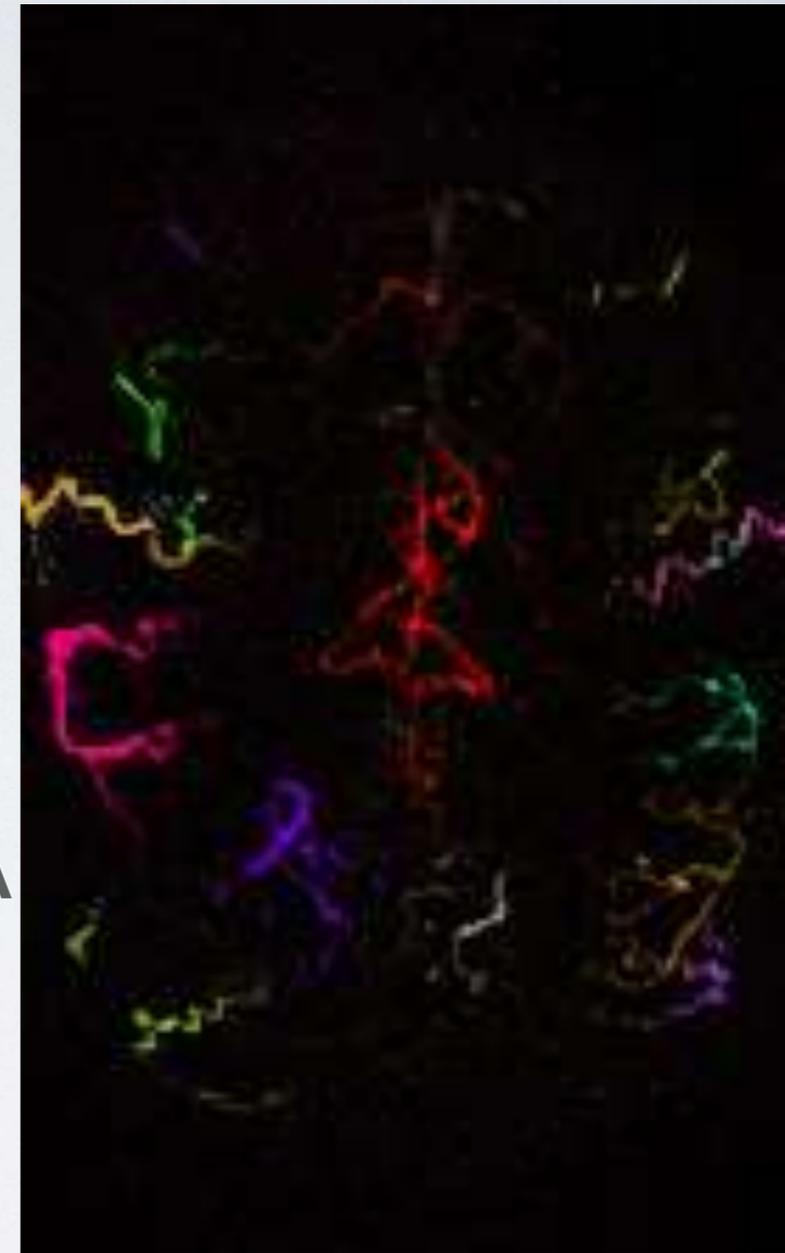


AVANCES EN RM EN PATOLOGÍA VASCULAR

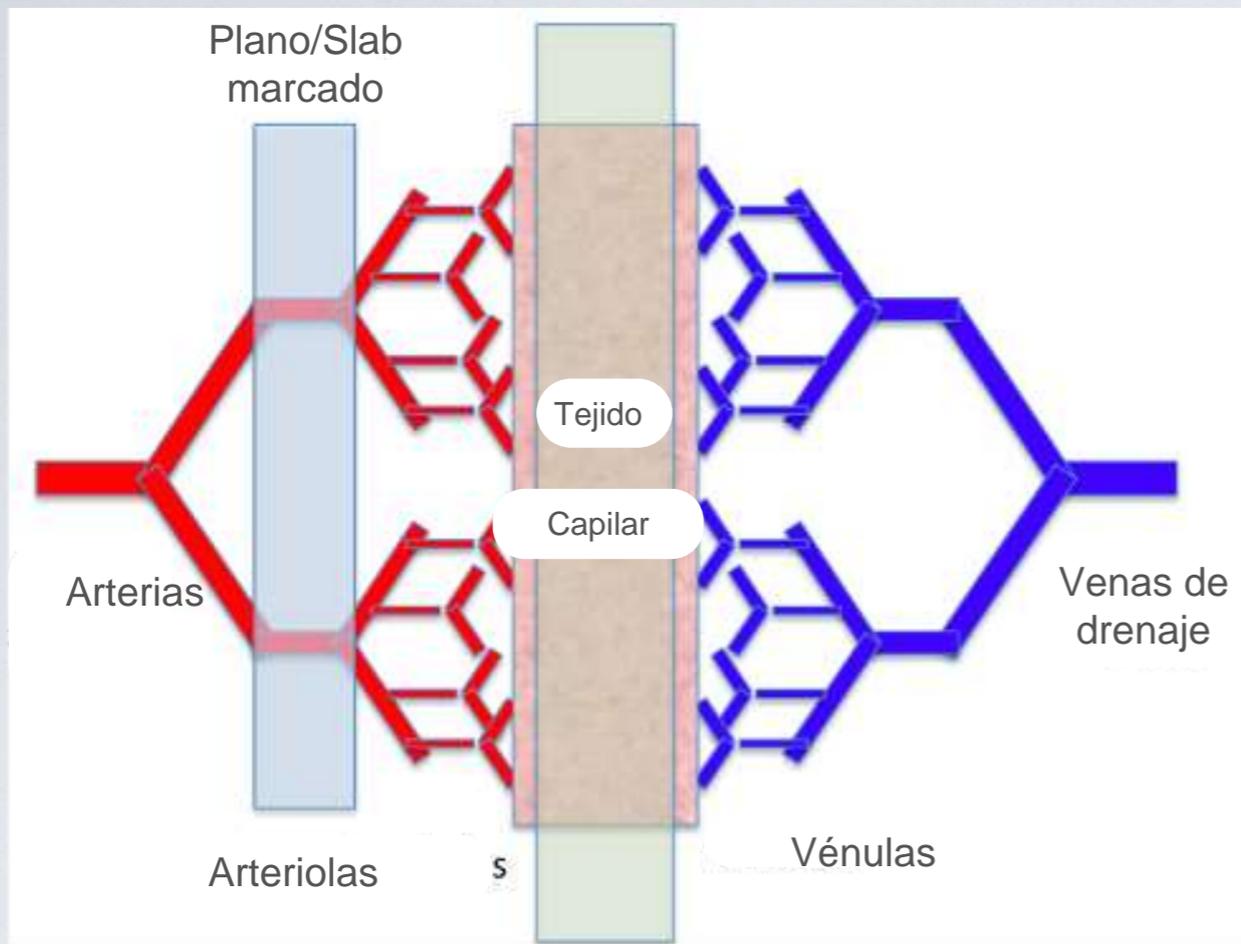
DR. ALBERTO CABRERA
OSATEK RM H. GALDAKAO

No conflictos de interés



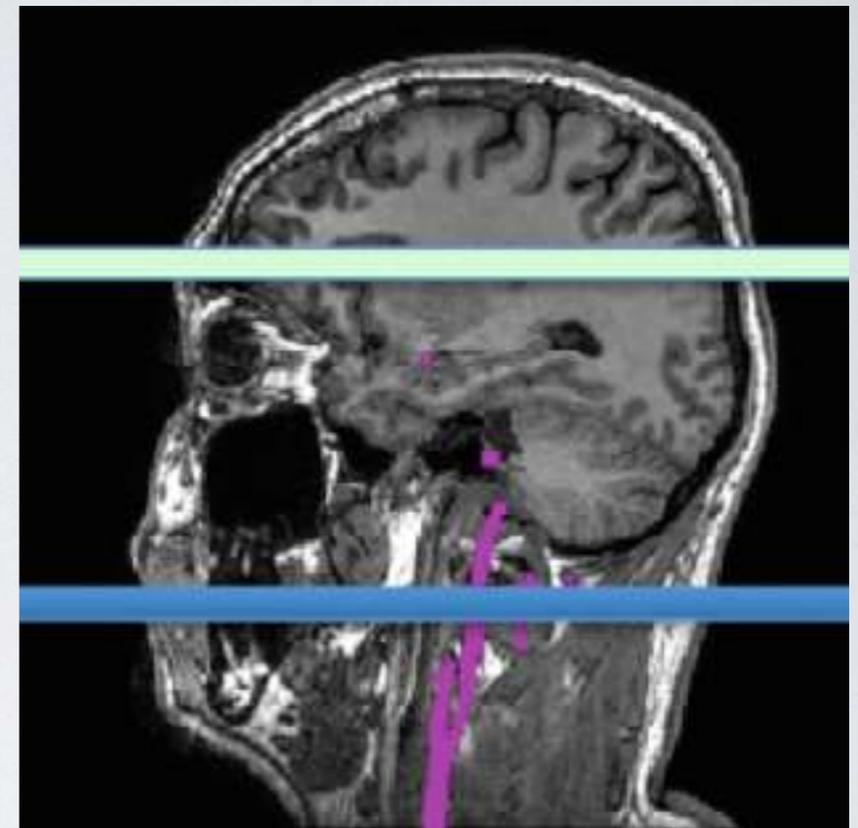
OBJETIVOS

- **ASL, ANGIO ASL 4D, ASL Territorial**
- **Aspectos técnicos**
- Hallazgos en Isquemia Aguda
- Hallazgos en Enf. esteno oclusiva
- Valoración de Shunt Arteriovenoso



Adaptado de Neuroradiology 2015;57:1181-1202

ΔX
2-3 cm



ΔT
1000 ms

PCASL: Espacial + Flujo

PCASL

Lectura GRASE/RARE (cartesiana o espiral)

Buena SNR

Eficiencia de marcado de 80-85%

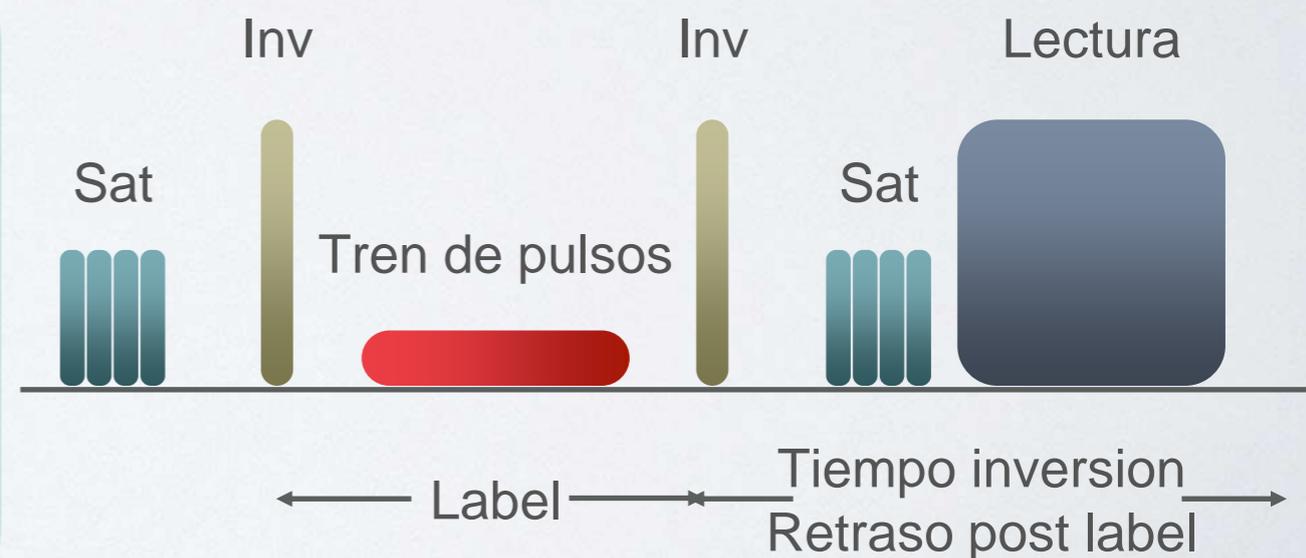
Buena supresión de señal del tejido estacionario

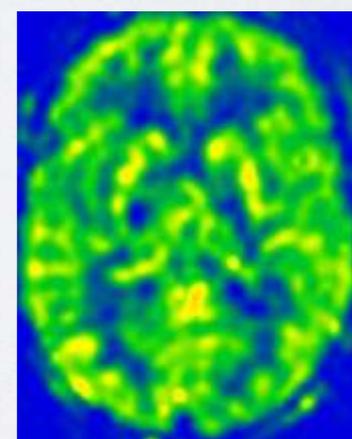
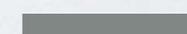
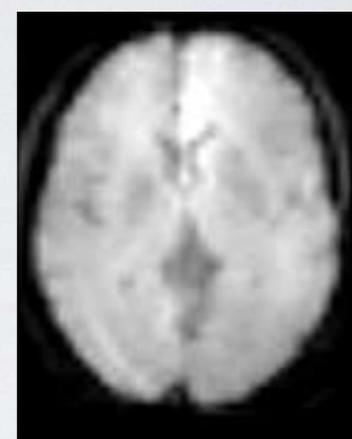
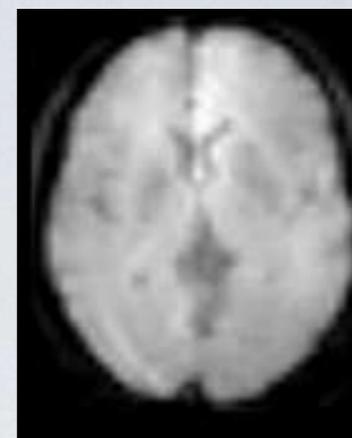
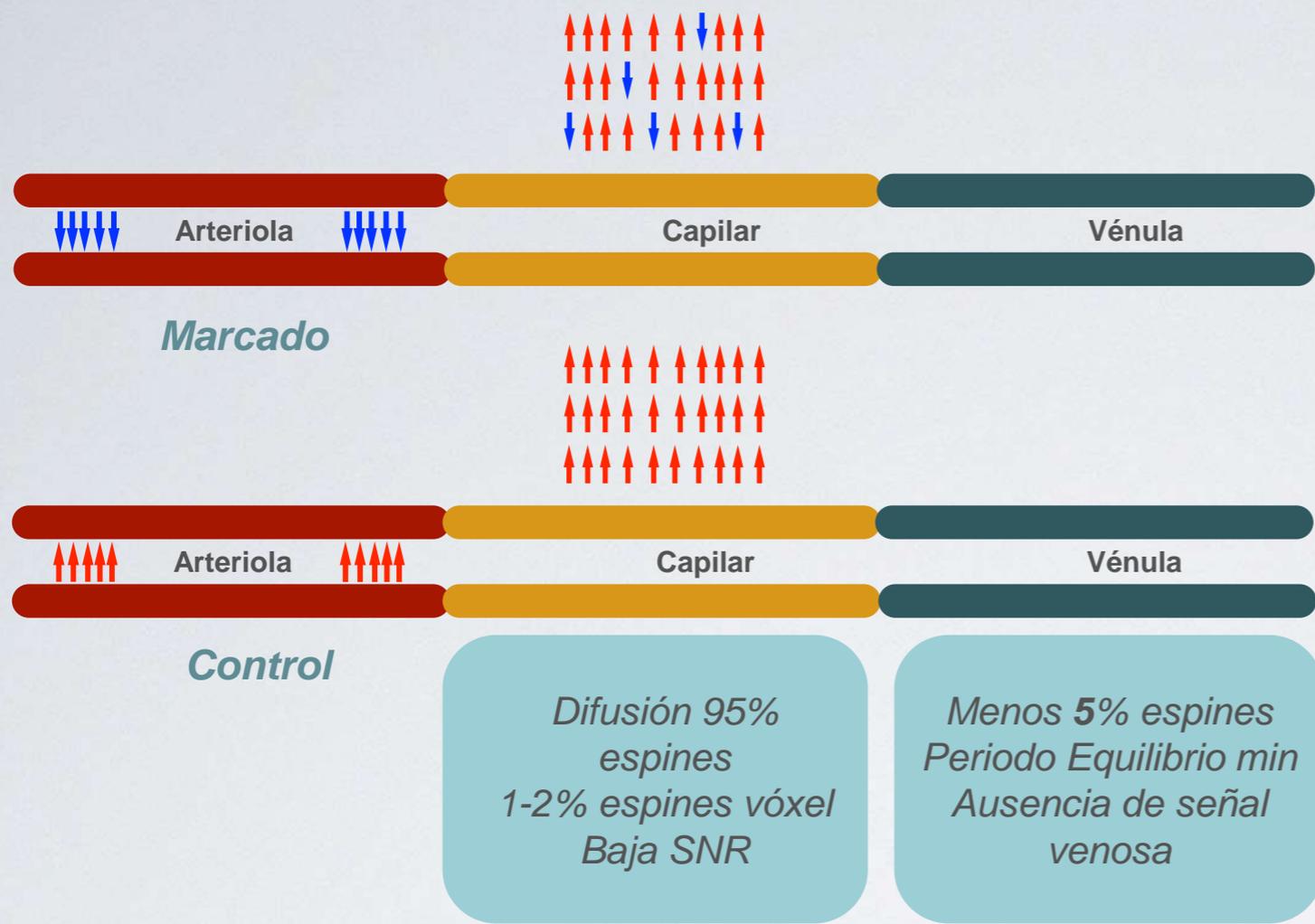
Menos artefactos de susceptibilidad magnética

Menor variabilidad de señal inter e intrasujeto

Posibilidad de adquirir 3D

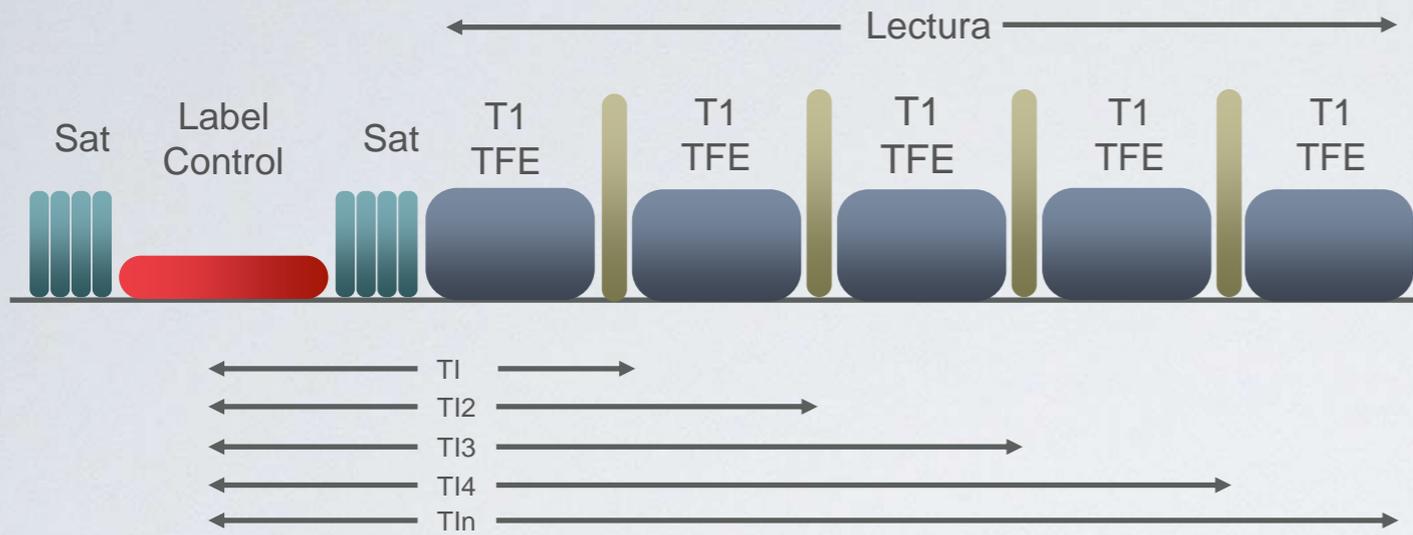
Todos los cortes se adquieren con el mismo PLD/TI



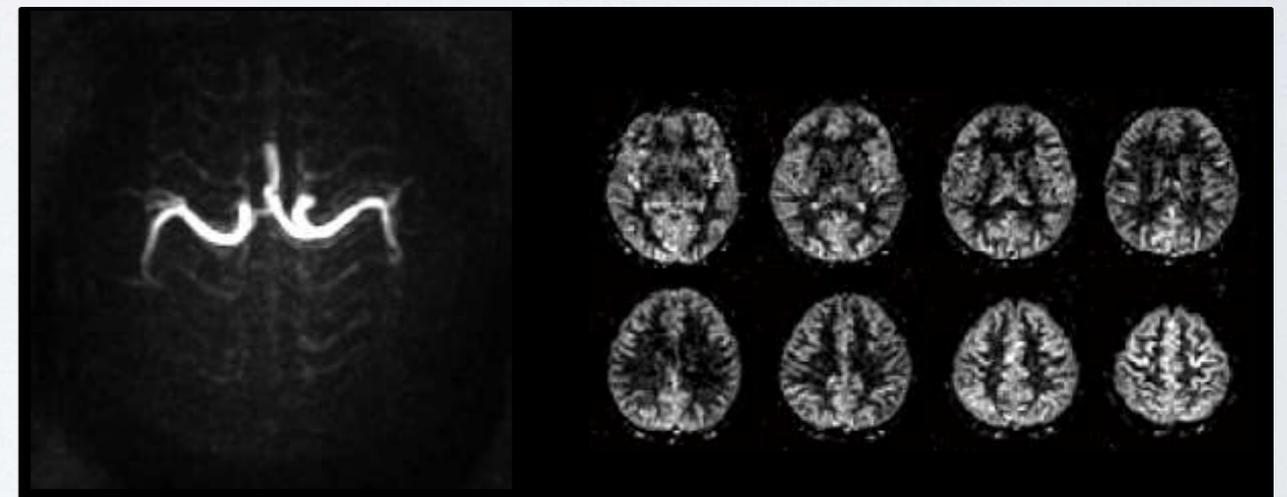
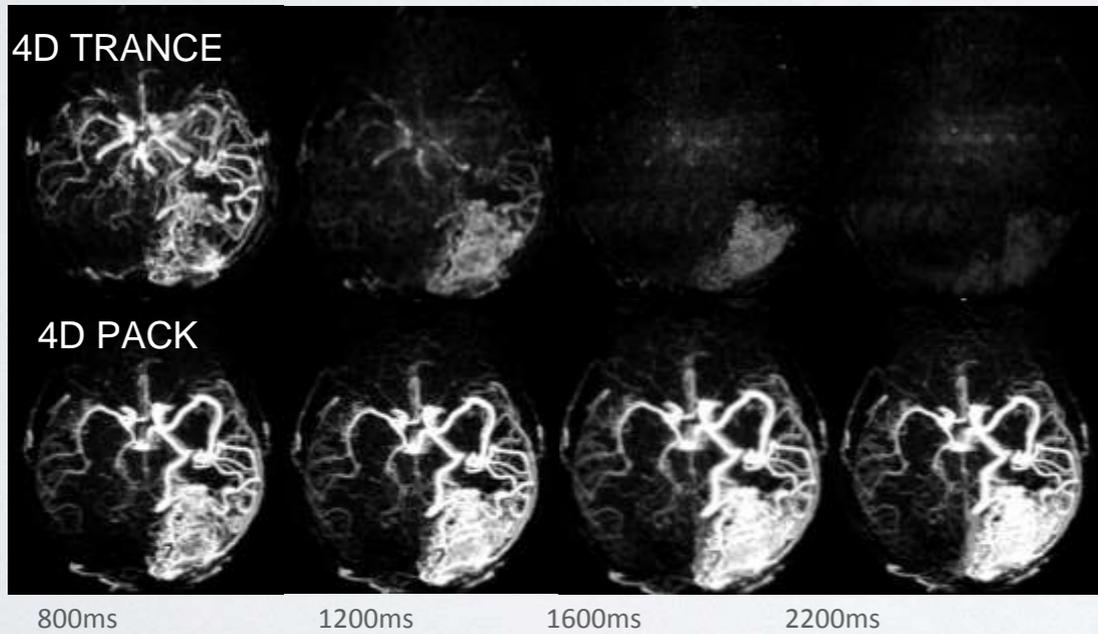
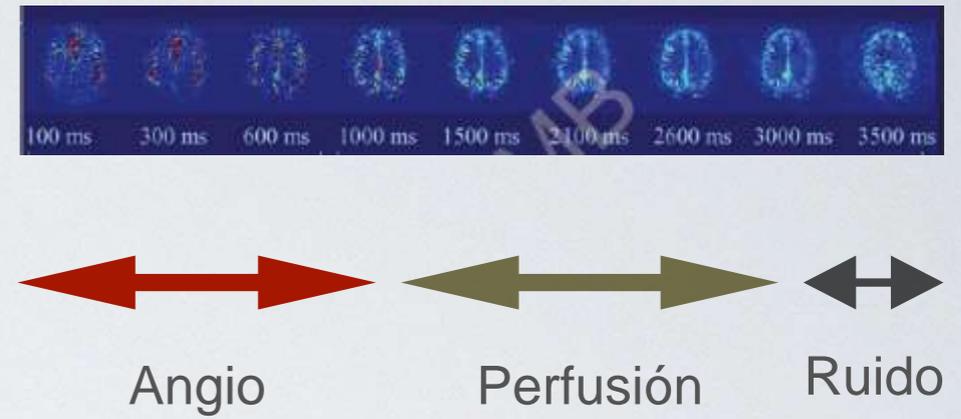


- A mayor flujo cerebral mayor diferencia de señal con respecto a ese mismo corte adquirido sin pulsos de inversión o saturación (control): **SG**
- Poco sensible en áreas de bajo flujo y áreas con mucho tiempo de tránsito arterial: **SB**
- Muy sensible a espines en el arbol vascular: **ATA** (Arterial Transient Artifact)

ANGIO-ASL 4D



TI:150-200ms. 6-14 fases

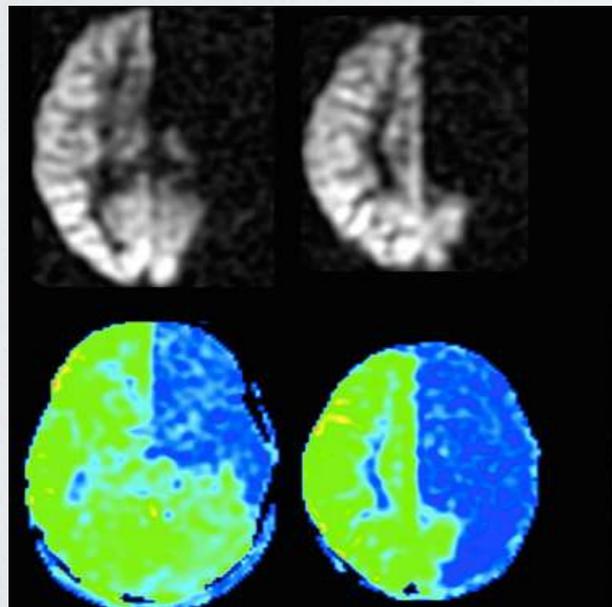
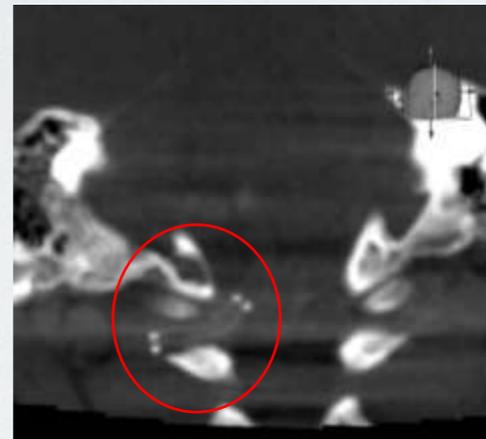
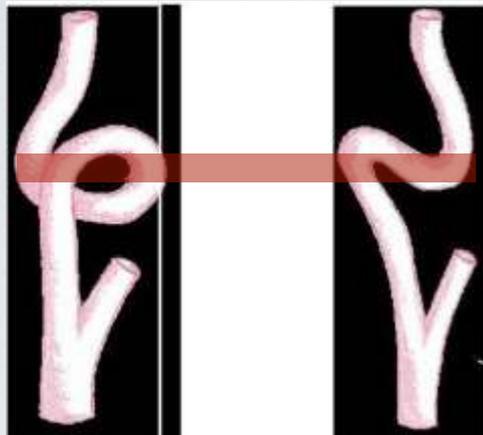
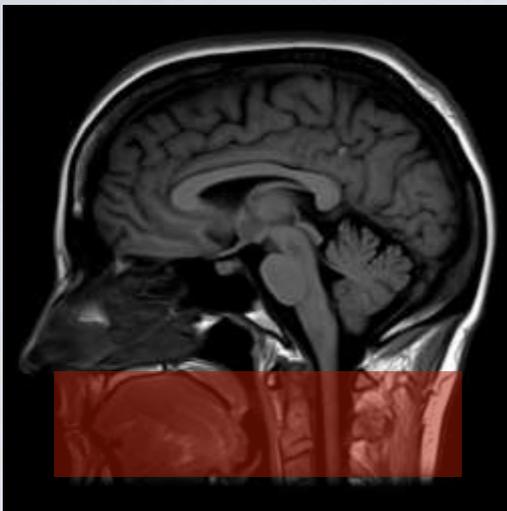


Adquisición conjunta fase vascular y tisular

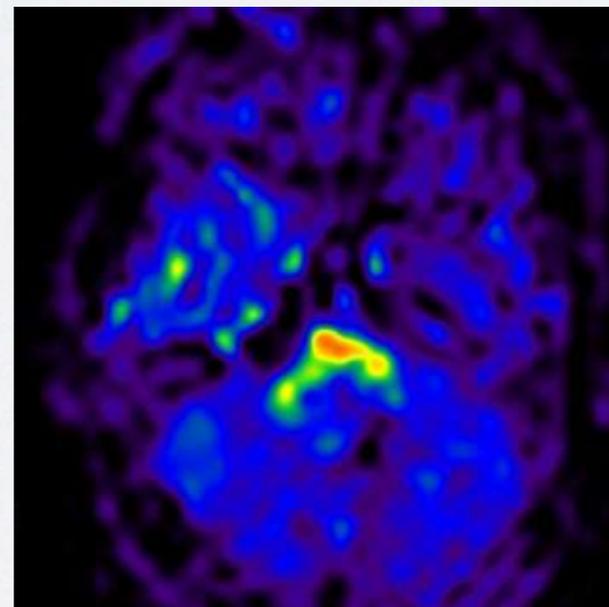
Cortesía: Osamu Togao, Kyushu University.

ARTEFACTOS MARCADO

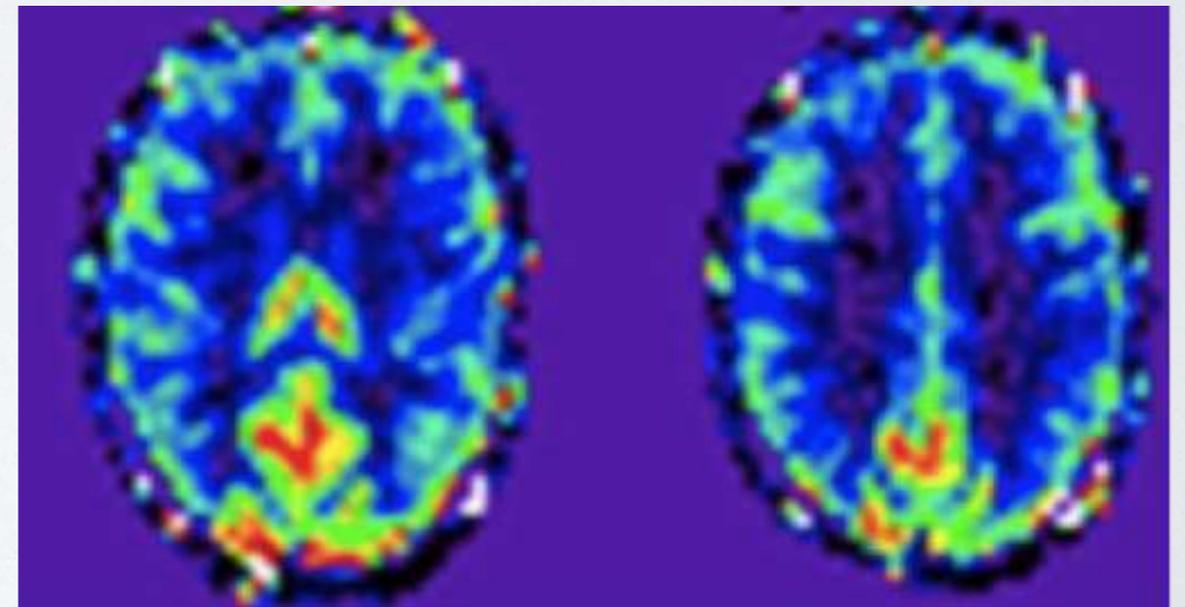
- **Pérdida efectividad del marcado**
 - Tortuosidad Carótida*
 - Artefacto susceptibilidad (Stent)*
- LCR hiperdinámico
- Reflujo Yugular
- Adquisición ojos abiertos



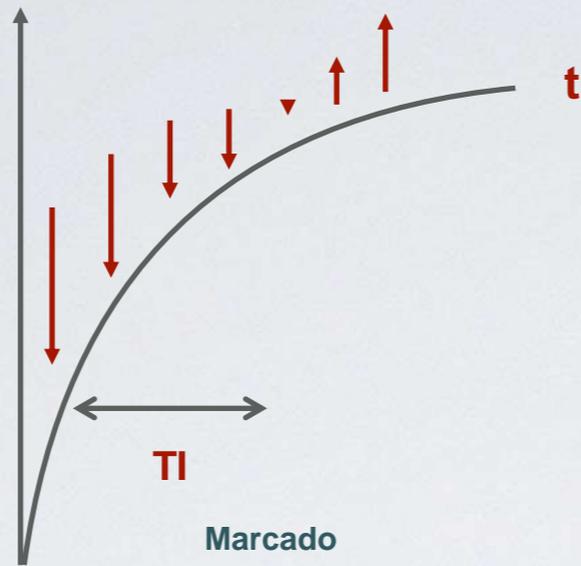
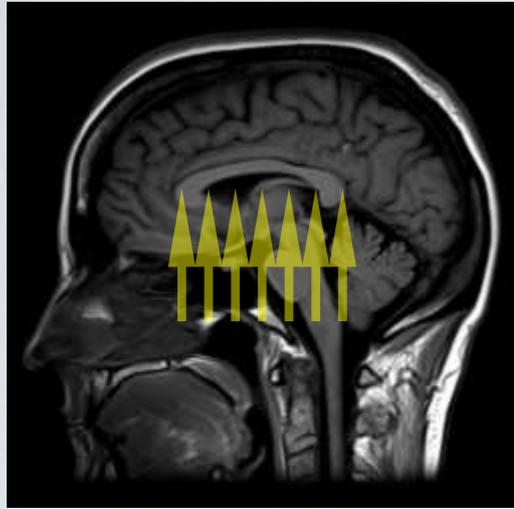
Artefacto Susceptibilidad



LCR hiperdinámico

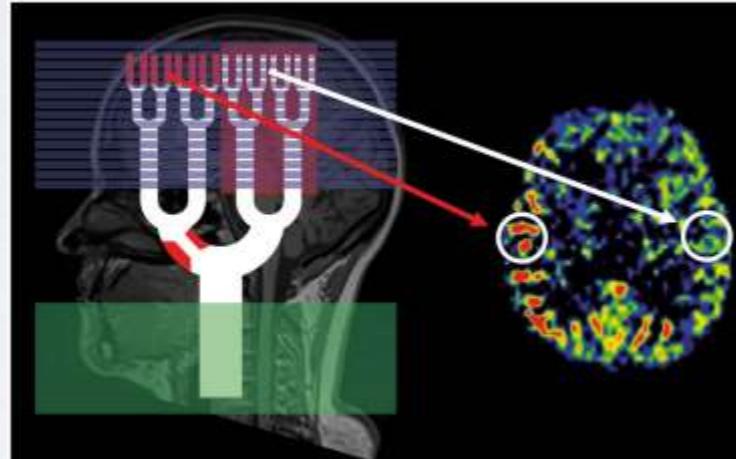


Adquisición ojos abiertos

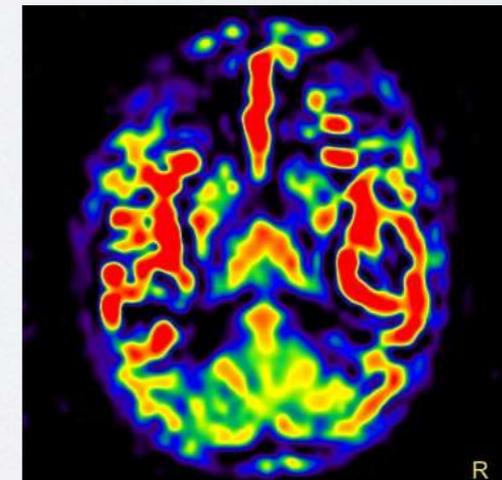
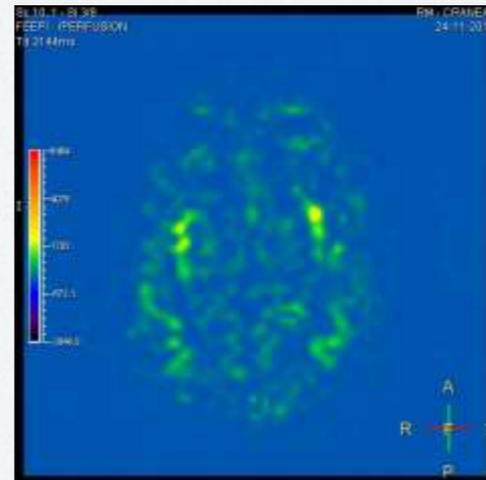
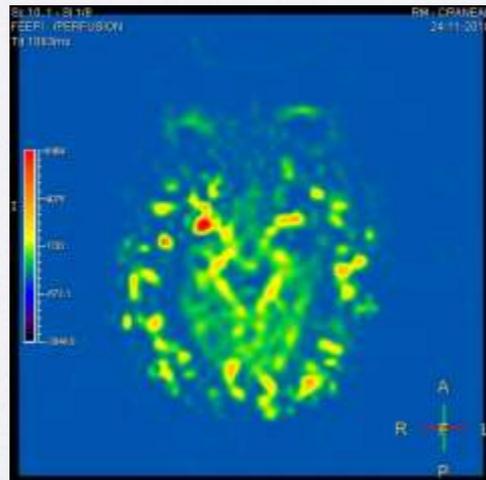
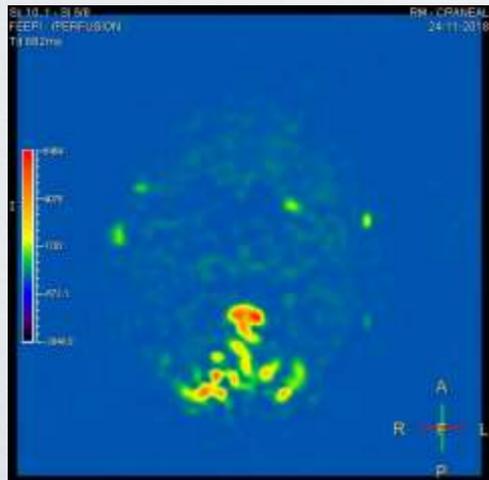


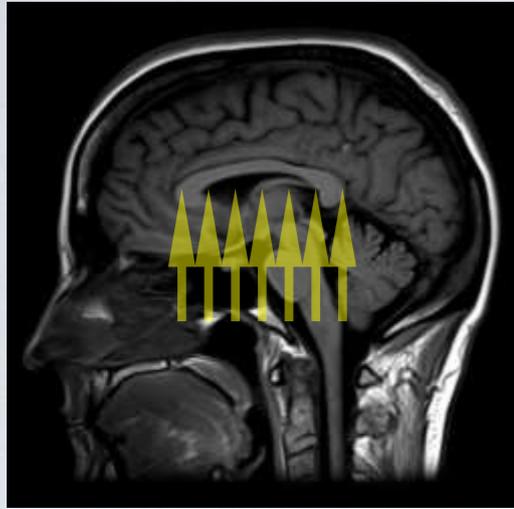
ARTEFACTOS TRÁNSITO

- Compromiso entre tiempo de tránsito arterial (TTA) y SNR por relajación T1
 - 65-70% Señal perdida a 2000 msg
 - 85% Señal perdida a 3000 msg
- Variación entre territorios e intraterritorial



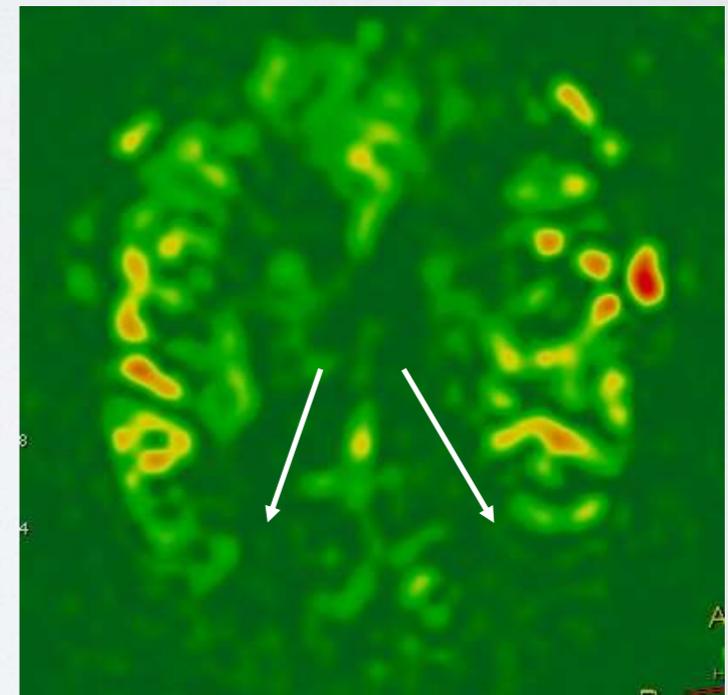
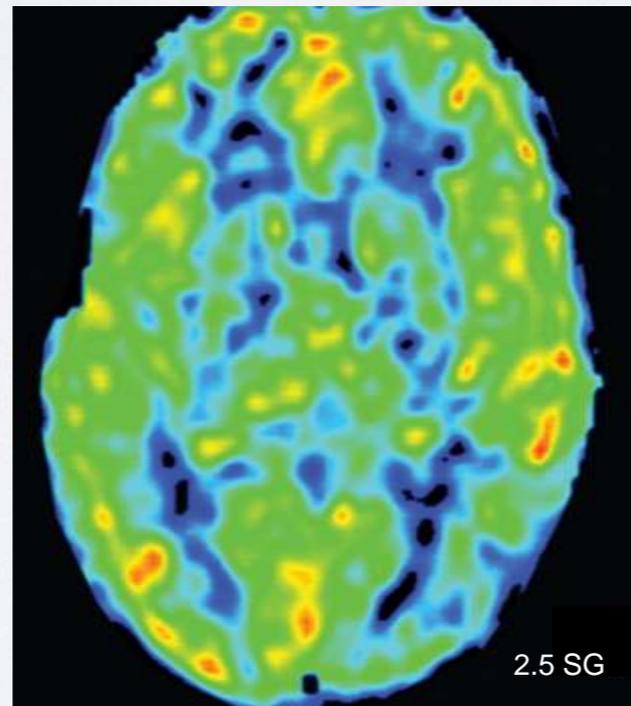
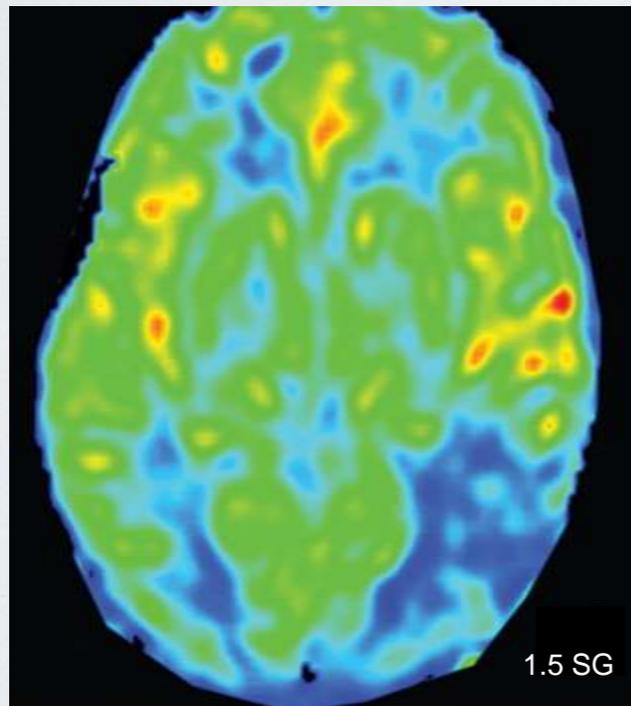
Plos One 2014;9



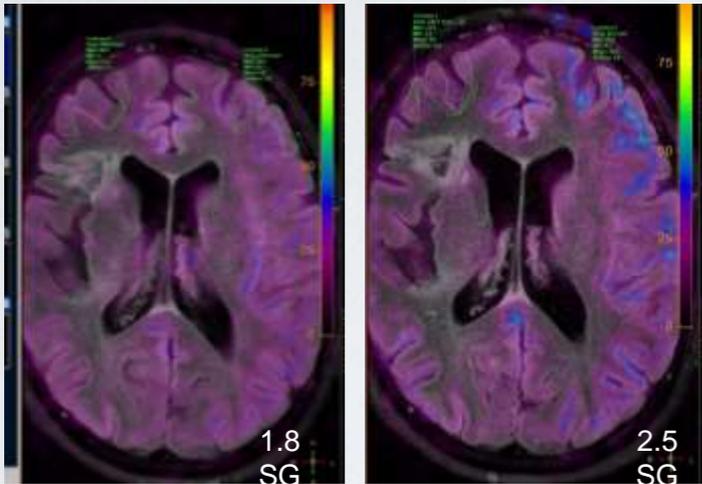
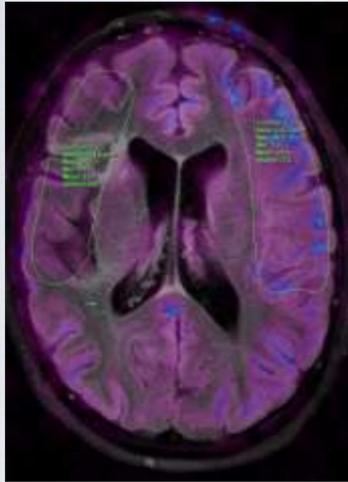


ARTEFACTOS TRÁNSITO

- **ATA** (Artefactos de tránsito arterial)*
- Sobreestimación focal de Hipoperfusión en función del tiempo de PLD
- **Borderzone** (global)*

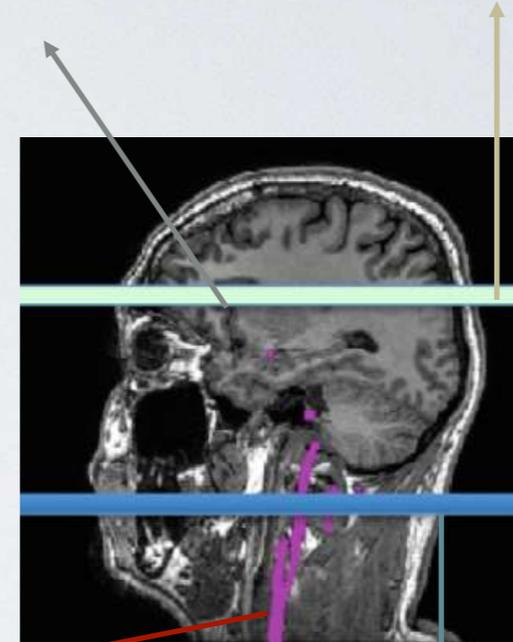


CUANTIFICACIÓN



T1 Sangre a T1 tejido
 Infraestima si se utiliza un modelo unicompartimental

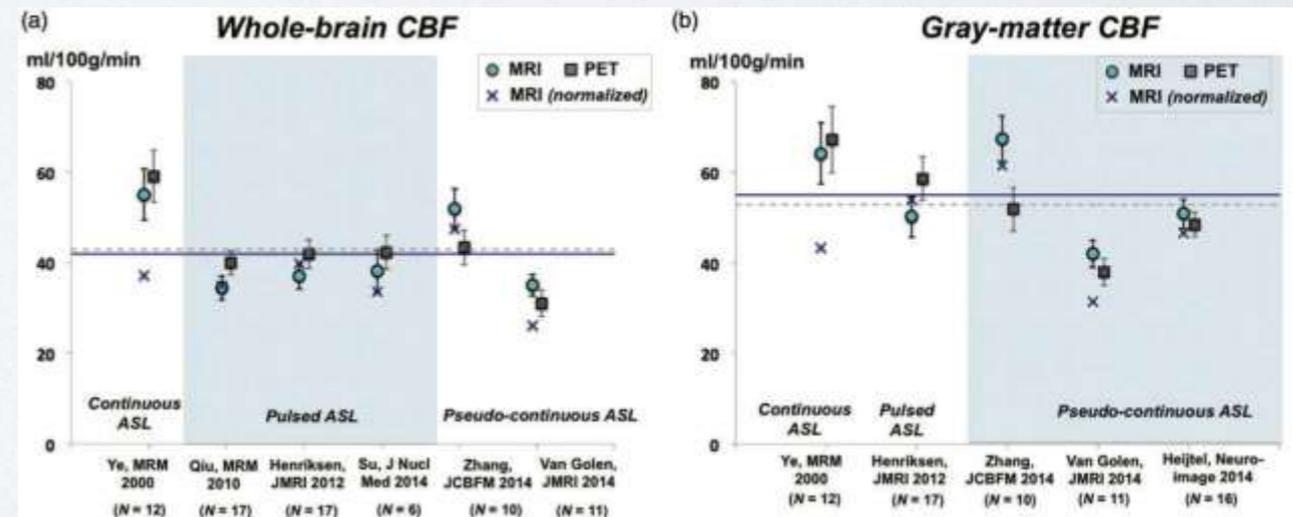
PLD
 Sobreestima o Infraestima si el es mayor del asumido



T1
 Sobreestima si mayor del asumido
 Infraestima si menor del asumido

Eficiencia
 Sobreestima si mayor de la asumida
 Infraestima si menor de la asumida

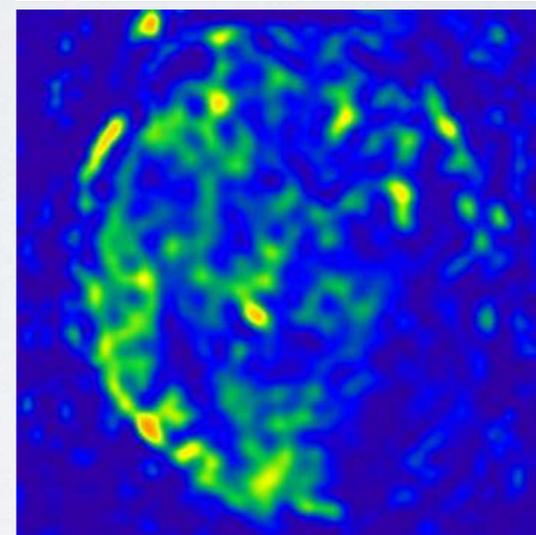
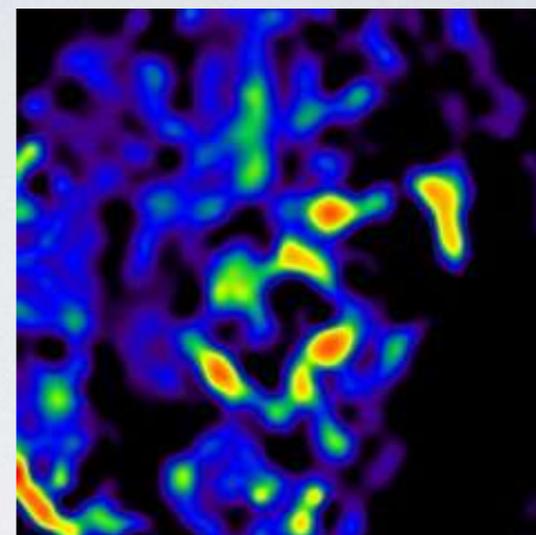
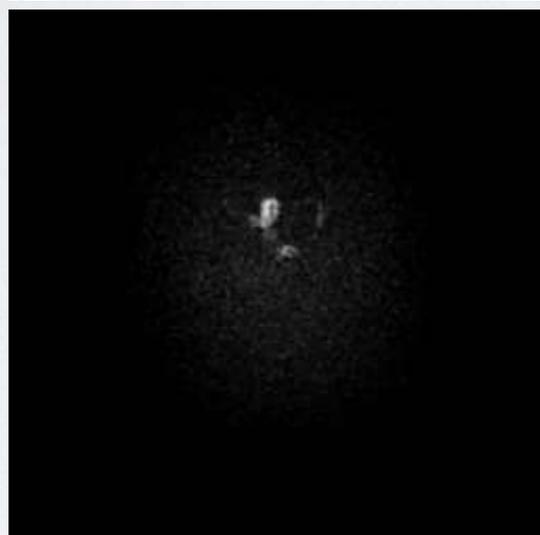
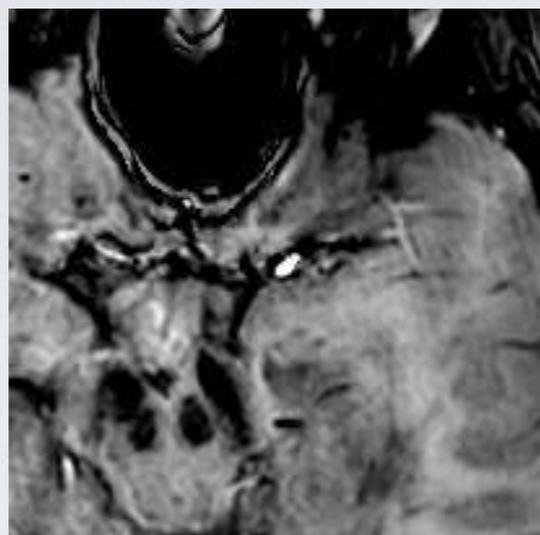
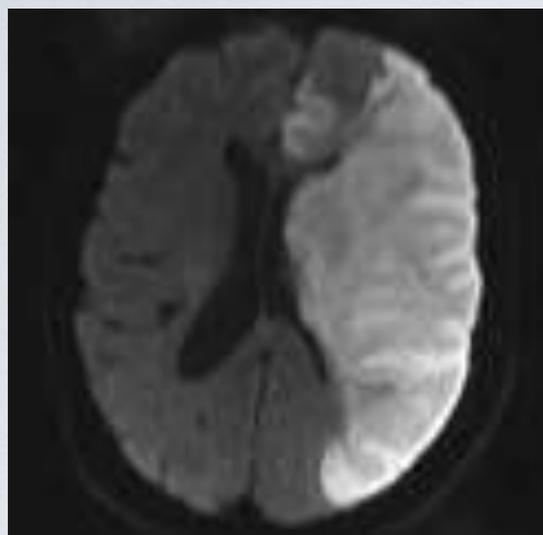
- Gasto cardiaco y tiempo de tránsito arterial
- Bolo de velocidad constante
- Eficiencia de marcado
- T1 sangre/tejido
- Mo equilibrio



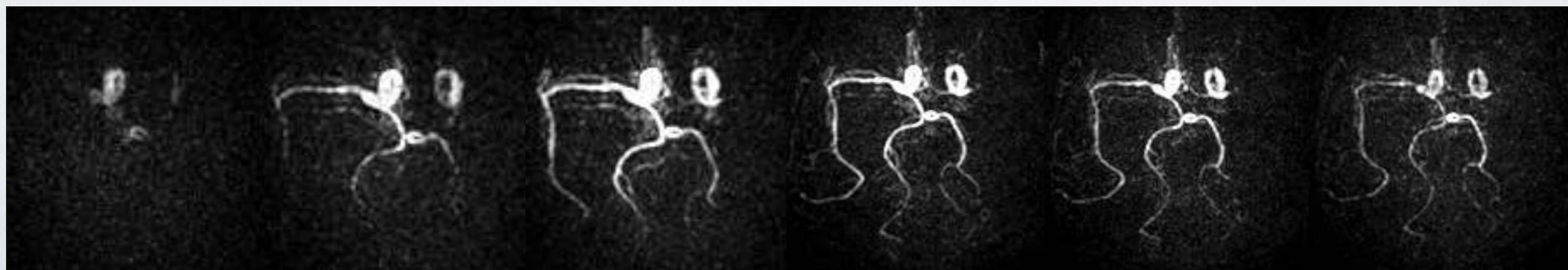
OBJETIVOS

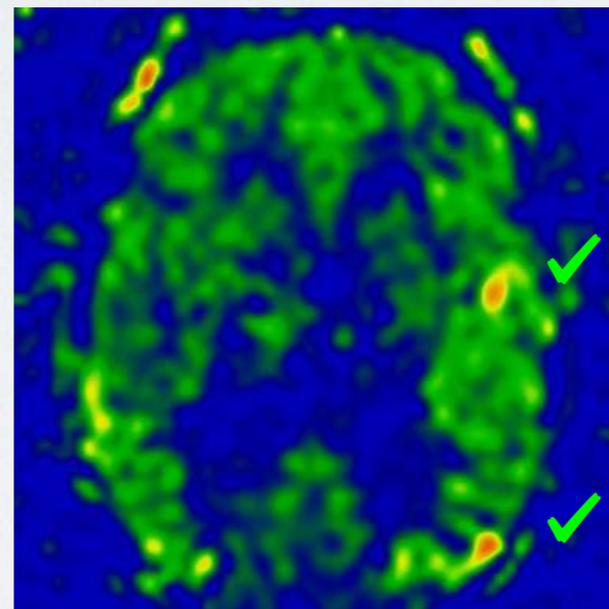
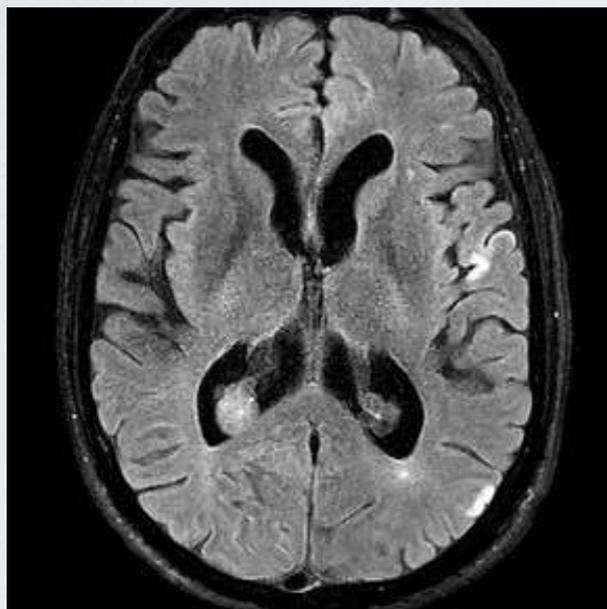
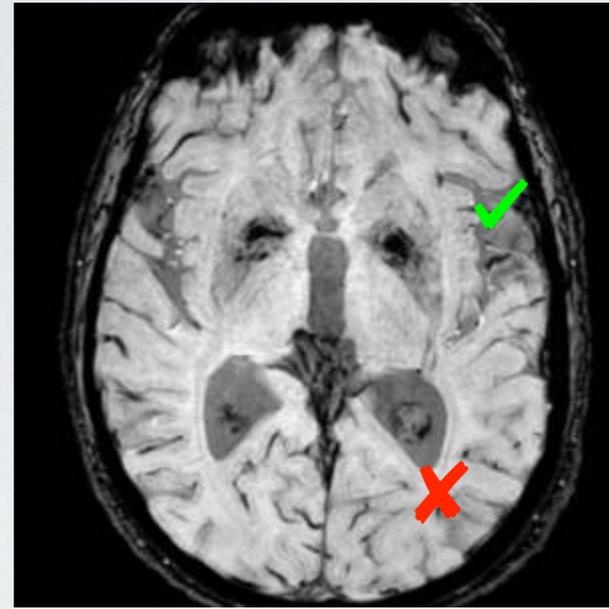
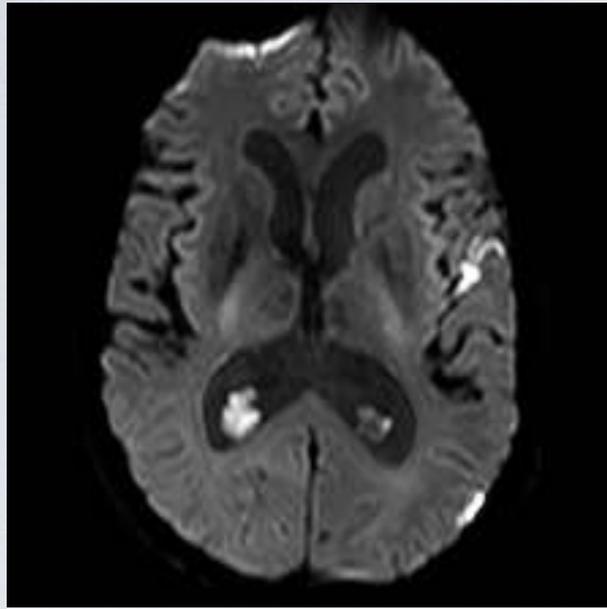
- **Hallazgos en Isquemia Aguda/Subaguda**
- Trombo
- Circulación colateral
- Hiperhemia/hiperperfusión
- AIT
- Simuladores

ATA: trombo



Despertar > 4.5h. Hemiplejia D, afasia global. Nivel conciencia preservado



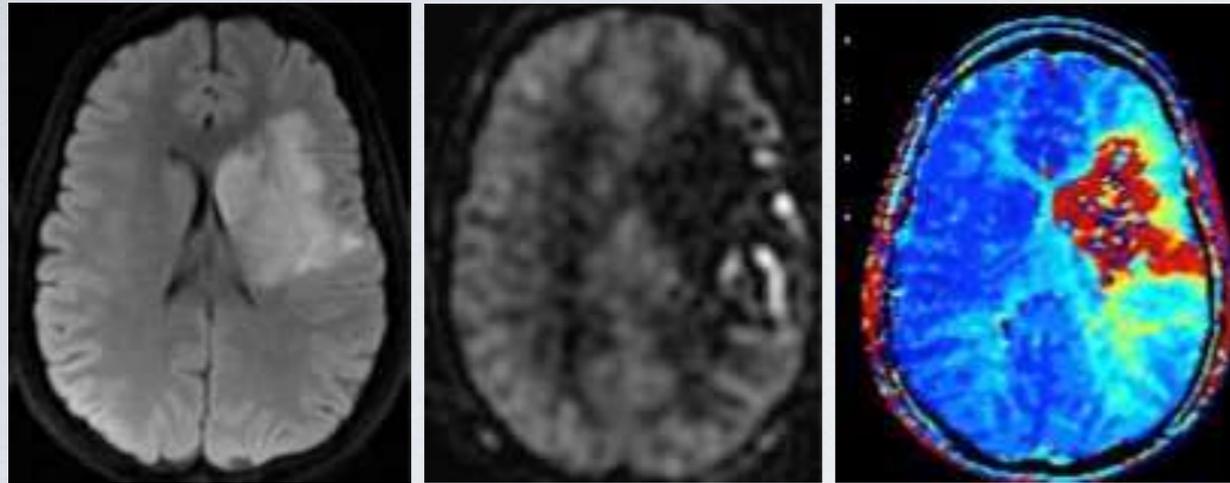


- Señal ASL depende de hemodinámica y es independiente de la composición del trombo
- Refleja el extremo proximal del trombo en SWI
- No identifica la longitud del trombo
- Más sensible para detectar trombos distales a M2 y en carótida interna intracraneal (artefactos de susceptibilidad)
- **FN** si se ocluye el ostium de perforantes (basilares, lenticuloestriadas o coroidea anterior)

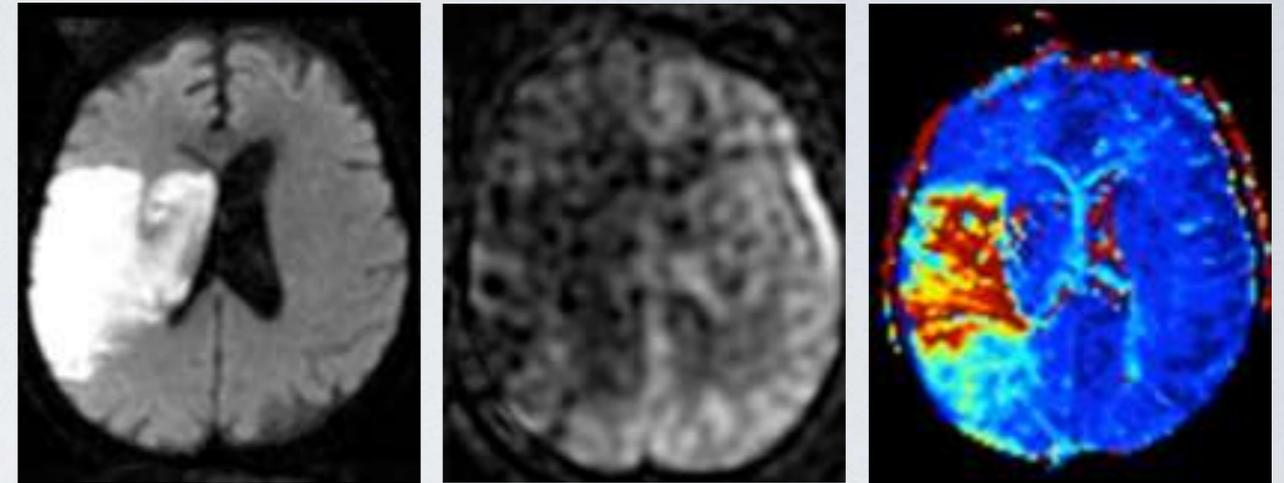
Cefalea y dificultad emisión lenguaje

	IAS	SVS	p values
Sensitivity, %	30 of 34 (88)	17 of 34 (50)	<0.05
Specificity, %	24 of 24 (100)	24 of 24 (100)	np
Positive predictive value, %	30 of 30 (100)	17 of 17 (100)	np
Negative predictive value, %	24 of 28 (86)	24 of 41 (59)	<0.05
Accuracy, %	54 of 58 (93)	41 of 58 (71)	<0.05

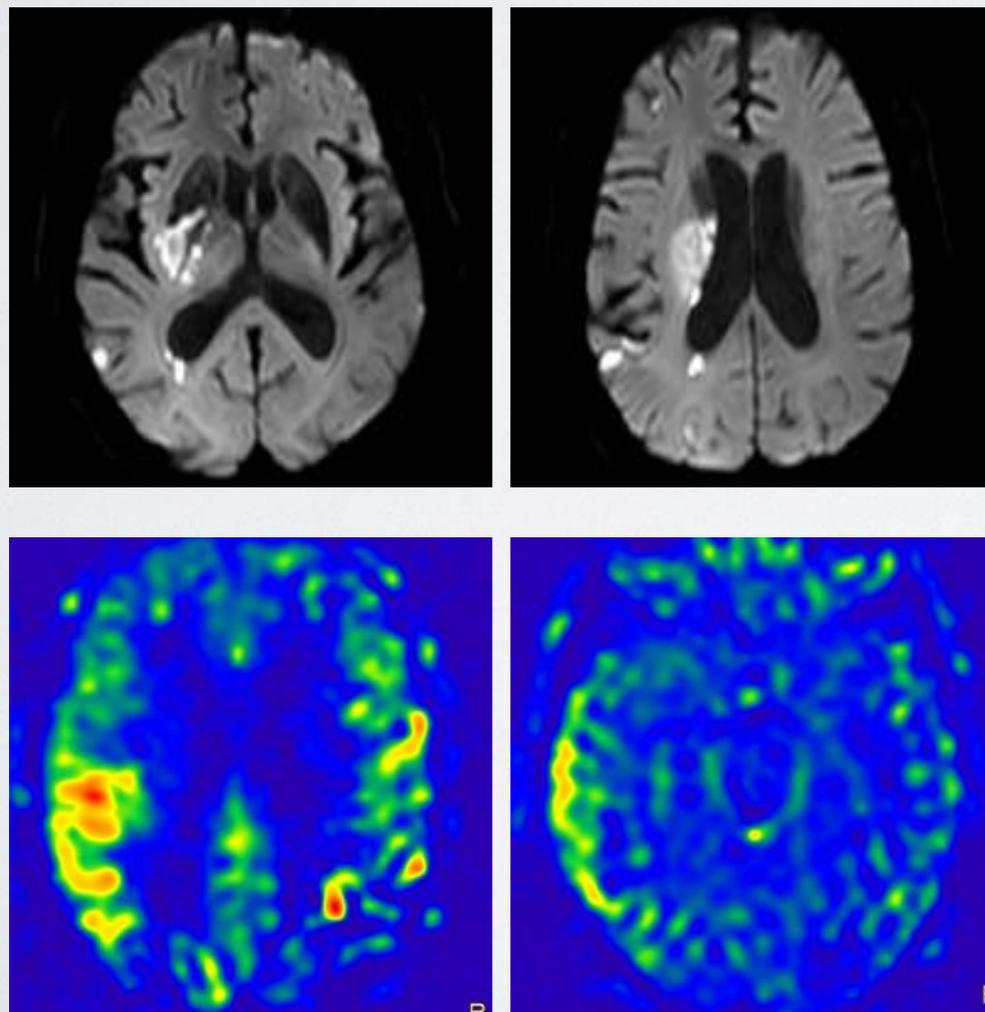
ATA: Colaterales



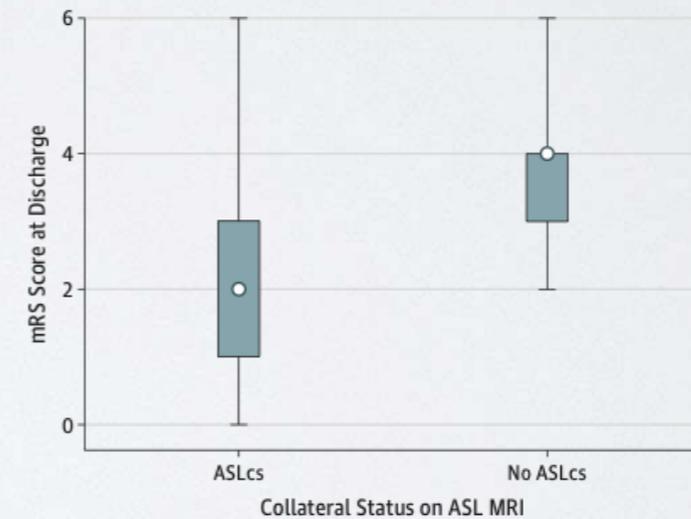
Neuroimaging Clin N Am. 2011; 21: 285–301.



- ATA en más de 10% de la superficie del infarto
- No hay correlación con las clasificaciones de circulación colateral



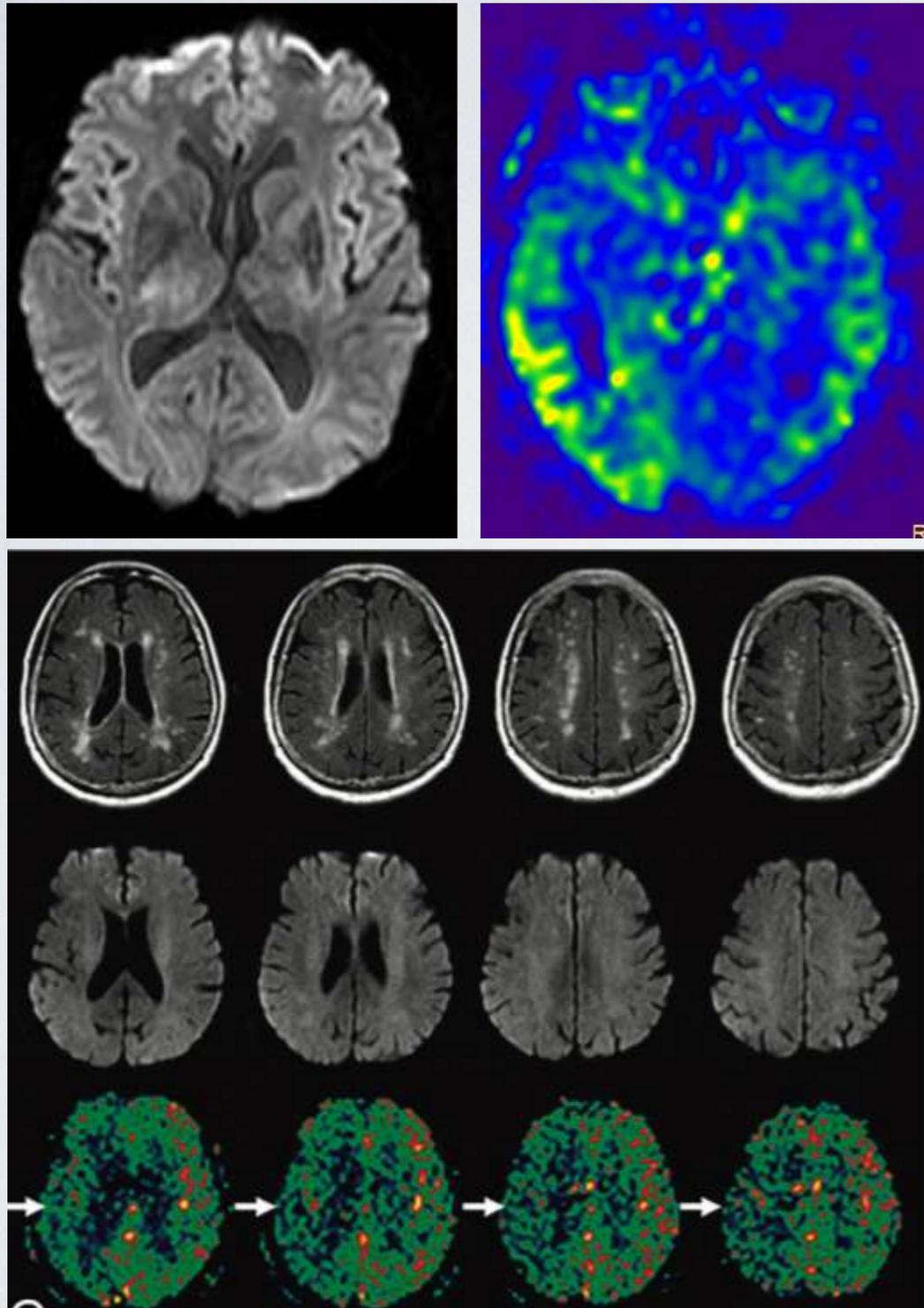
Cefalea, desorientación, hemiparesia y hemianopsia I.



JAMA 2017:74

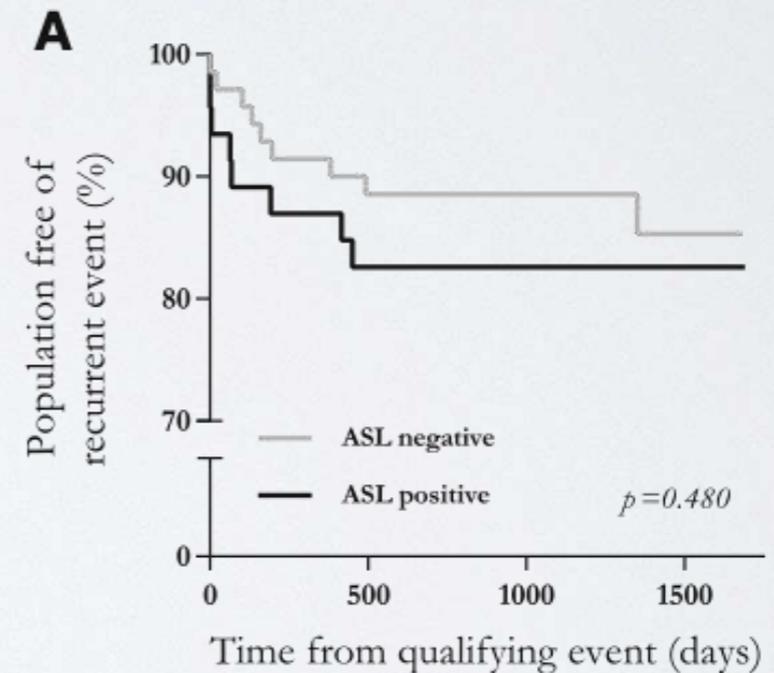
Análisis Univariante OR 6.4 descenso 1 punto mRS
 Análisis Multivariante* OR 5.1 descenso 1 punto mRS

*NIHSS, grado oclusión, mRS premórbido y FA



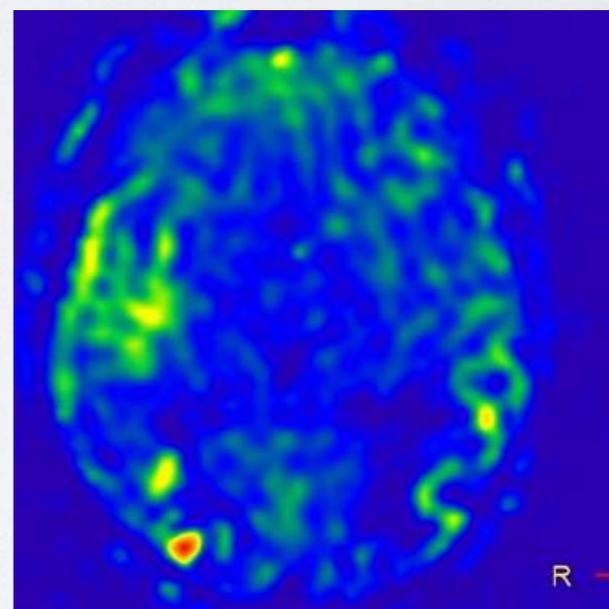
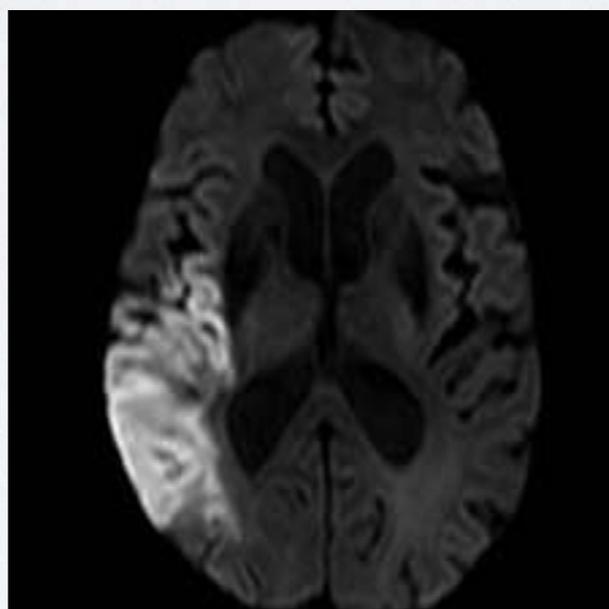
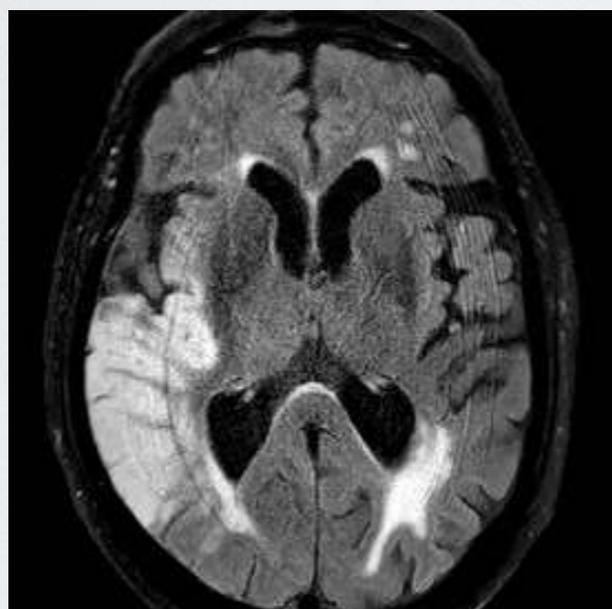
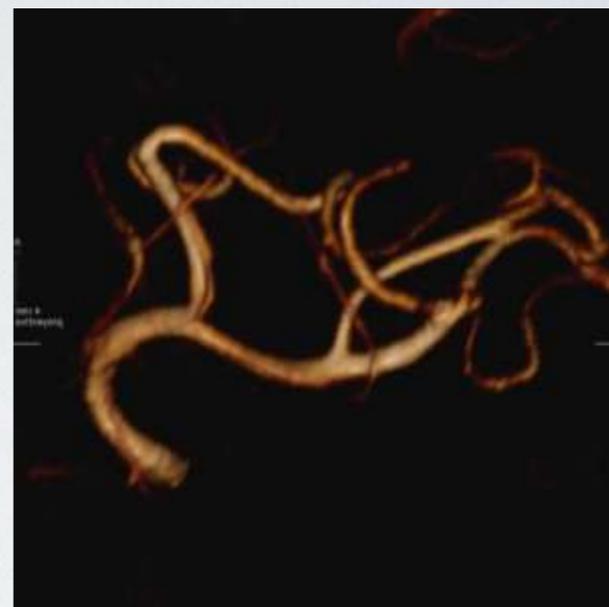
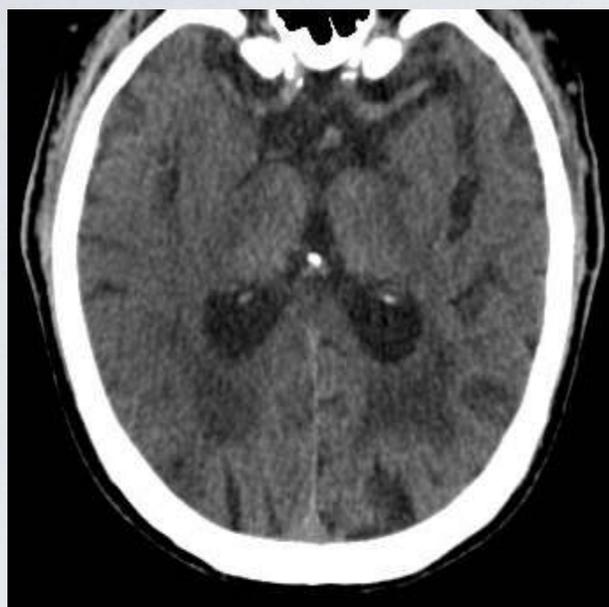
AJNR 2103.34:2125–30

- Puede manifestarse como **ATA**, hipoperfusión o hiperperfusión (poco frecuente)
- Incrementa la presencia de datos radiológicos de AIT de un 40% a casi un 60%
- Mejora el rendimiento diagnóstico de signos de isquemia pero no se ve un aumento estadísticamente significativo del número de lesiones residuales.

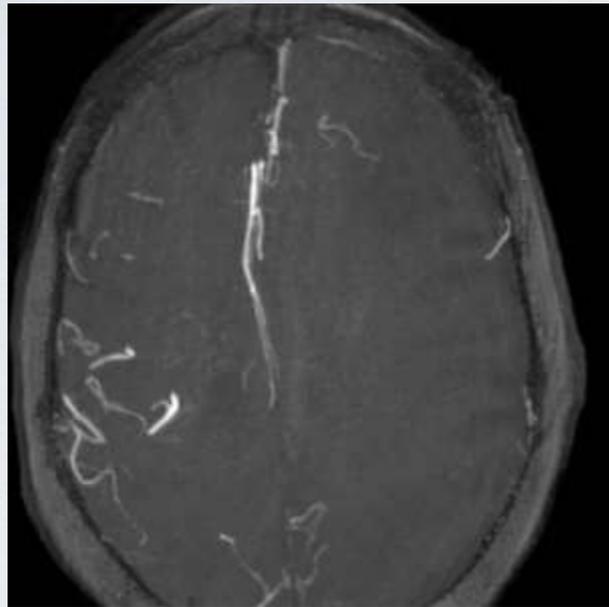


BMC Medical Imaging 2018;18:24-32

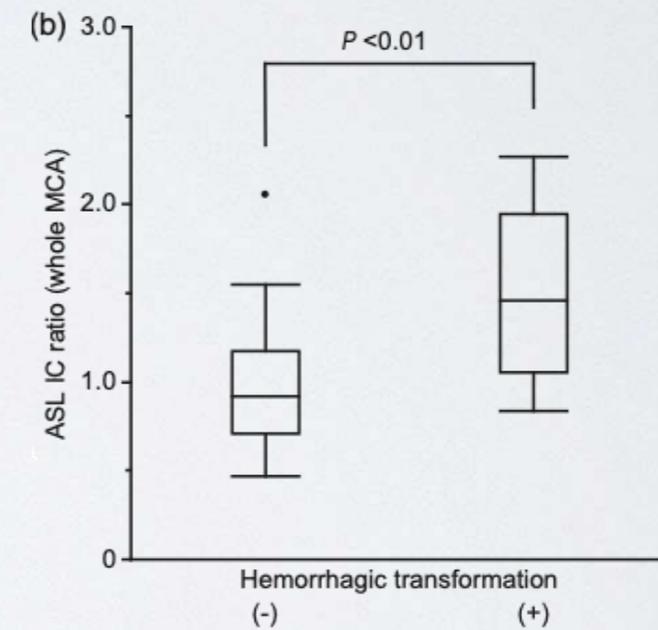
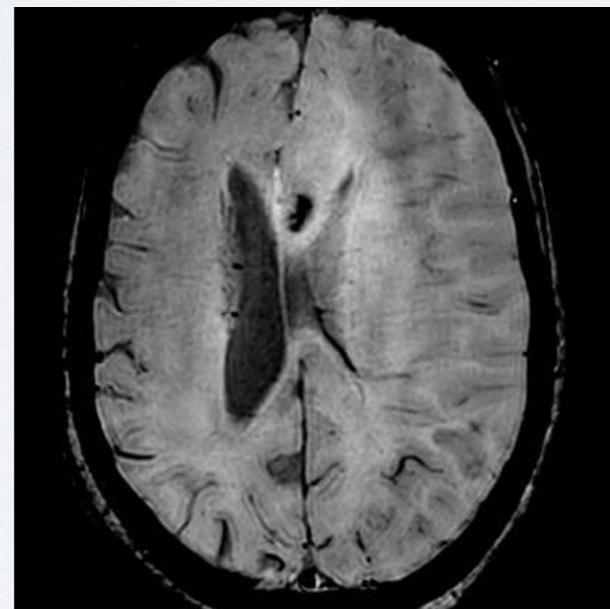
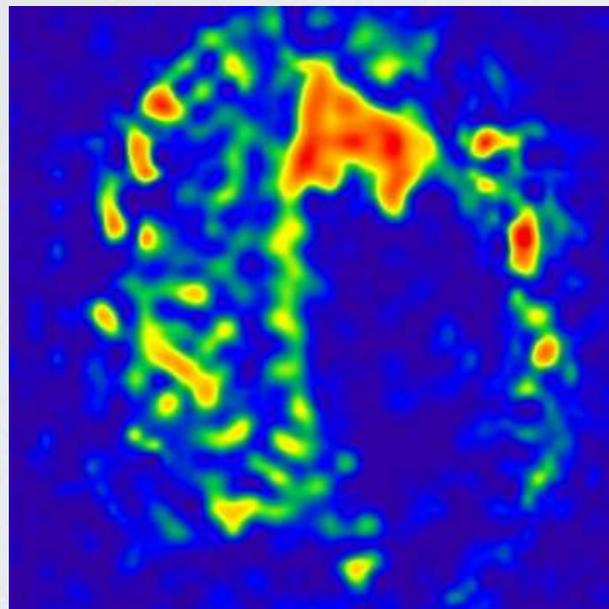
HIPERHEMIA



88 a. FA. Disartria, debilidad hemicuerpo I y hemianopsia y hemi inatención I. No fibrinolisis



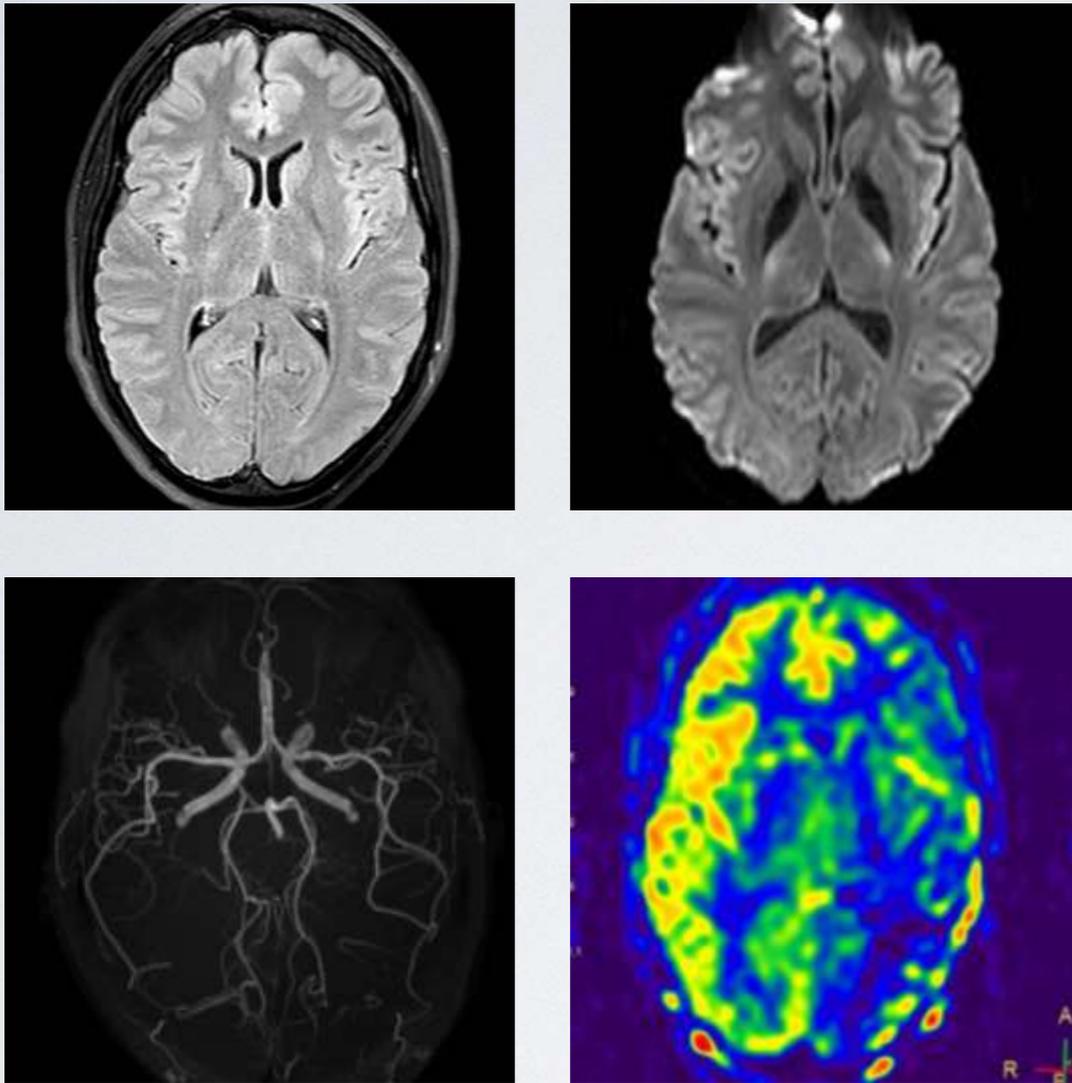
- Hiperhemia visible en 30% pacientes tras trombolisis
- Punto de corte para hemorragia no establecido
 - ♦ ¿1.7 con respecto al contralateral?
- **VPN muy alto.** Si no se observa aumento de señal en ASL es improbable que se desarrolle hiperperfusión



Trombectomía T carotídea. Mala evolución clínica

SIMULADORES

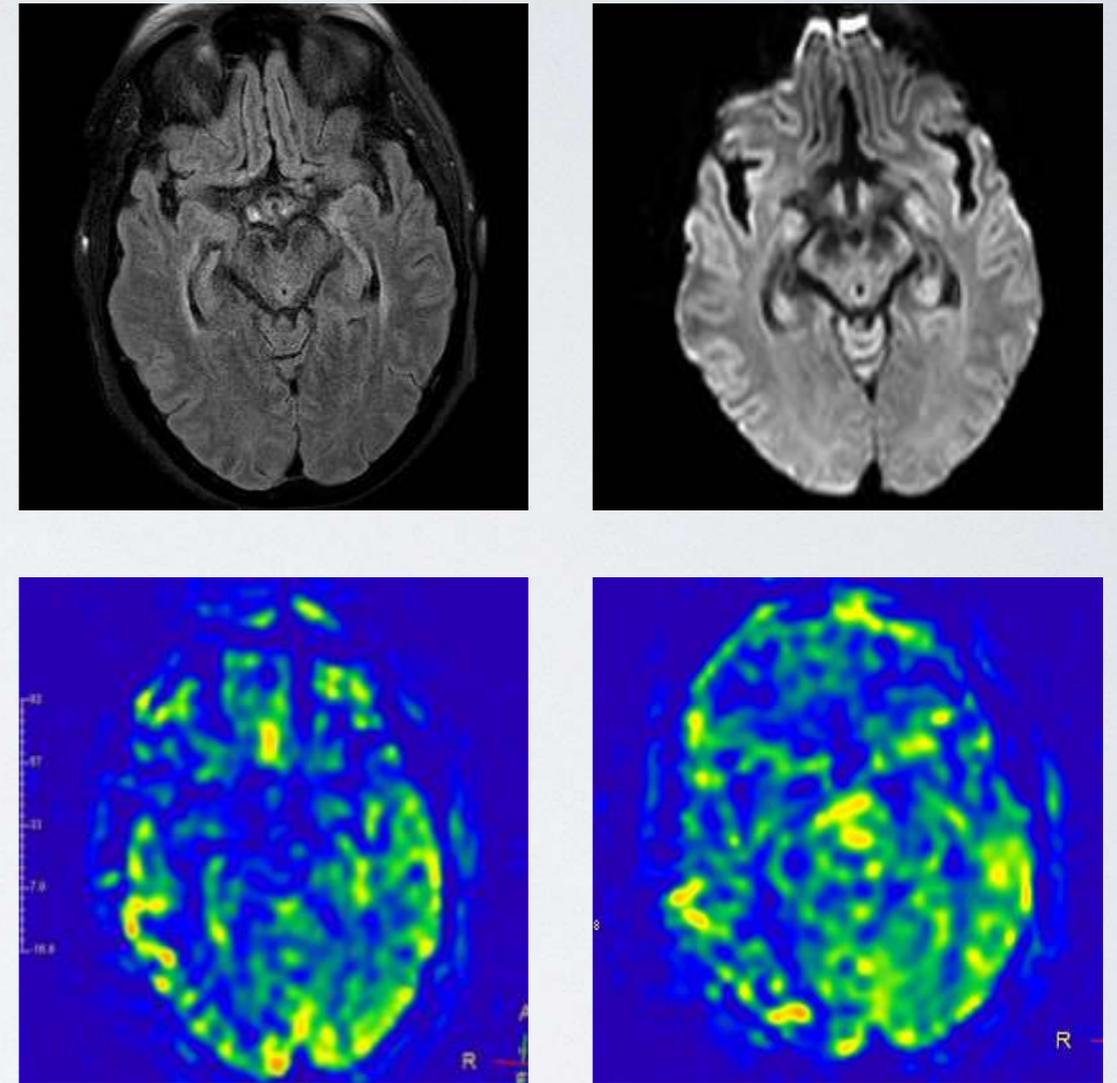
28 a. Afasia y hemiparesia derecha en vuelo Londres Madrid



Aura

- Migraña con aura señal ASL variable en función de la fase
- Migraña sin aura no asociada a alteraciones ASL (Gil-Gouveia 2017 Front Neurol)

53a. Afasia y hemianopsia homónima derecha



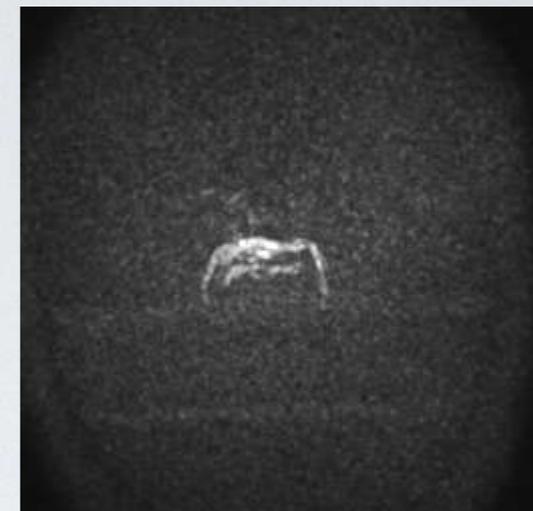
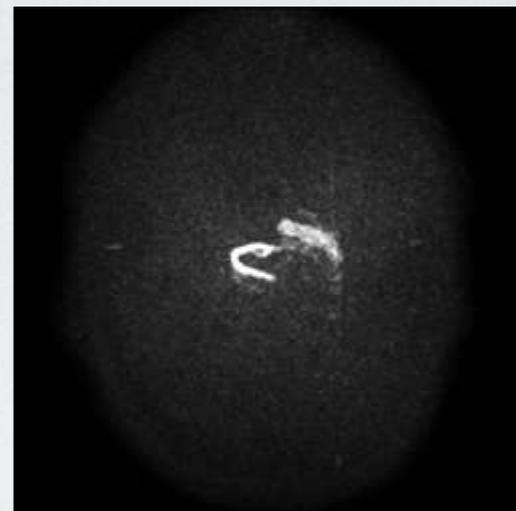
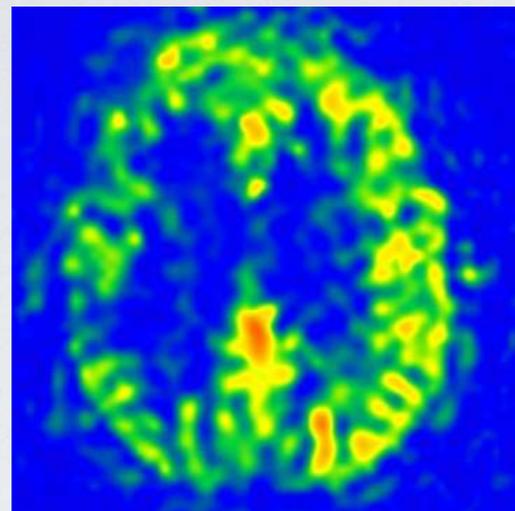
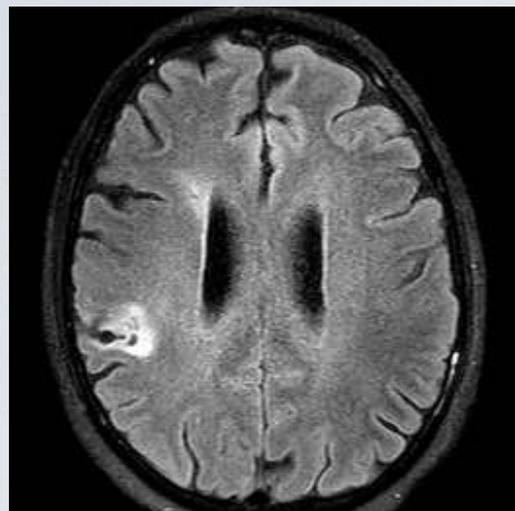
Status no convulsivo

- Descrita alteraciones de perfusión en ASL en Press, Encefalopatía Hipertensiva, MELAS, Hiperglicemia (tálamo y prefrontal), Hematoma subdural, Muerte Cerebral

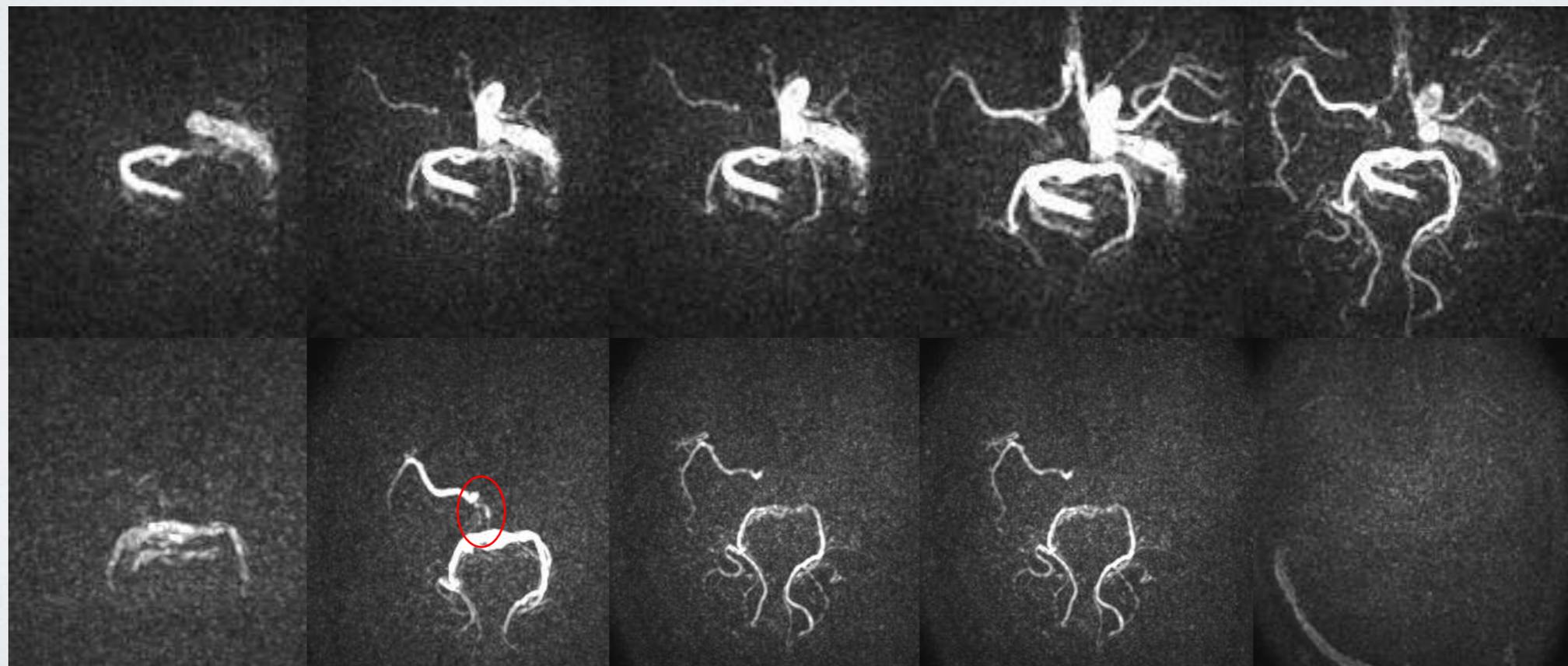
OBJETIVOS

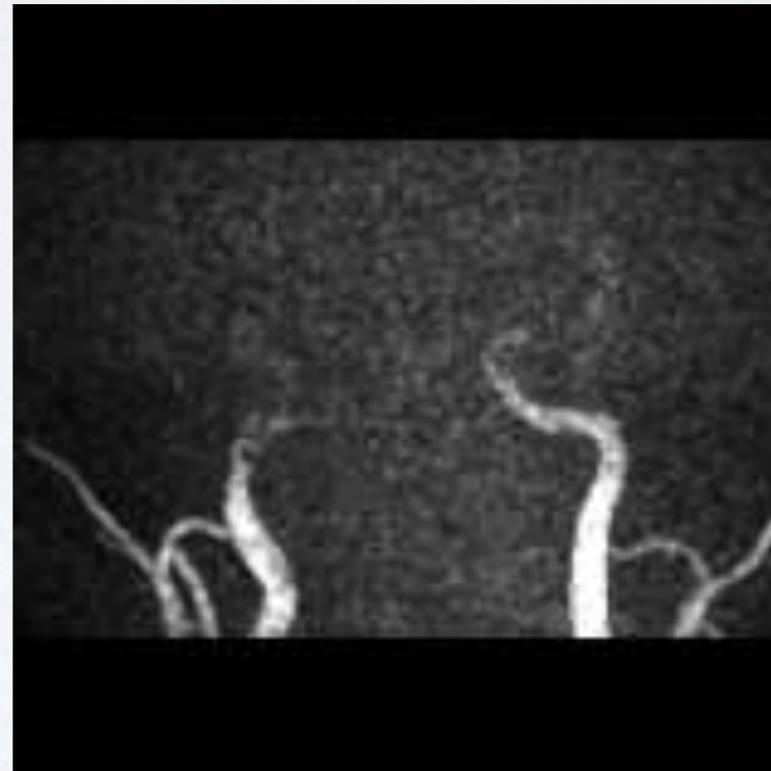
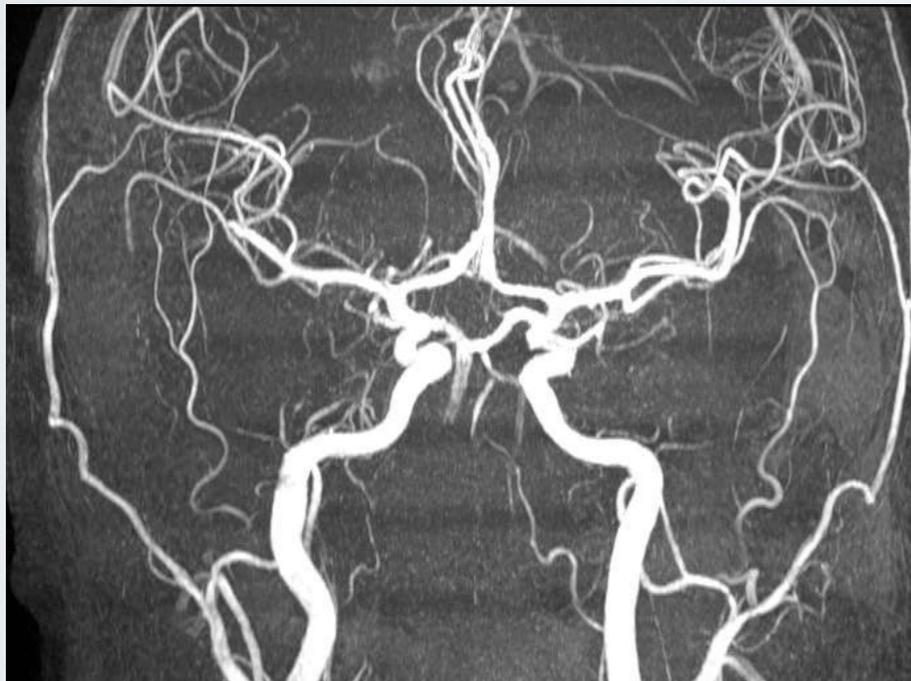
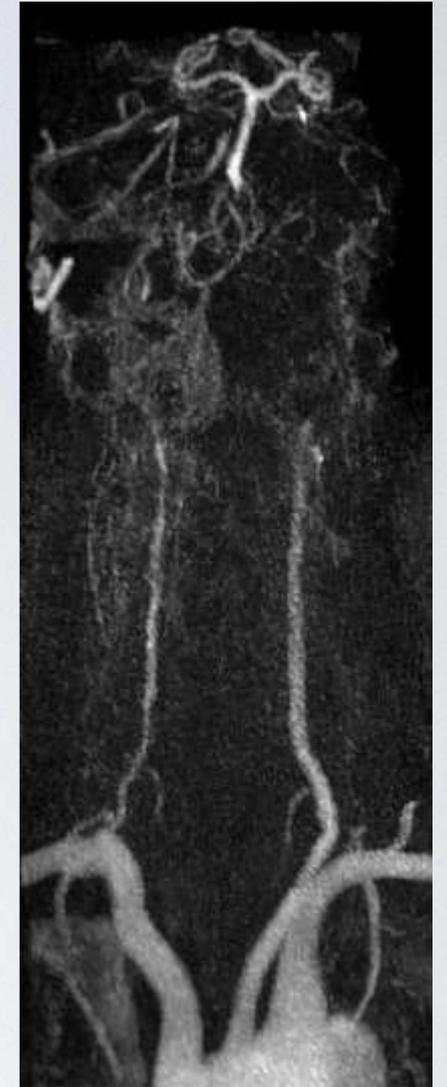
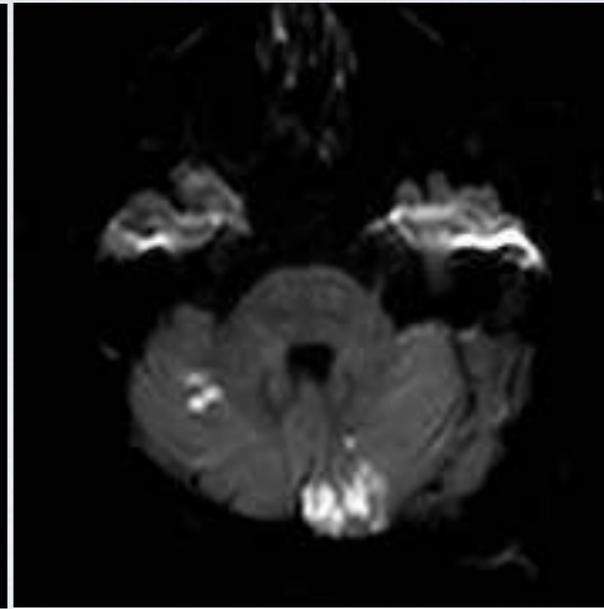
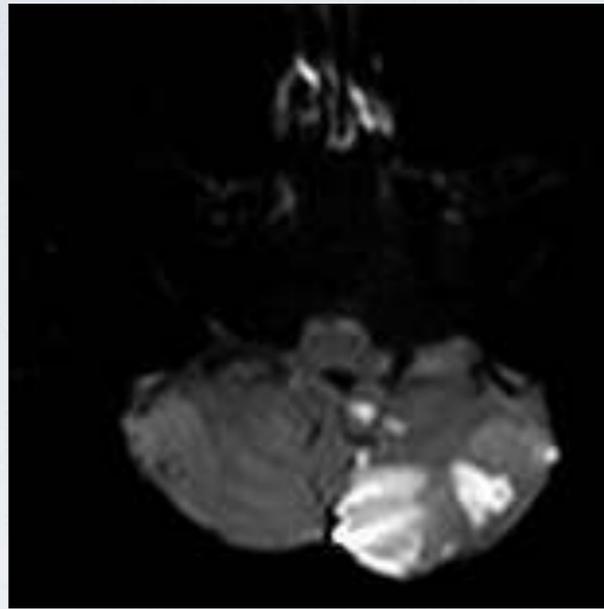
- **Hallazgos en Enf. Esteno oclusiva**
- Colateralidad
- Perfusión parénquima

Enfermedad esteno oclusiva. Colateral primaria



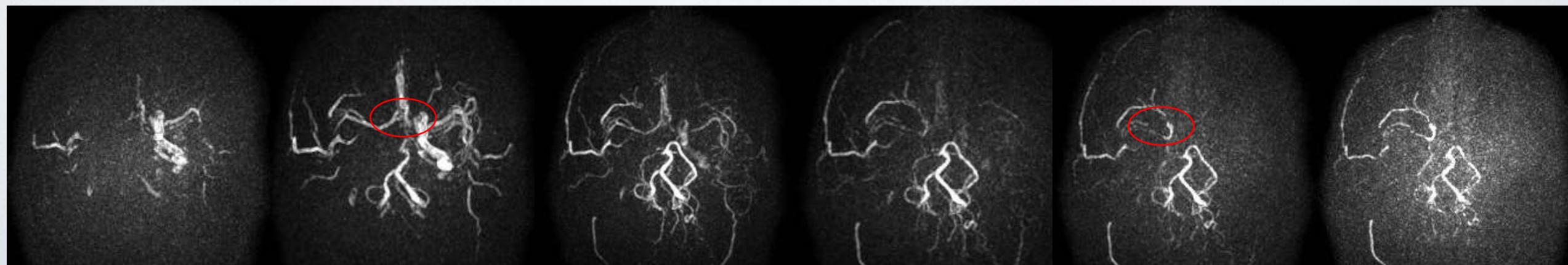
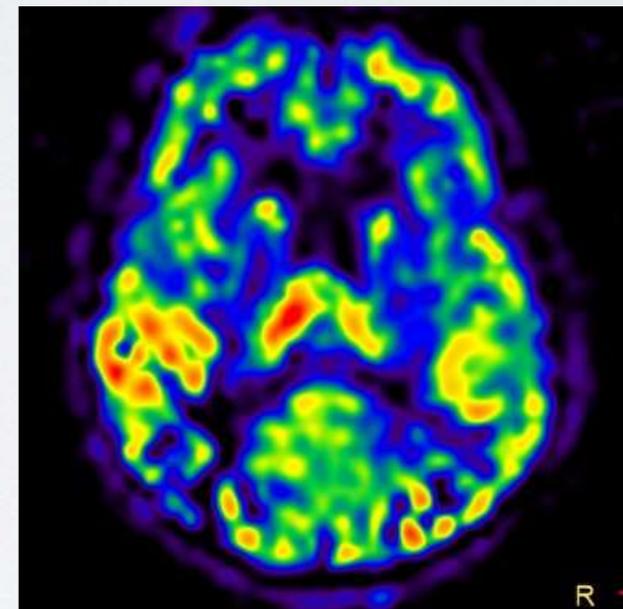
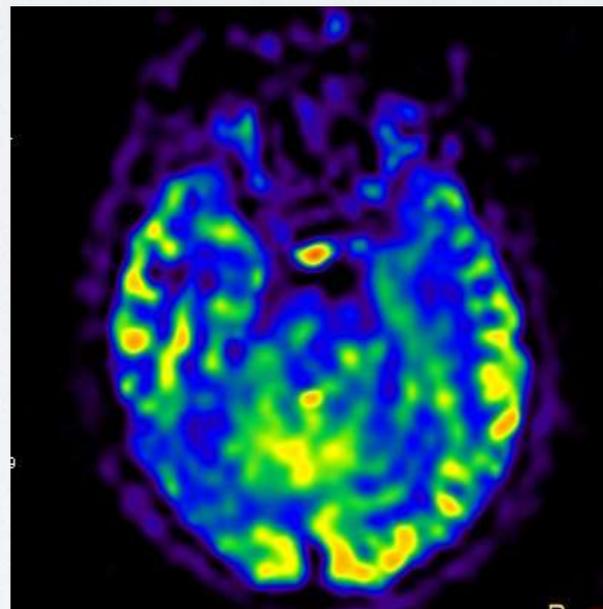
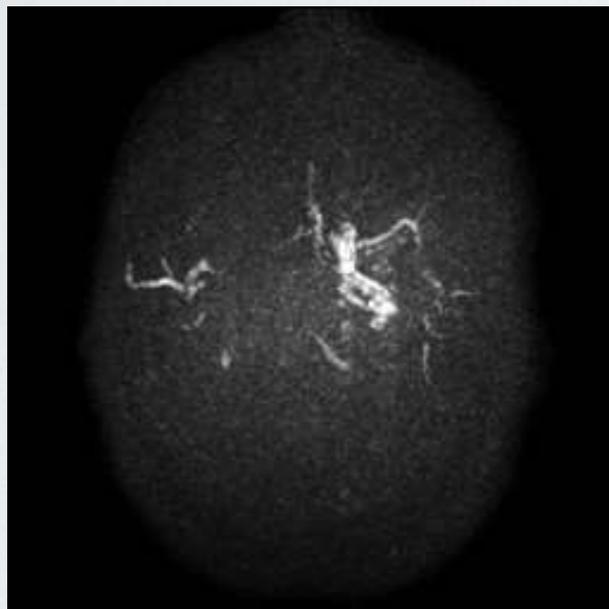
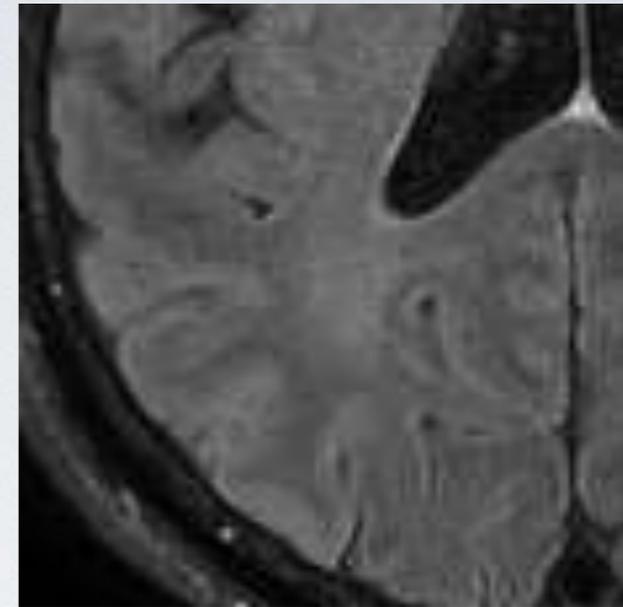
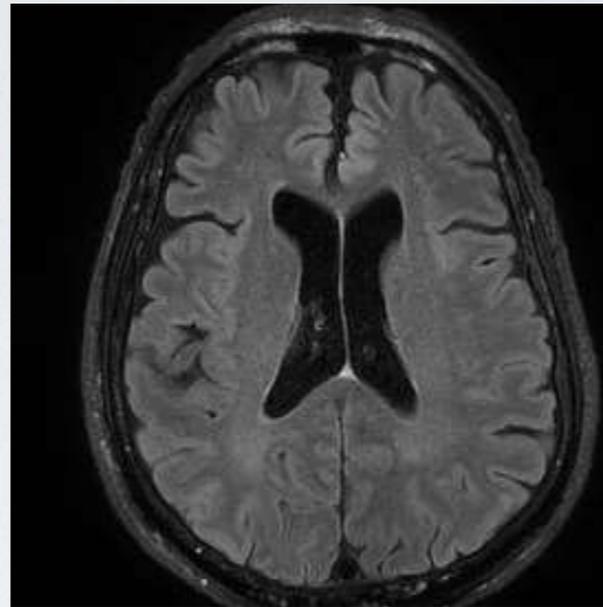
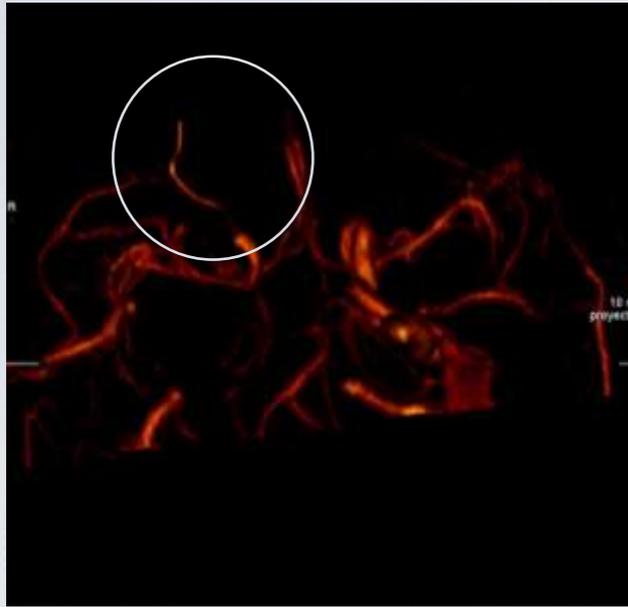
Dolor hemicraneal derecho. Sospecha Horton. Episodio de disartria y hemiparesia izquierda

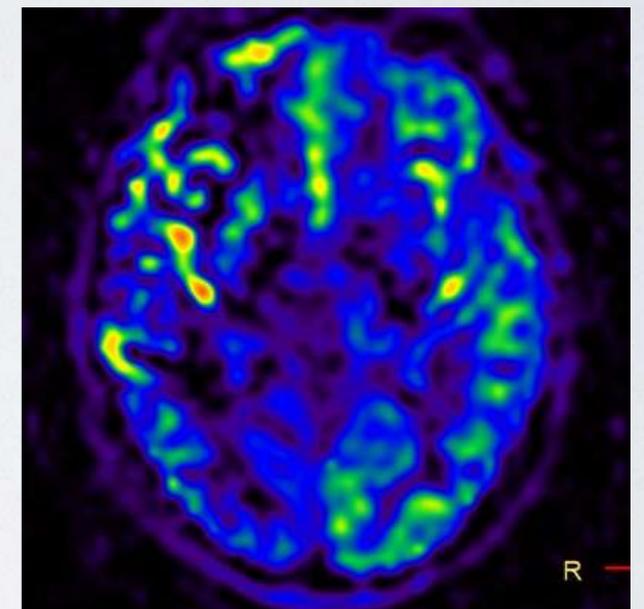
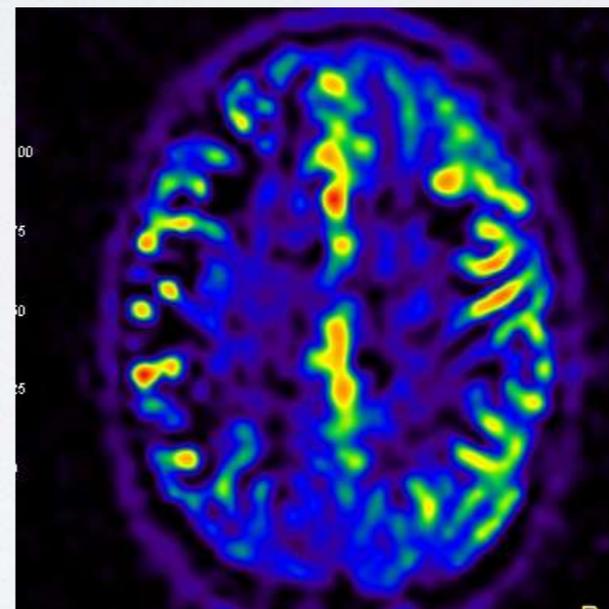
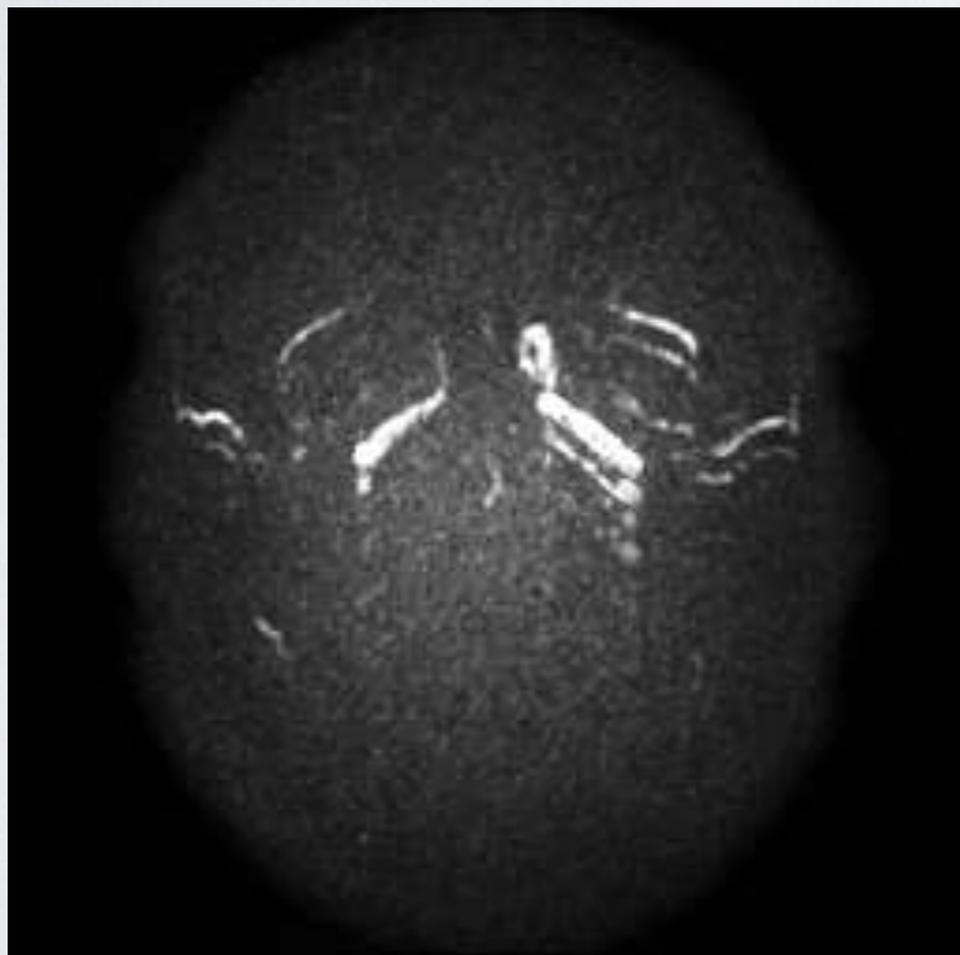
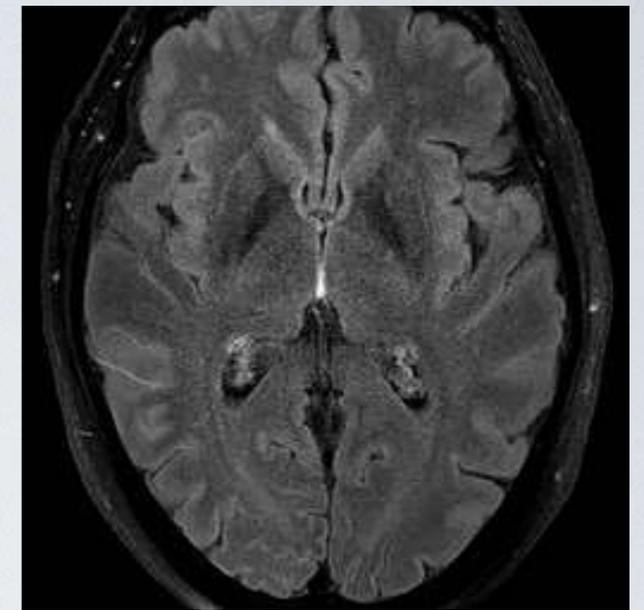
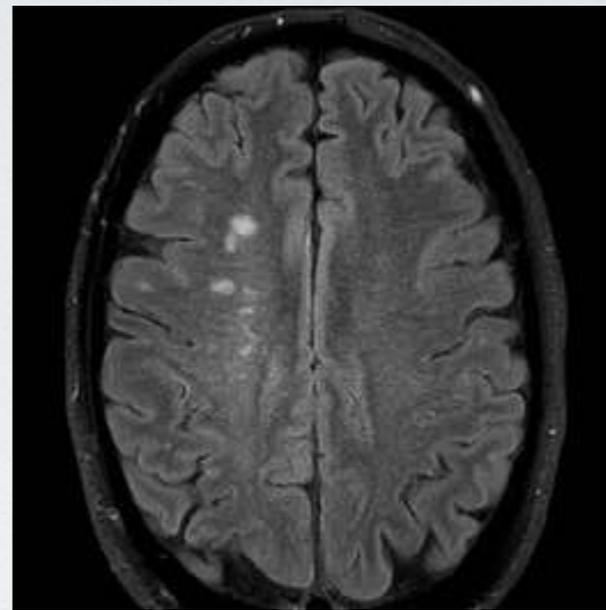




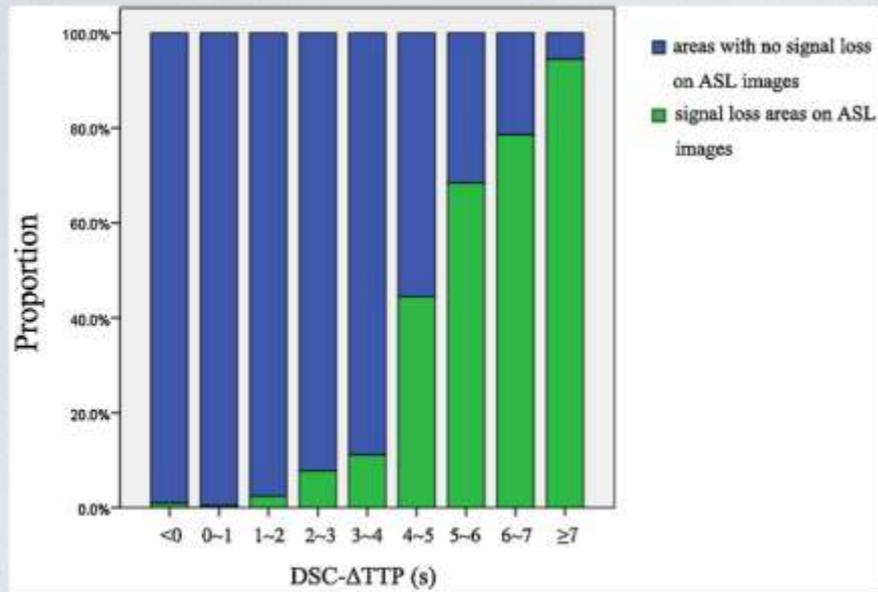
FA. Episodios repetidos de mareo e inestabilidad etiquetados de síncope vasovagal con mareo, giro de objetos e imposibilidad para levantarse a las 48 h

Parestesias ext. Izquierdas y apraxia. Colaterales secundarias ext-int



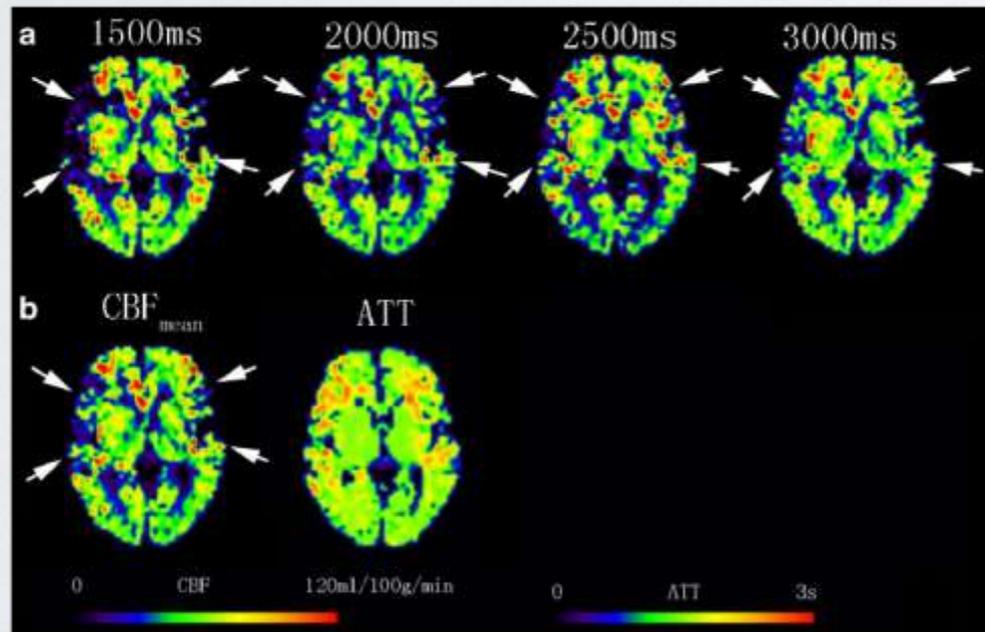


Hipoestesia de mano derecha y disartria.
Colaterales secundarias piales?



J Neurorad. 2017;44:73-280

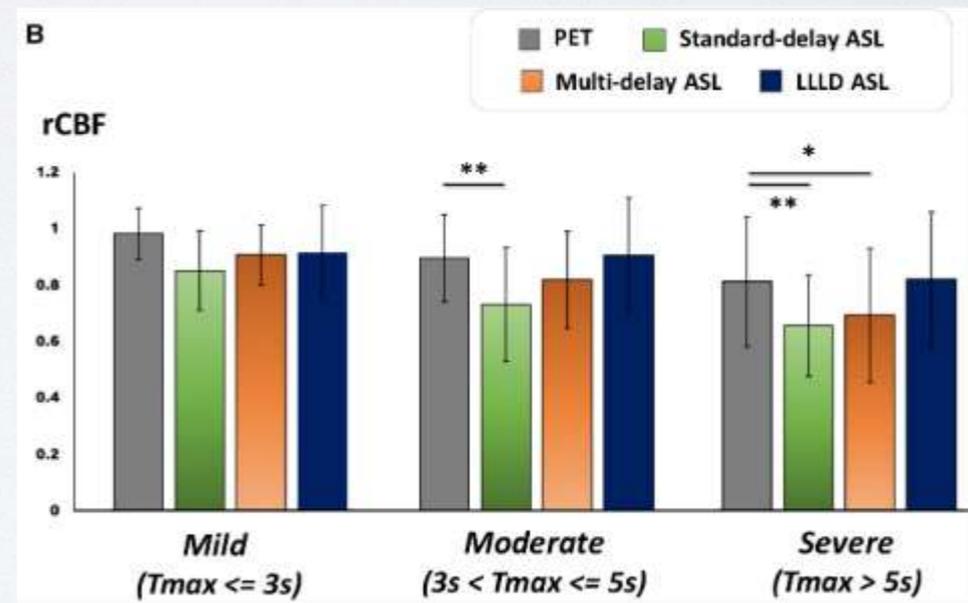
- Secuencias multi PLD/TI
- Adquieren TIn, normalmente entre 1.5 y 4 sg
- Mapa paramétrico de **BAT/TTA**
- Corrigen la CBF para cada tiempo y calculan CBF media
- No disponible comercialmente y procesado complejo (off line)



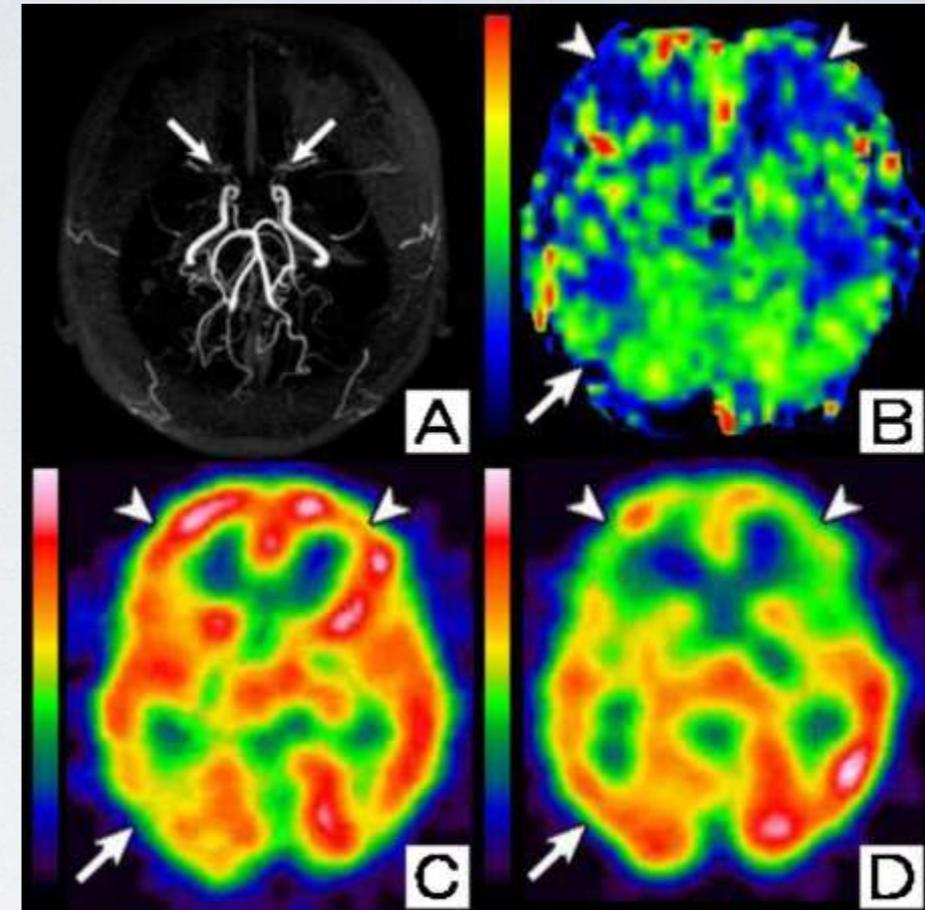
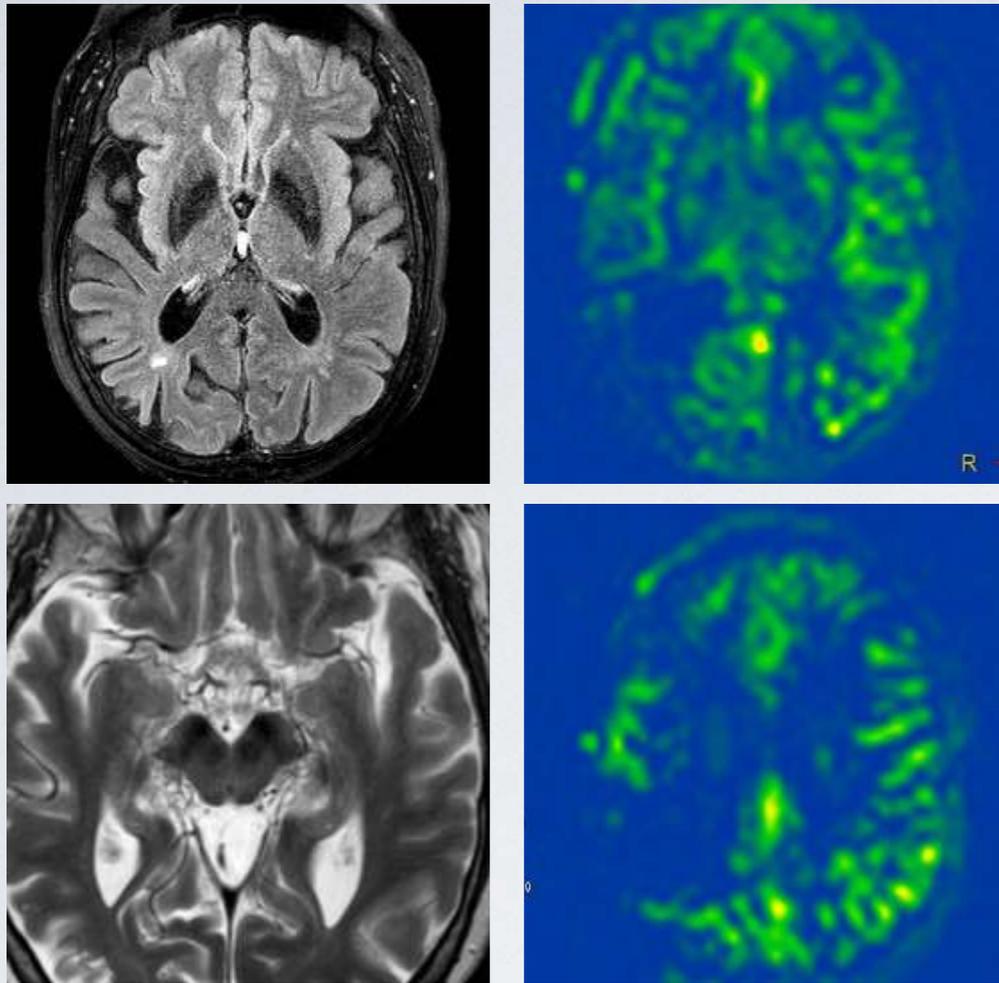
>4 SG



Stroke. 2017;48:2441-2449

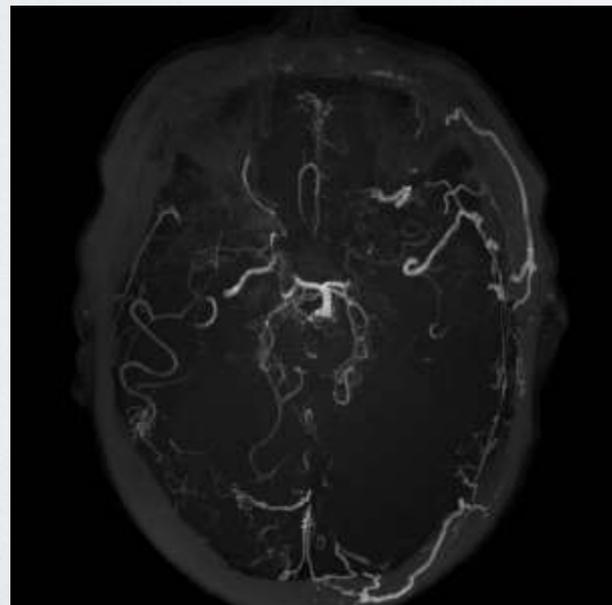


Stroke. 2017;48:2441-2449



Eur J Rad 2011;;80: 557–562

Eur J Rad 2015;84:1137–1143

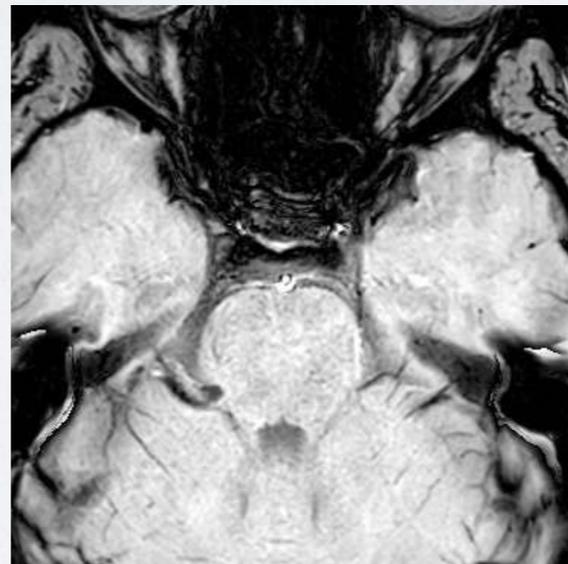
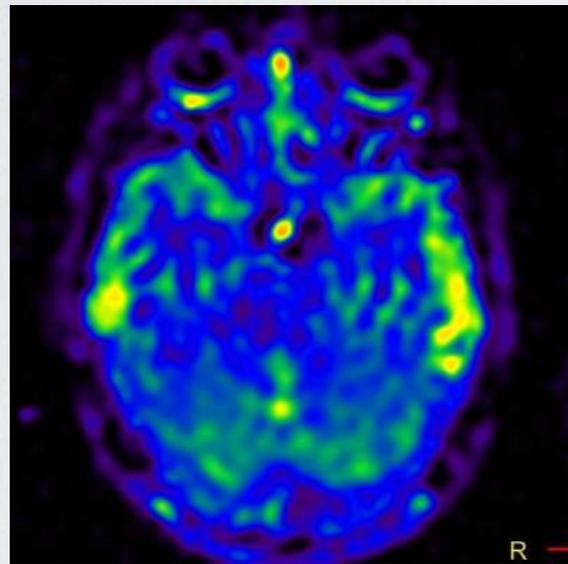
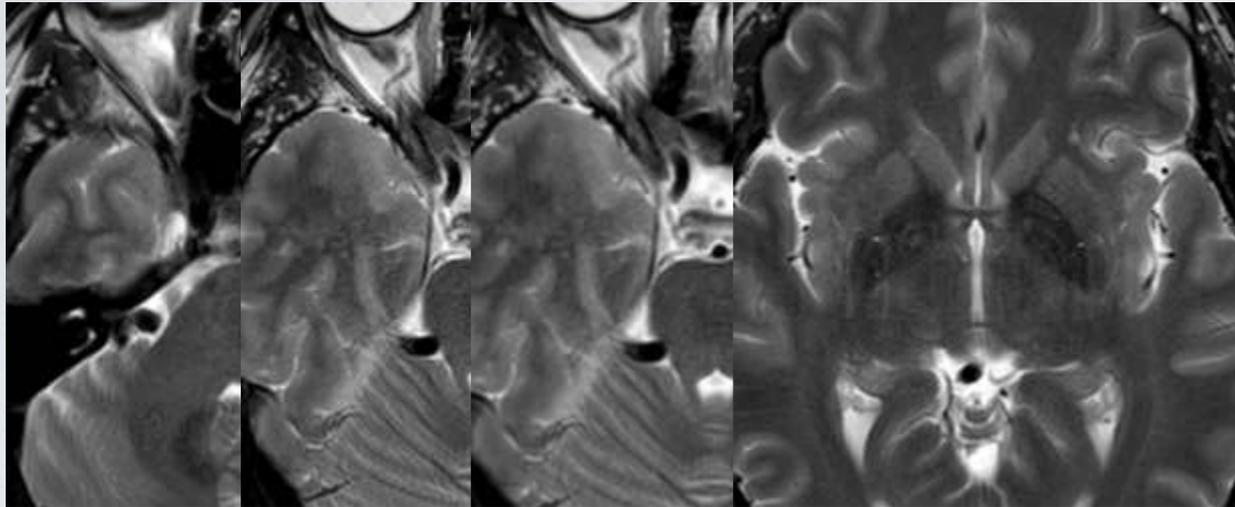


- Mejor correlación de las áreas de hipoperfusión severa con ACZ SPECT
- Equivalente indirecto de alteración de la vasoreactividad cerebral

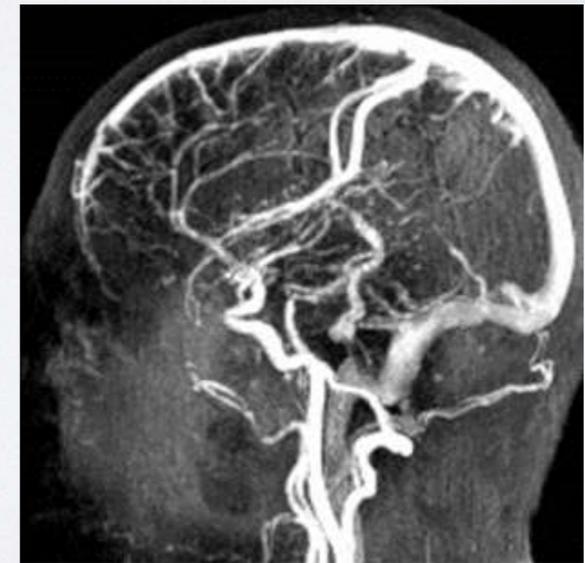
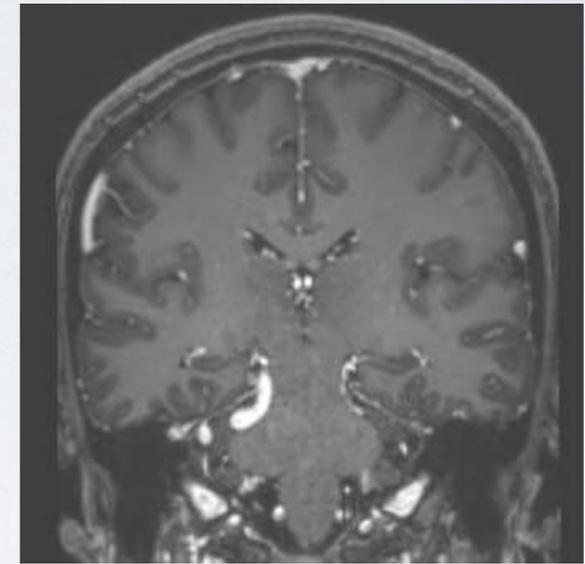
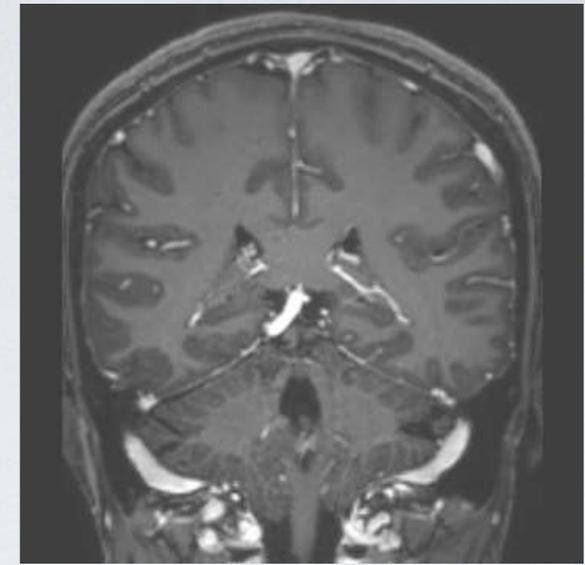
OBJETIVOS

- **Valoración de Shunt Arteriovenoso**

37a. Cefalea



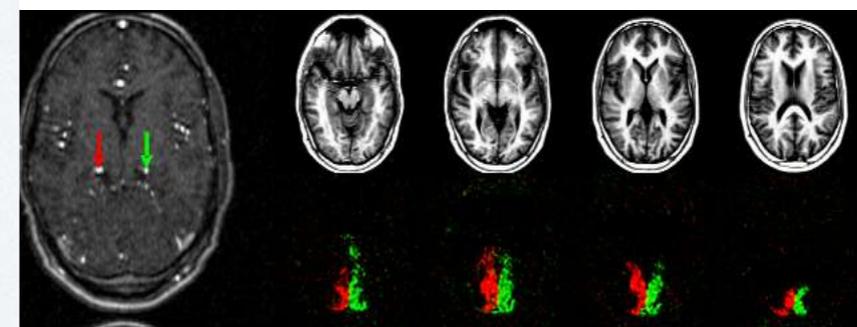
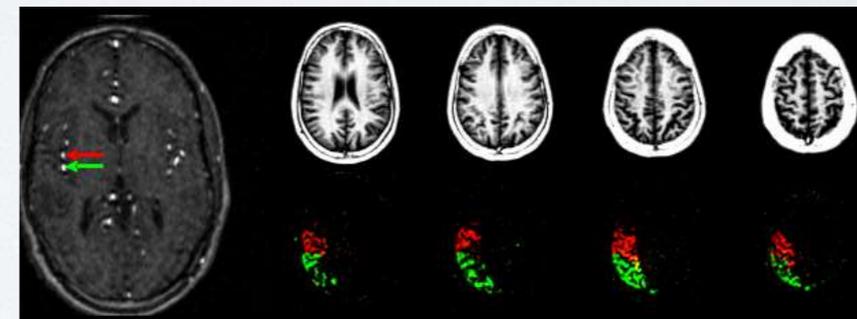
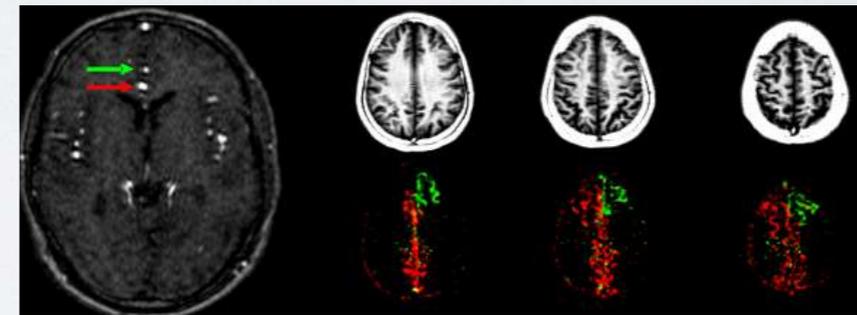
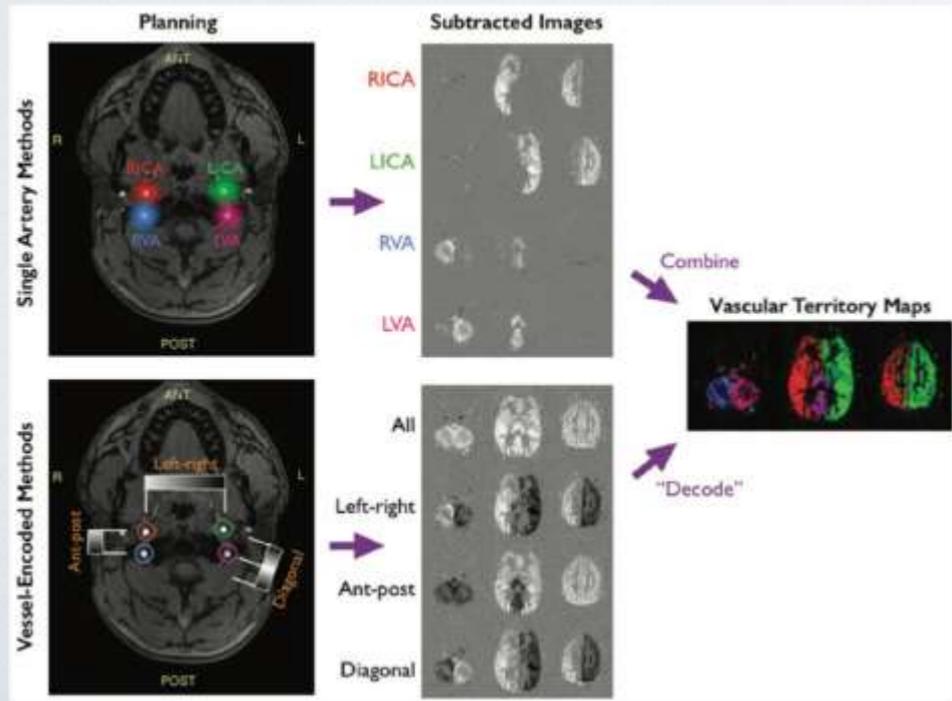
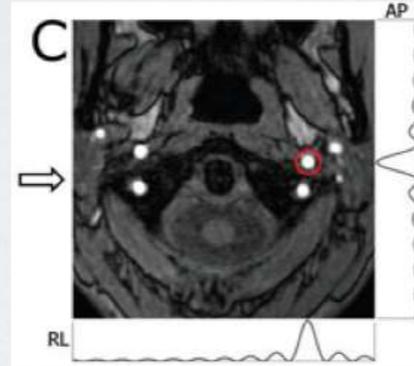
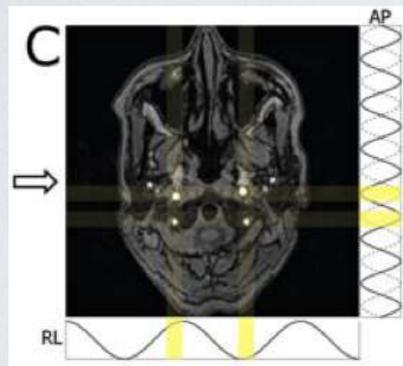
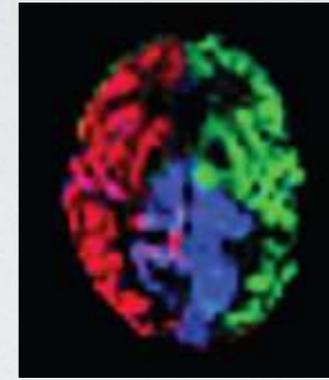
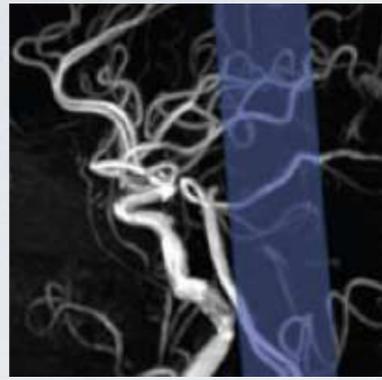
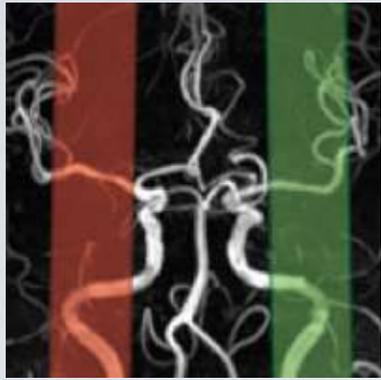
Ausencia de **ATA**: Alto VPN



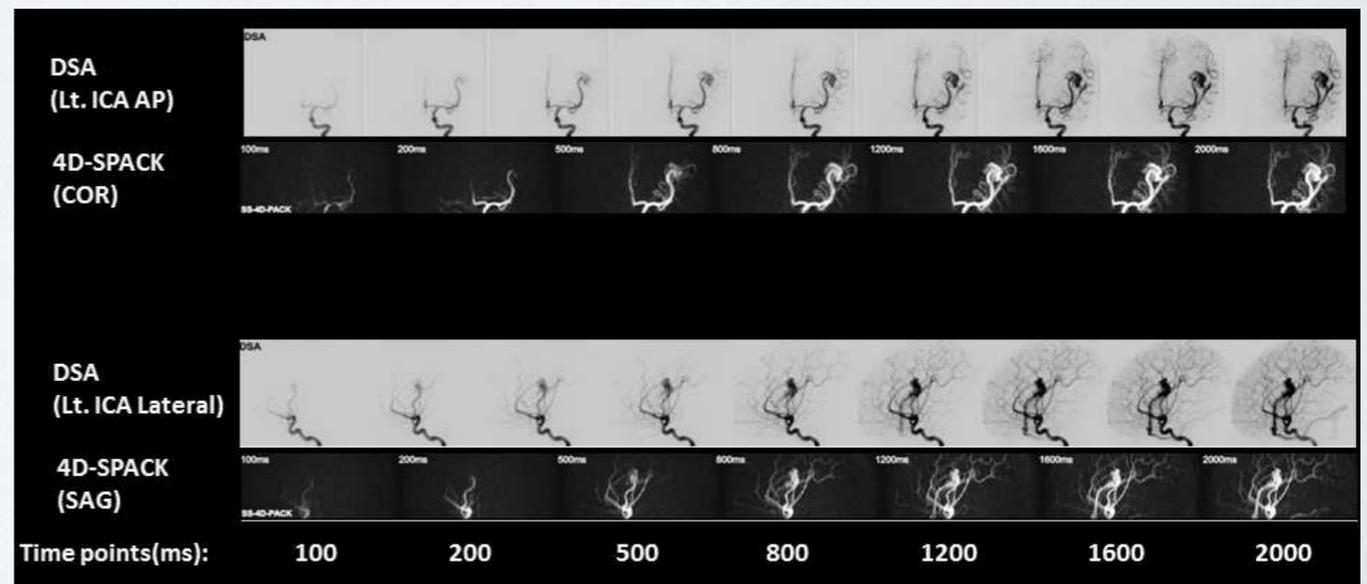
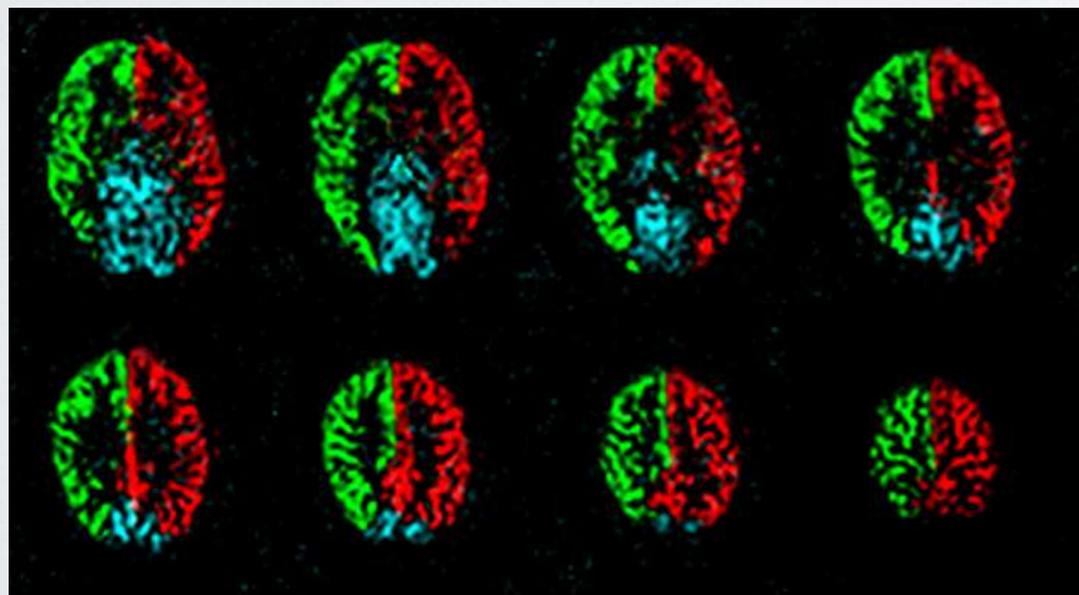
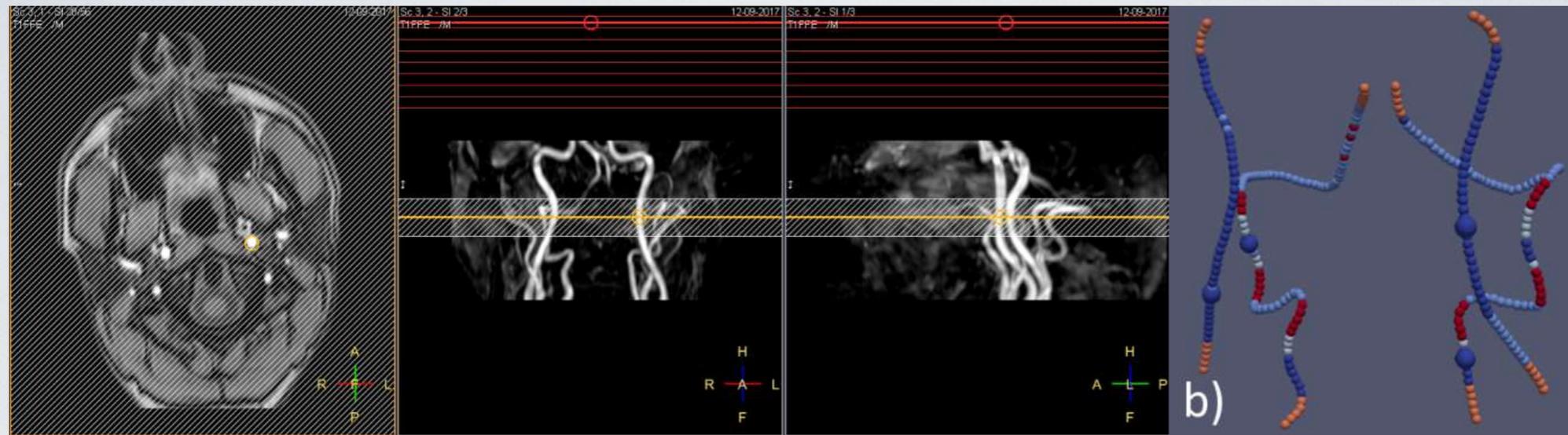
OBJETIVOS

- **ASL Territorial**

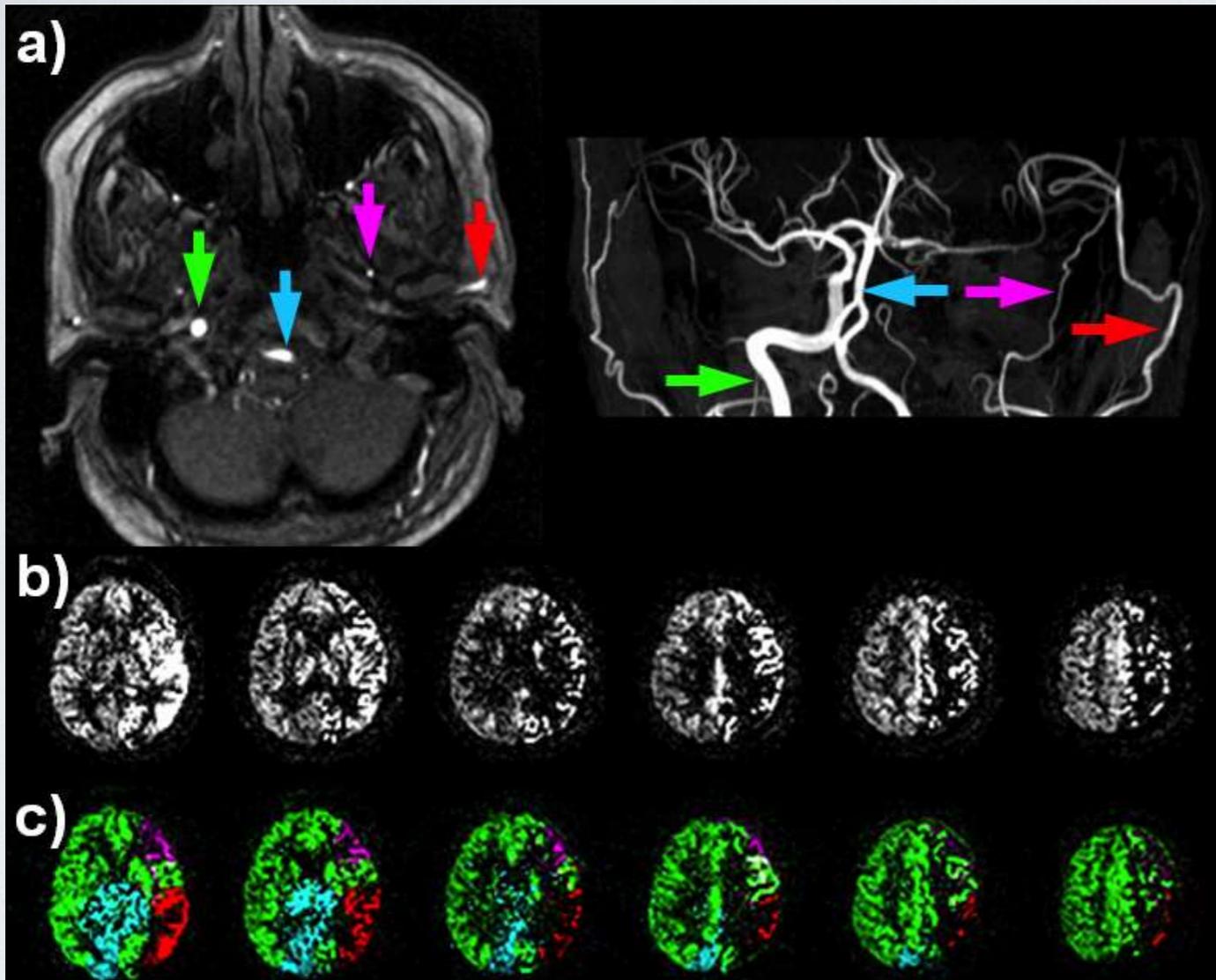
ASL TERRITORIAL



Cortésia Michael Helle, Philips Research Hamburg



Cortesia Osamu Togao, Kyushu University, Japan



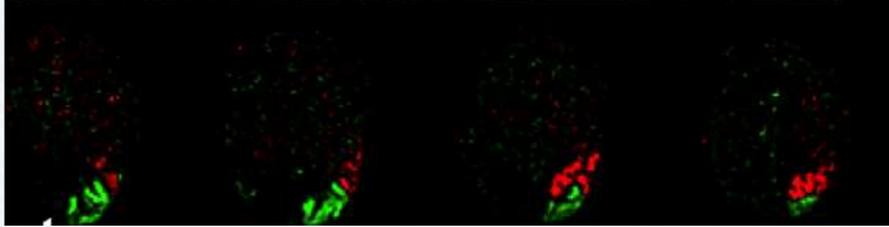
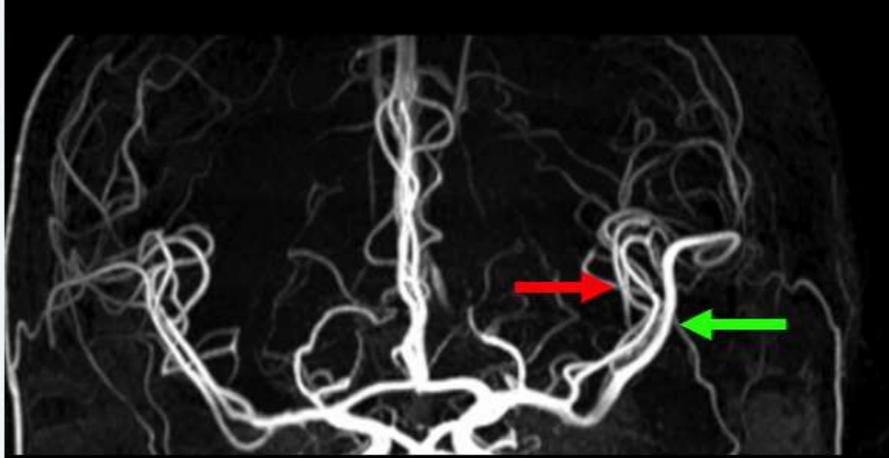
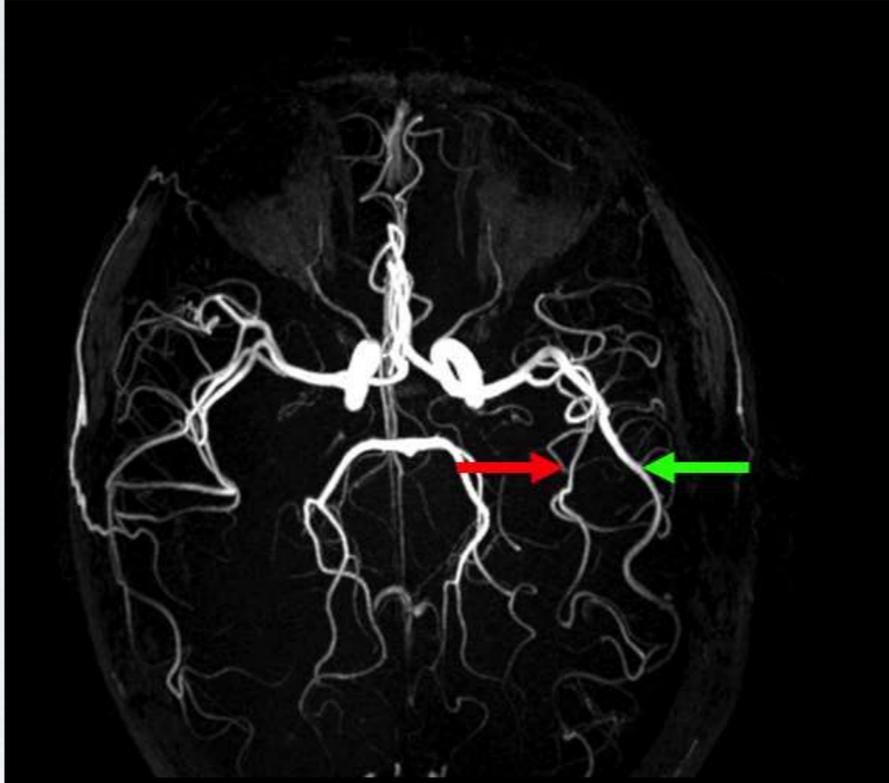
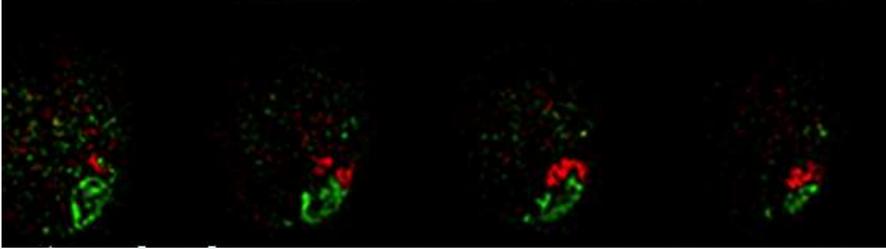
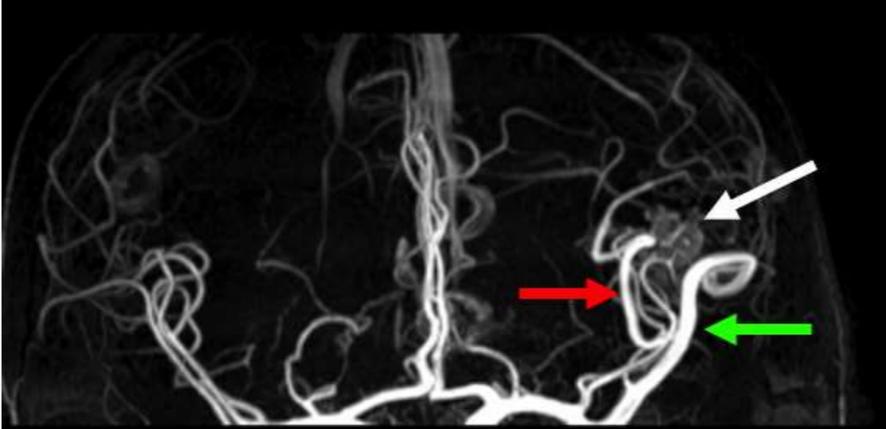
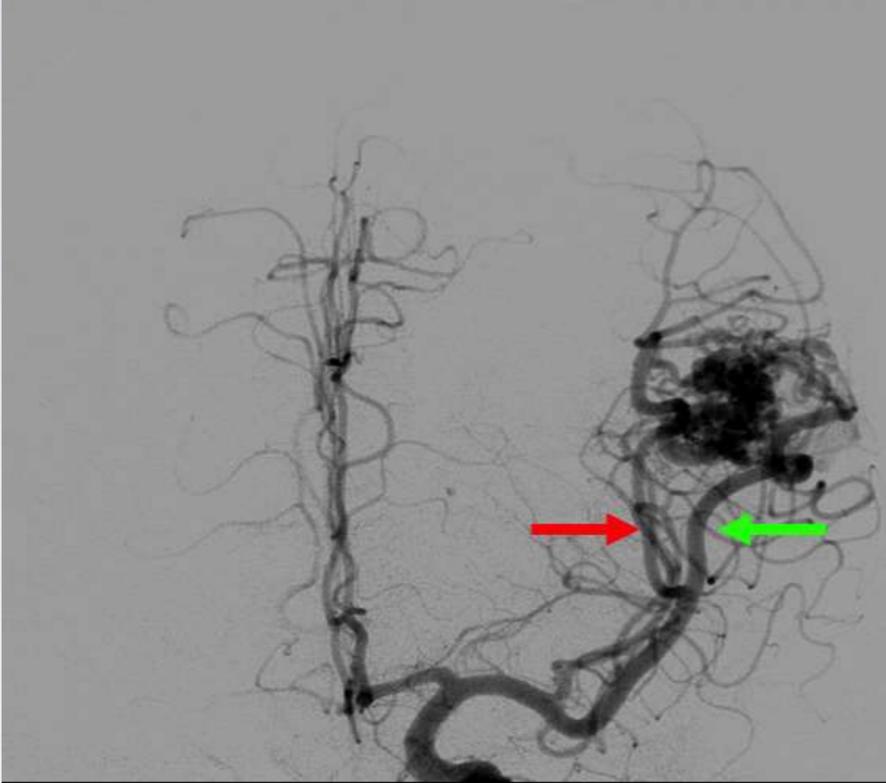
ARTERIA BASILAR

ARTERIA CARÓTIDA DERECHA

ARTERIA MENINGEA MEDIA

ARTERIA TEMPORAL SUPERFICIAL

Cortesía Michael Helle, Philips Research Hamburg



Cortesía Michael Helle, Philips Research Hamburg

CONCLUSIONES

- **Isquemia Aguda/Subaguda**

- Oclusión vascular (trombo)
- Circulación colateral
- Hiperhemia
- Mimicks

- **Enfermedad esteno oclusiva crónica**

- Circulación colateral primaria en el polígono Willis
- Circulación colateral secundaria ACE ACI (oftálmica)
- Circulación colateral secundaria leptomenígea ?

- **Shunt AV**

- Shunt AV
- Drenaje venoso de la MAV
- Robo en parénquima adyacente

CONCLUSIONES

- EL ASL es una técnica muy versátil (perfusión/ arteriografía/ territorial)
- Muy sensible en vóxeles con altas concentraciones del trazador
- El análisis cualitativo es más útil en práctica clínica
- La valoración cuantitativa de CBF en pacientes con patología cerebro vascular es compleja, limitada por el aumento y variación del tiempo de tránsito arterial
- No tiene un papel bien definido en los protocolos de imagen