected to be associated with intracranial arterial dissection remain unknown, uncertain and not well established.† (COR IIb; LOE C-LD)§

4.- OTRO HALLAZGOS: anatomía, malformaciones vasculares

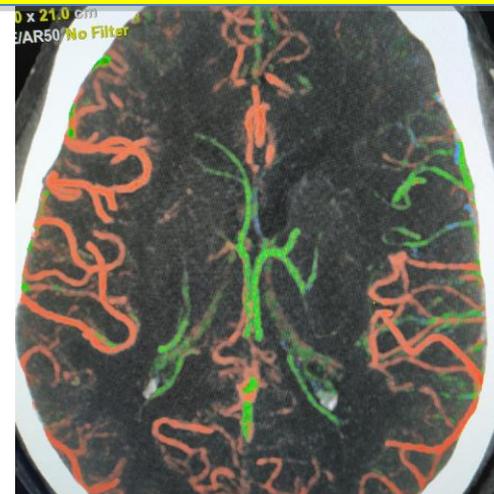
| | |
|--|---|
| Unruptured intracranial aneurysm | For patients presenting with AIS who are known to harbor a small or moderate-sized (<10 mm) unruptured and unsecured intracranial aneurysm, administration of IV alteplase is reasonable and probably recommended. † (COR IIa; LOE C-LD)§ |
| | Usefulness and risk of IV alteplase in patients with AIS who harbor a giant unruptured and unsecured intracranial aneurysm are not well established. † (COR IIb; LOE C-LD)§ |
| Intracranial vascular malformations | For patients presenting with AIS who are known to harbor an unruptured and untreated intracranial vascular malformation the usefulness and risks of administration of IV alteplase are not well established. † (COR IIb; LOE C-LD)§ |
| | Because of the increased risk of ICH in this population of patients, IV alteplase may be considered in patients with stroke with severe neurological deficits and a high likelihood of morbidity and mortality to outweigh the anticipated risk of ICH. † (COR IIb; LOE C-LD)§ |



1.- DEFECTO DE REPLECIÓN



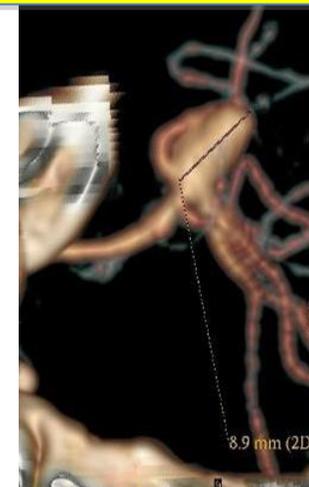
2.- COLATERALES

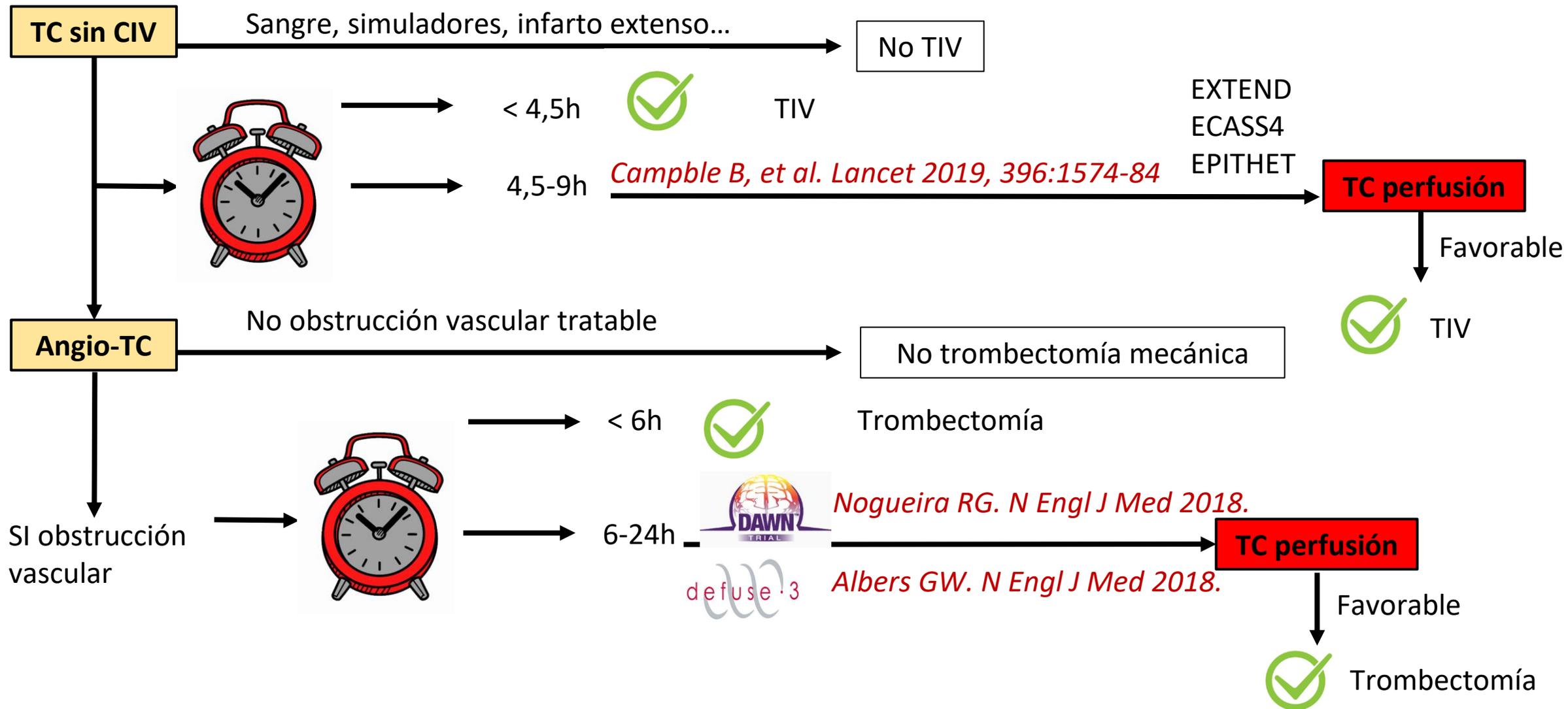


3.- TERRITORIO EXTRACRANEAL



4.- OTRO HALLAZGOS





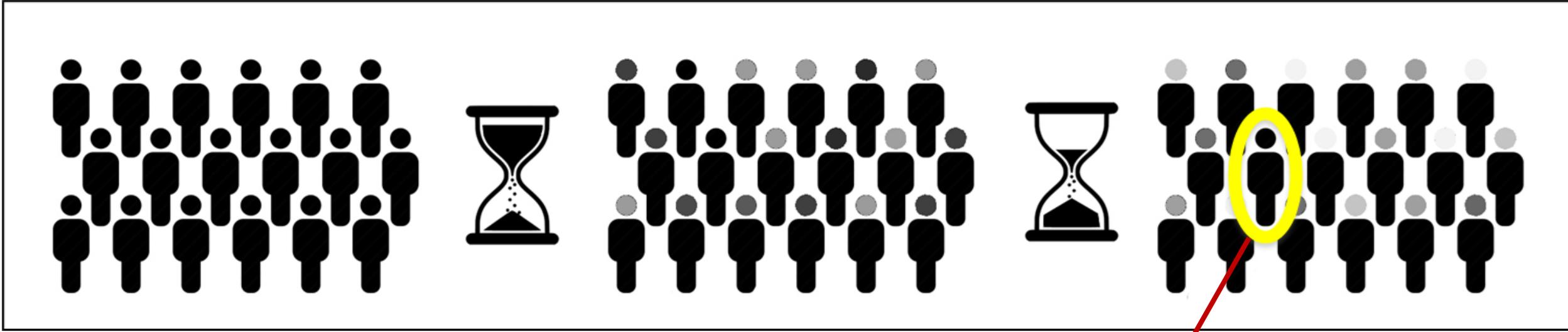
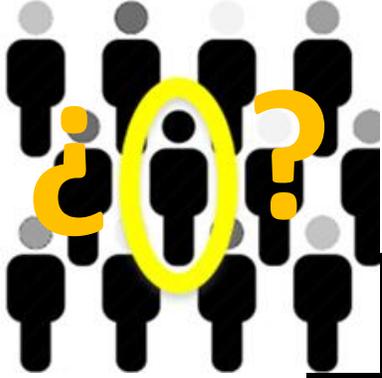


IMAGEN ES CEEBRO

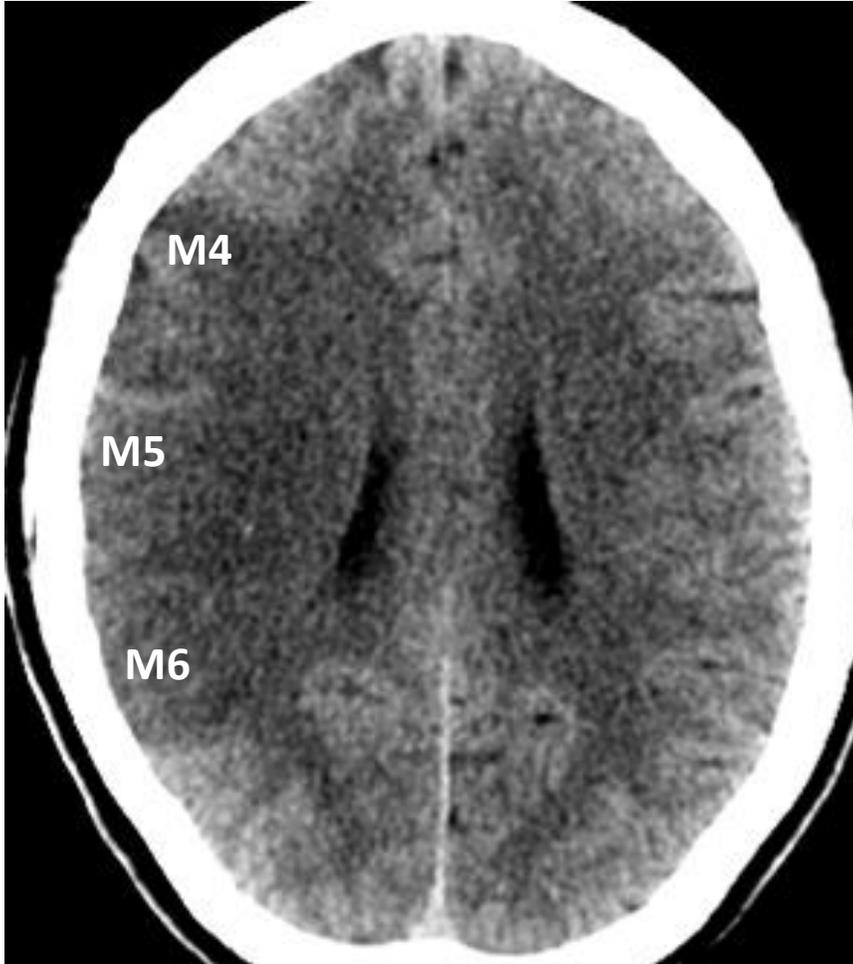
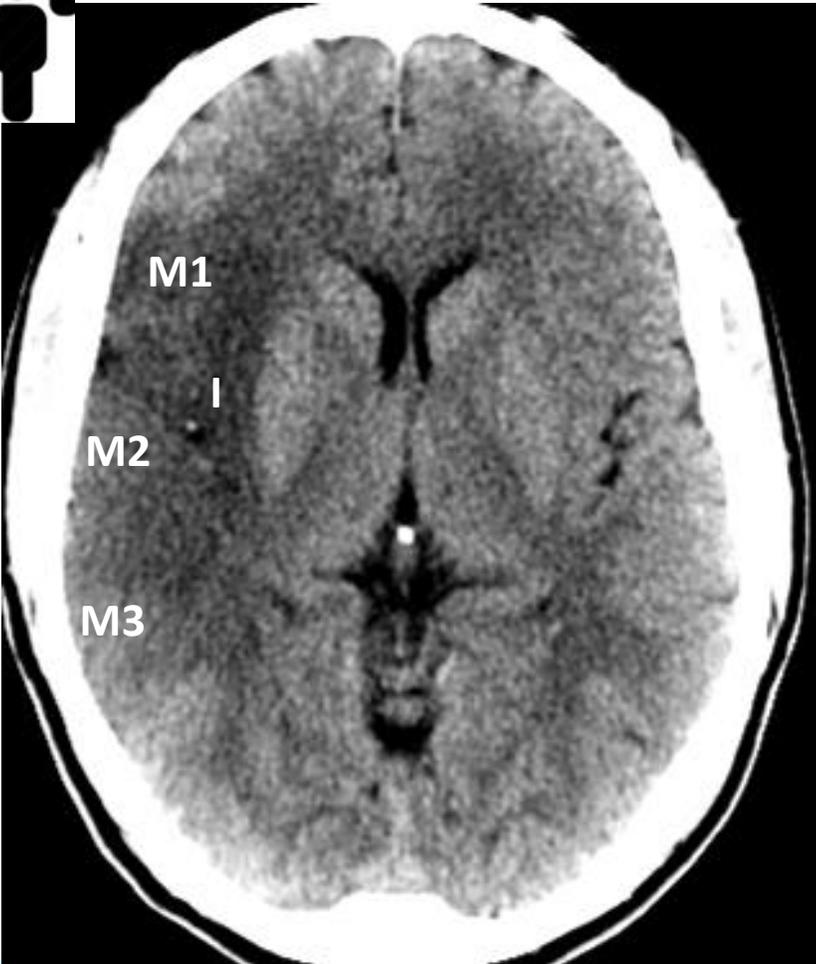
5. **CTA with CTP** or MR angiography (MRA) with diffusion-weighted magnetic resonance imaging (DW-MRI) with or without MR perfusion is recommended for certain patients.

| | |
|---|---|
| I | A |
|---|---|

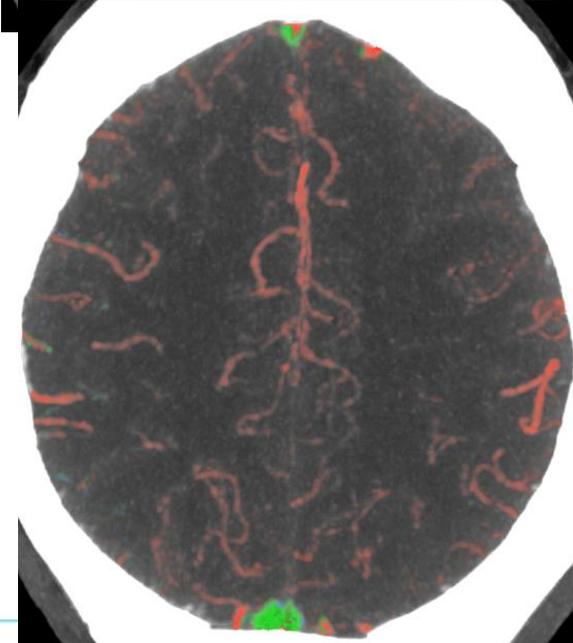
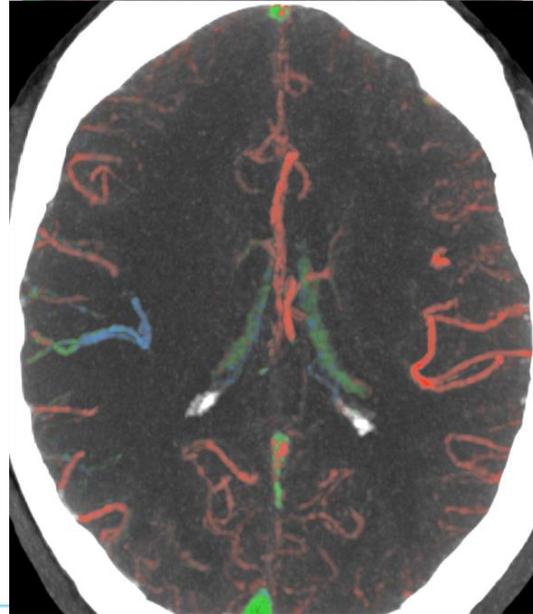
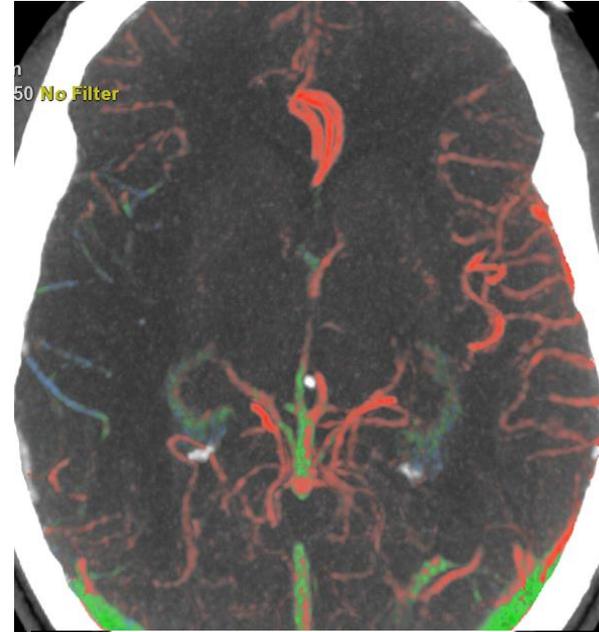
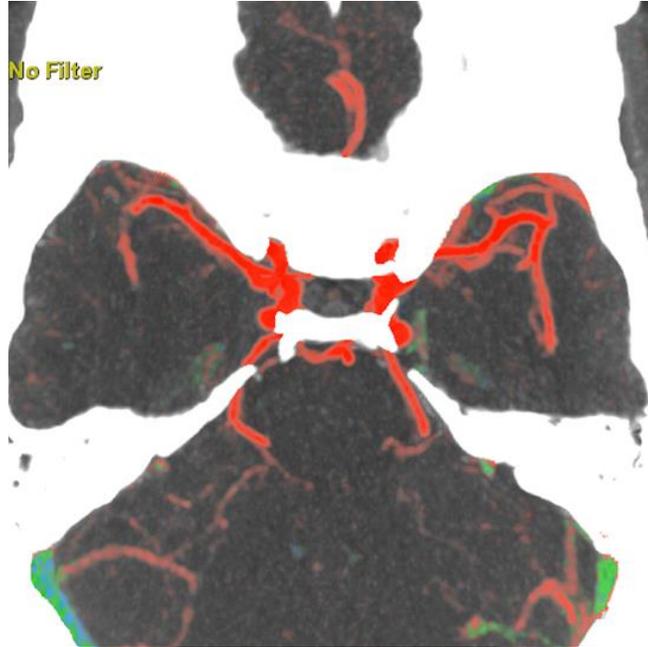
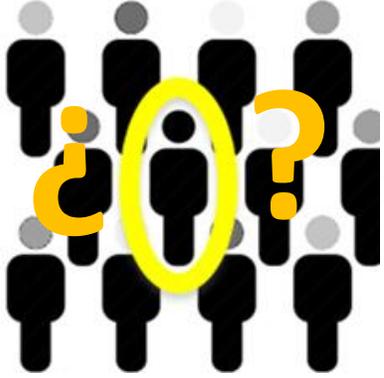
New recommendation.



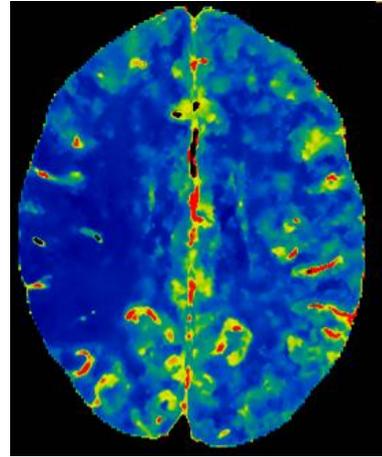
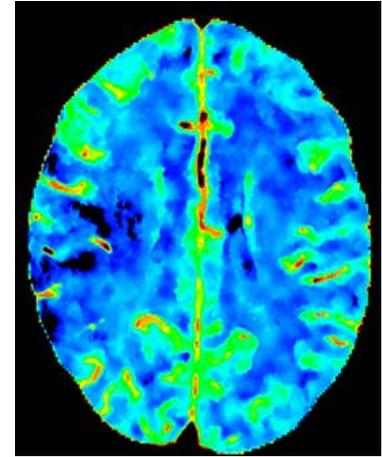
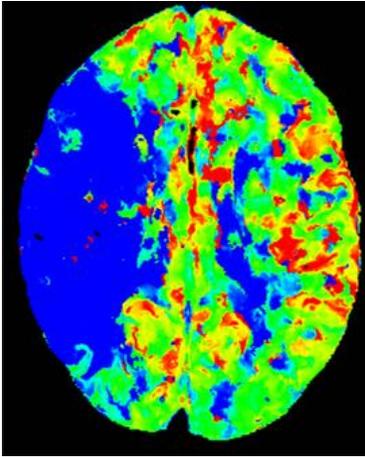
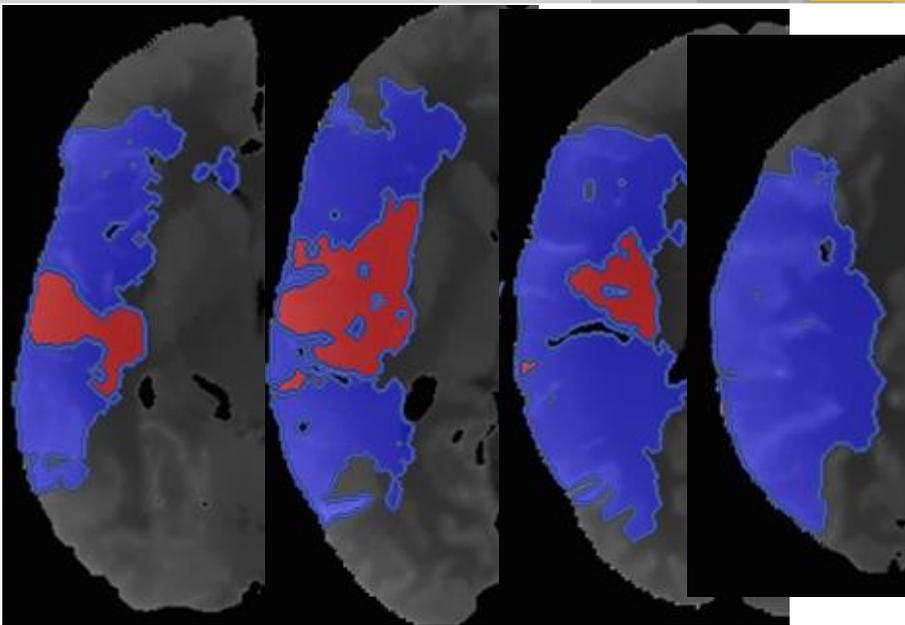
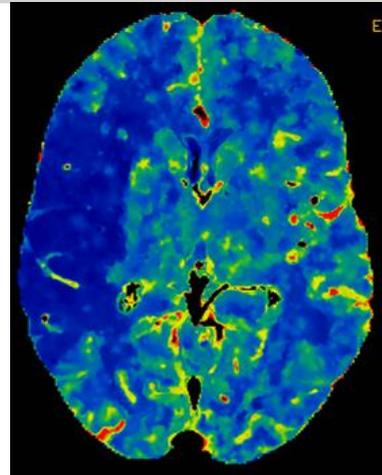
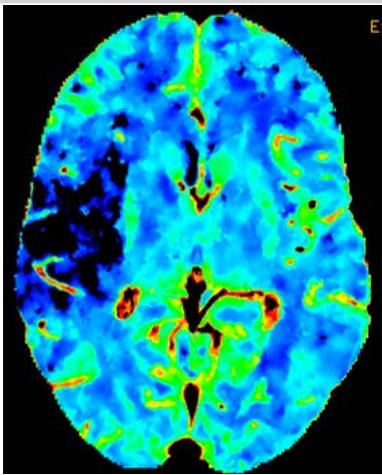
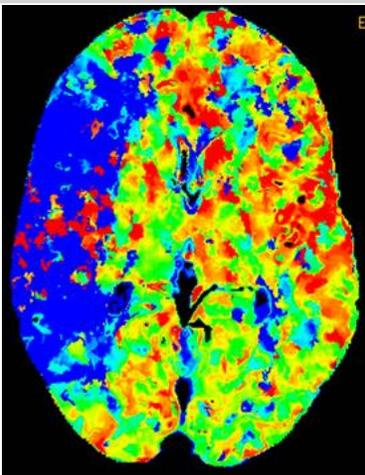
ASPECTS 3



NIHSS 11 → 18



- Oclusión M1 pre bifurcación.
- mCTA 2



Tmax

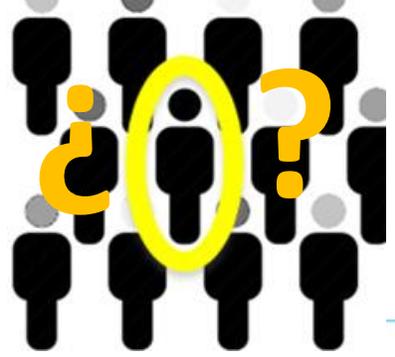
CBV

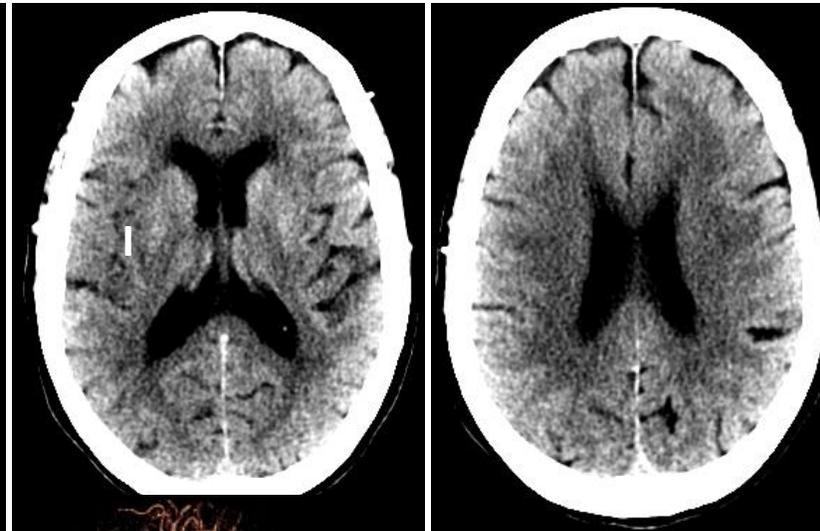
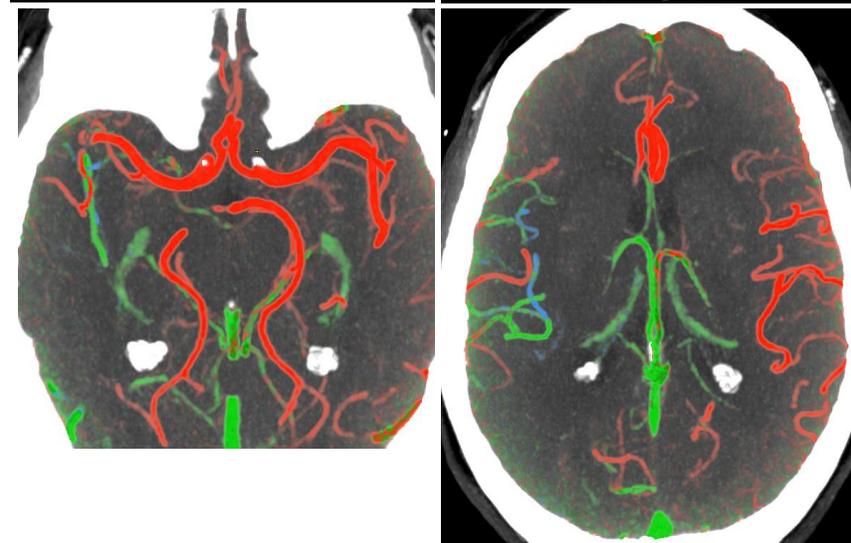
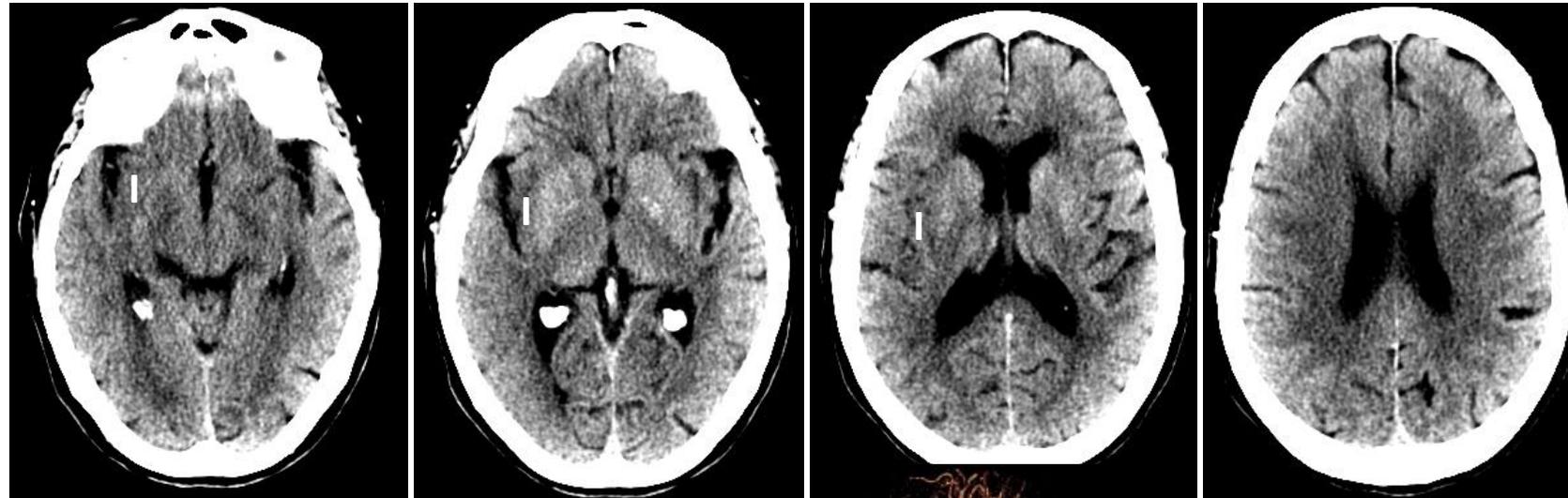
CBF

**Infarto establecido 29 cc
Penumbra 89 cc
Ratio P/CI = 3,07**

Trombectomía mecánica

NIHSS 3





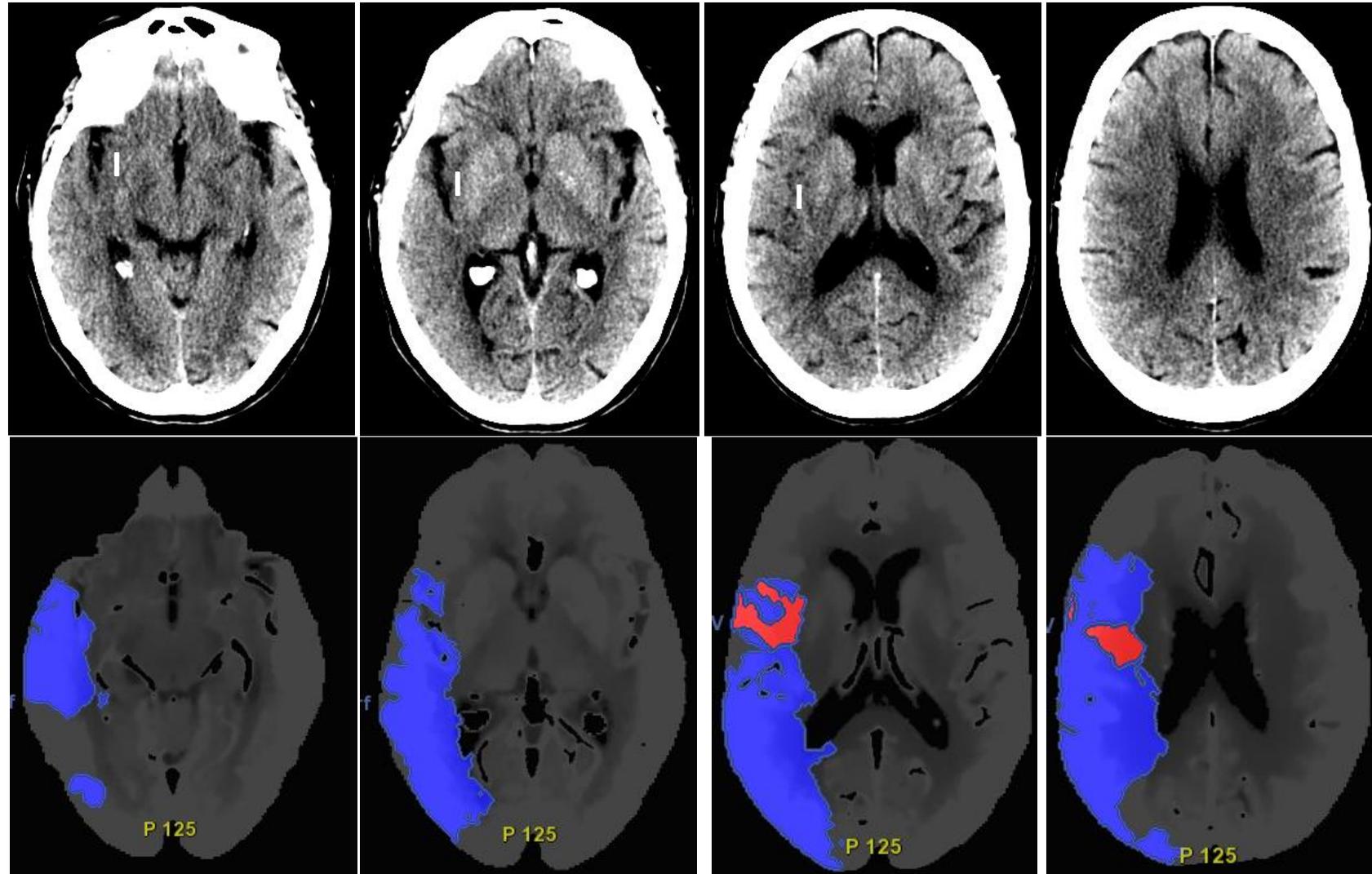
NIHSS 14

ASPECTS 9

Obstrucción M2 proximal ACM D

Colaterales m CTA 3



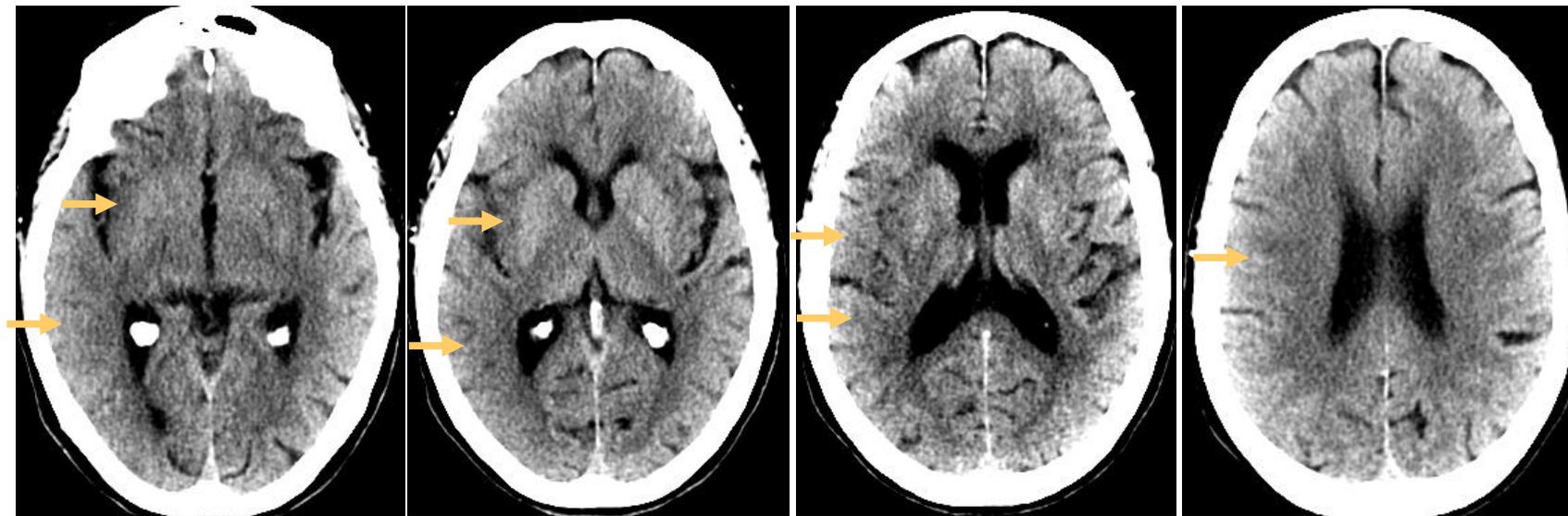
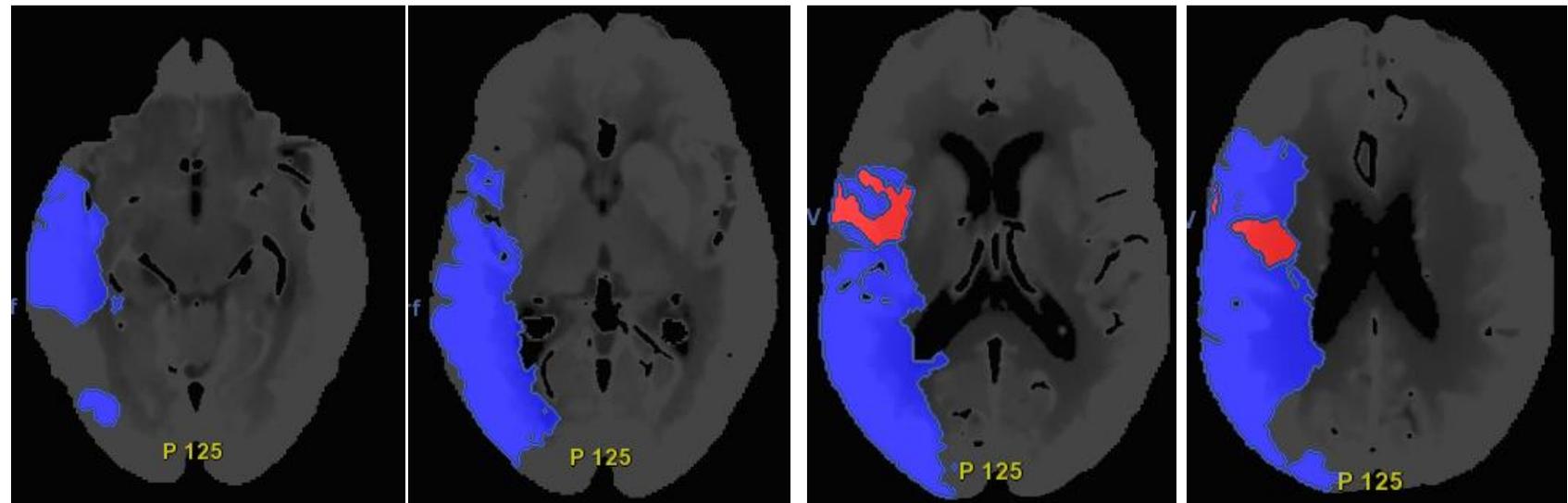


ASPECTS 9

**Infarto establecido 12 cc
Penumbra 72 cc
Ratio P/CI = 6**

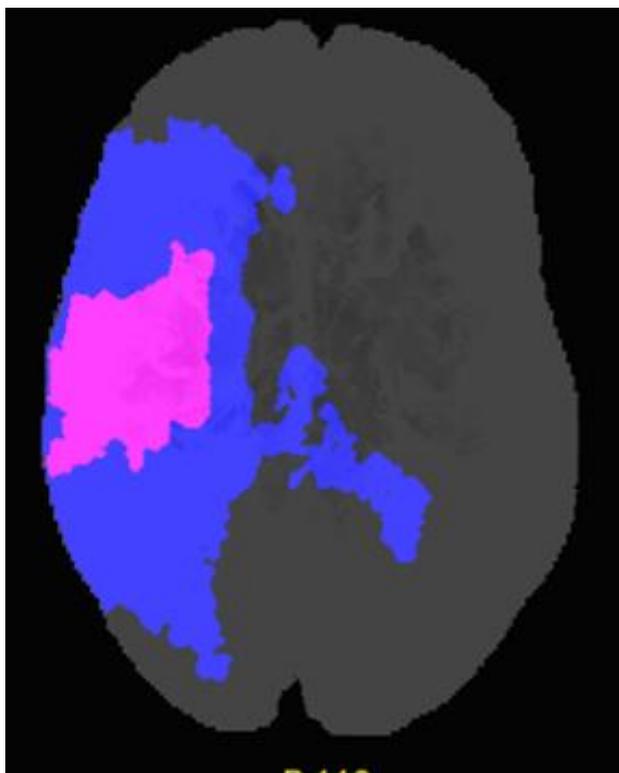


**TROMBECTOMÍA
MECÁNICA**

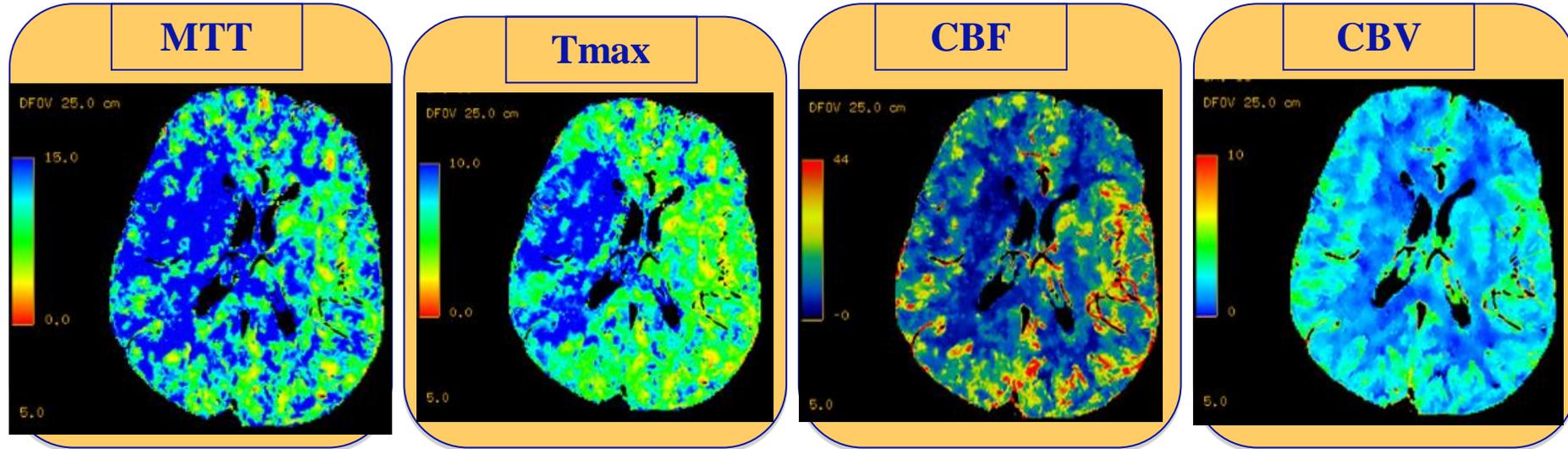


10 días

- 1. Infarto establecido
- 2. Penumbra
- 3. Ratio entre ambos

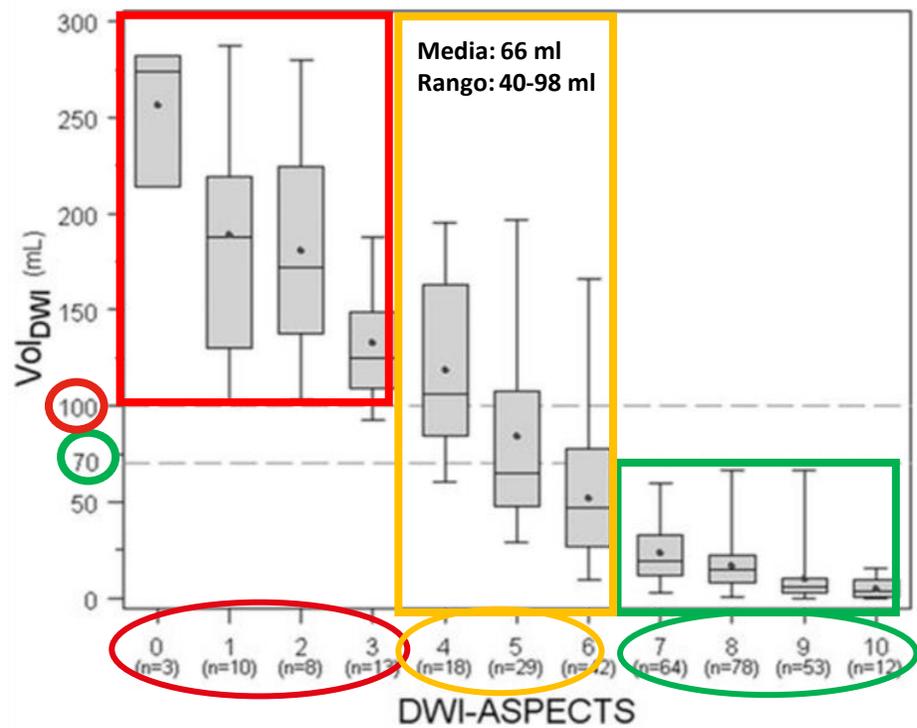
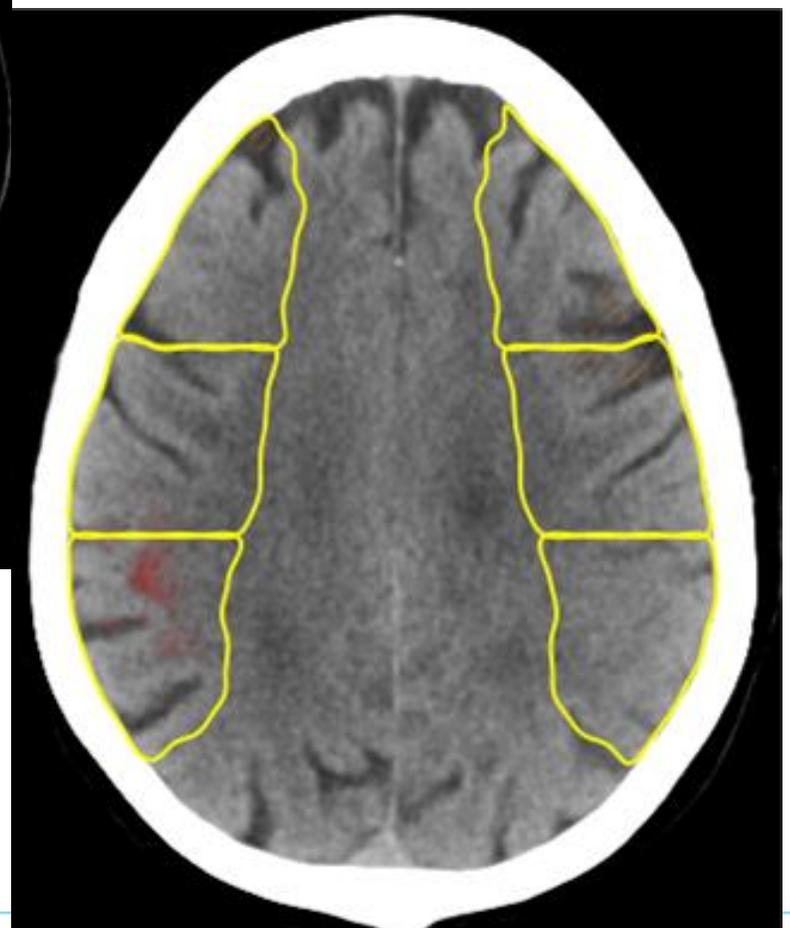
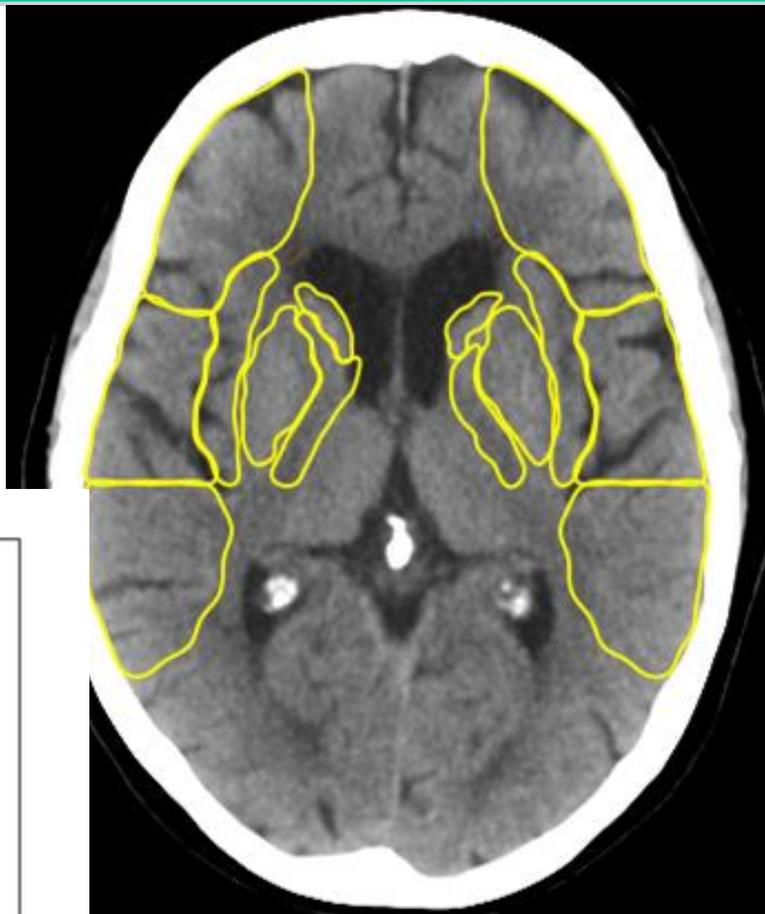


| | DEFUSE 3 | DAWN |
|---|--|---|
| Ischemic core volume CBF < 30% | <u>≤70 mL</u> | ≤20 mL if age >80 ≤30 mL if age <80 and NIHSS 10–20 ≤50 mL if age <80 and NIHSS >20 |
| Mismatch volume T _{max} > 6 s | <u>≥15 mL and a mismatch ratio of ≥1.8</u> | Not required |
| Vessel occlusion | M1 or ICA (cervical and intracranial) | M1 or ICA (intracranial and cervical if stent not anticipated to be required) |



| | MTT (sg) | Tmax (sg) | CBF (ml/100gr/min) | CBV (ml/100gr) |
|---------------------|----------|-----------|--------------------|----------------|
| PENUMBRA | + | + | - | = + |
| INFARTO ESTABLECIDO | + | + | - | - |

- 1. Infarto establecido
- 2. Penumbra
- 3. Ratio entre ambos



CONCLUSIÓN

TC CRANEAL SIN CIV



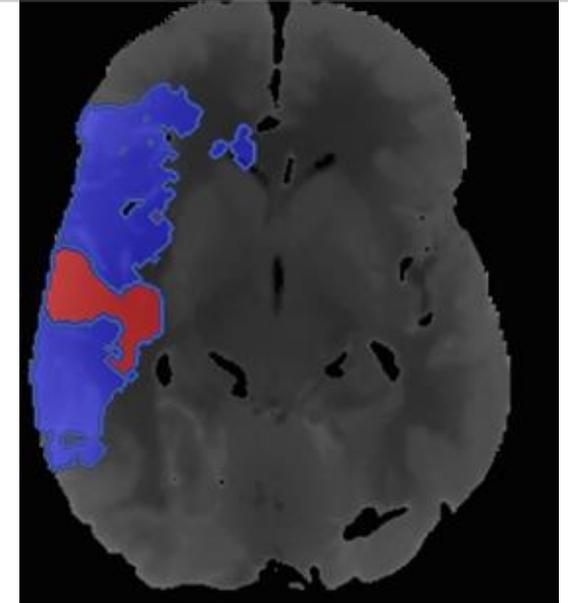
- Sangre y simuladores
- ICTUS isquémico: ASPECTS
- Trombo hiperdenso
- Otros hallazgos con relevancia

ANGIO-TC TSA INTRACRANEAL



- Defecto de repleción: localización y extensión
- Colaterales: escalas
- Circulación extracraneal: NASCET y vulnerabilidad
- Otros hallazgos: disección, malformaciones vasculares..

TC PERFUSIÓN



- Infarto establecido
- Penumbra
- Ratio entre penumbra e infarto

CONCLUSIÓN

| <u>TC BASAL</u> | |
|----------------------------|---|
| Sangre: SI/No | |
| Simuladores: | |
| ASPECT: 0-10 | Derecho/ Izquierdo I, L, C, CI M1, M2, M3 M4, M5, M6 |
| Trombo hiperdenso: | |
| Otras lesiones isquémicas: | |
| Otros hallazgos: | |

| <u>ANGIO-TC INTRACRANEAL</u> | | <u>ANGIO-TC EXTRACRANEAL</u> | |
|------------------------------|--|------------------------------|---|
| Defecto de repleción: | Localización: M1, M2, M3, M4 División anterosuperior División posteroinferior A1, A2, A3 | Extensión: mm | Placa: <ul style="list-style-type: none"> NASCET: % estenosis Vulnerabilidad |
| Colaterales | Fase Arterial: Menos, igual, más | Multifásico: m CTA: 5-0 | Otros: disección, malformación vascular... |

| <u>TC PERFUSIÓN</u> | | |
|-----------------------------|----------------|--|
| | Con volumetría | Sin volumetría |
| Infarto establecido: | ml | Aproximación: 1/3 territorio, ASPECTS |
| Penumbra: | ml | % respecto al infarto |
| Ratio P/CI | | % |

MUCHAS GRACIAS



Isabel.herherrera@gmail.com