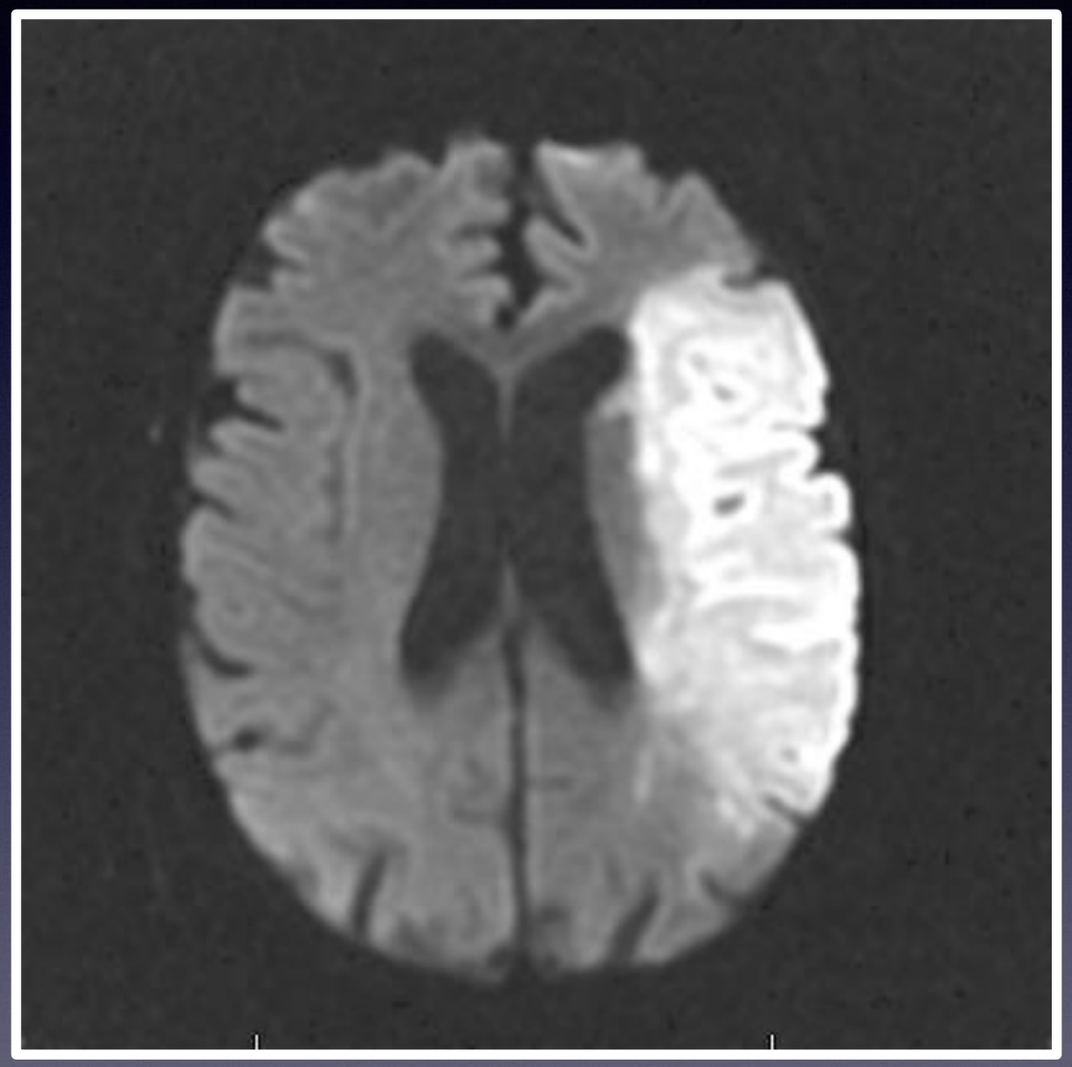
ΑΠΕΙΚΟΝΙΣΗ ΑΓΓΕΙΑΚΩΝ ΕΓΚΕΦΑΛΙΚΩΝ ΕΠΕΙΣΟΔΙΩΝ ΚΑΙ ΑΝΕΥΡΥΣΜΑΤΩΝ

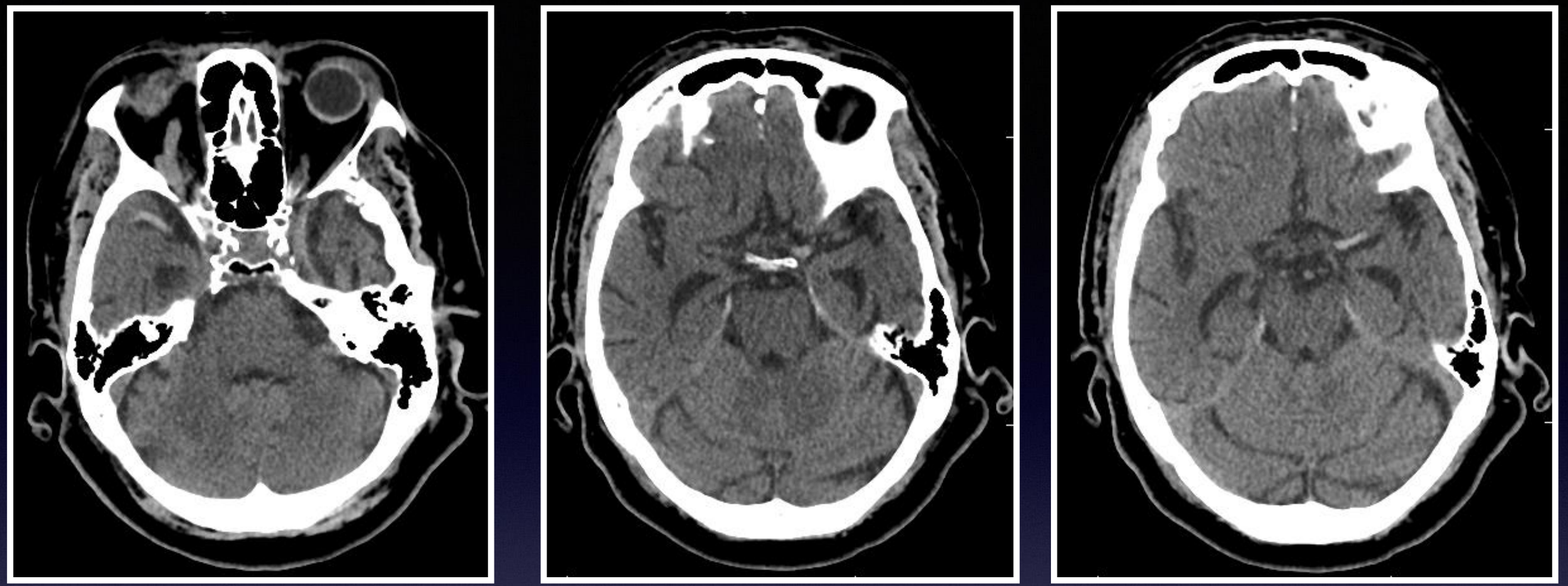
Χρήστος Γκόγκας,
Επεμβατικός Νευροακτινολόγος

Ischemic Stroke



Acute Stroke

- What is the role of imaging?

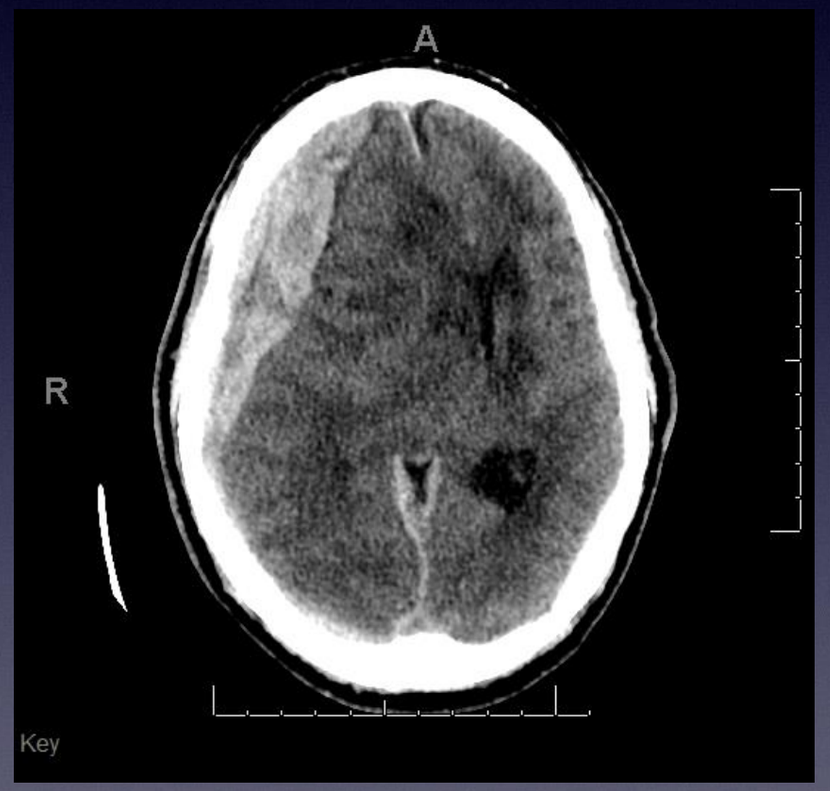


84 yo with sudden loss of consciousness, GCS 4

I. What is the role of imaging?

- Patient with acute onset neurologic deficit.
  - Rule-out hemorrhage
  - Rule out other pathology
  - Identify and quantify early ischemic changes

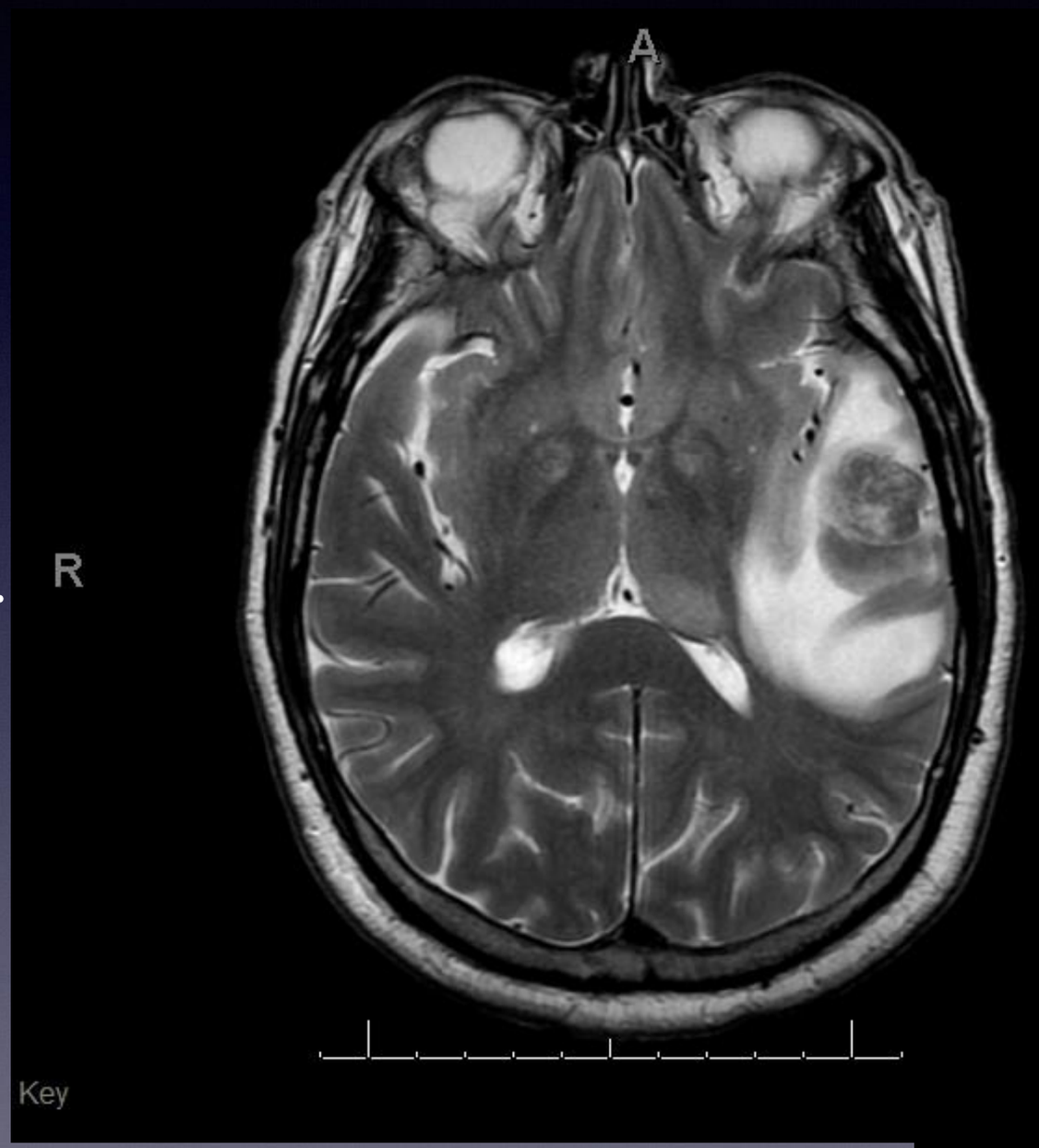
Rule-out hemorrhage



I. What is the role of imaging?

3hrs earlier

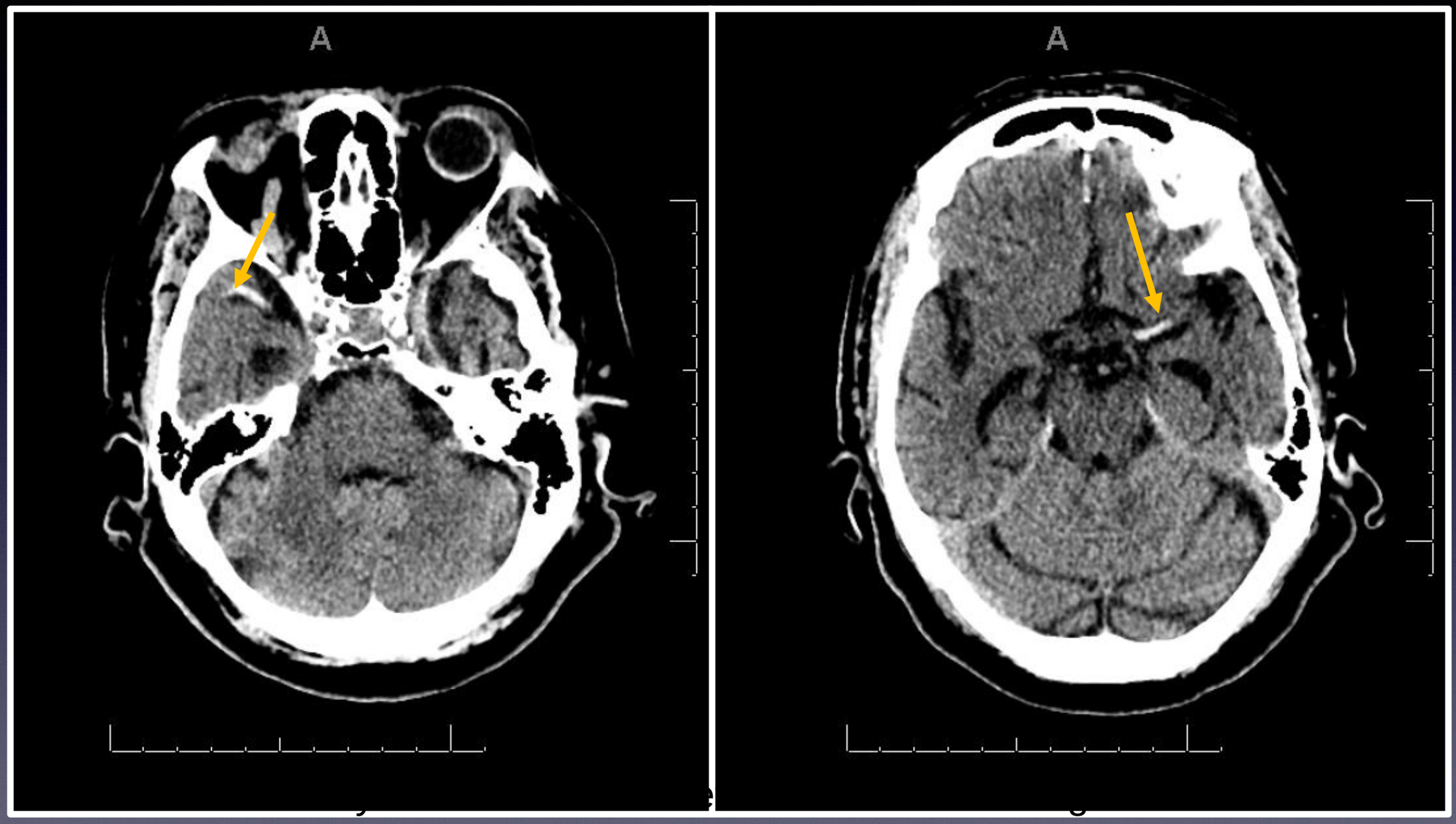
I. What is the role of imaging?

1. 

asia

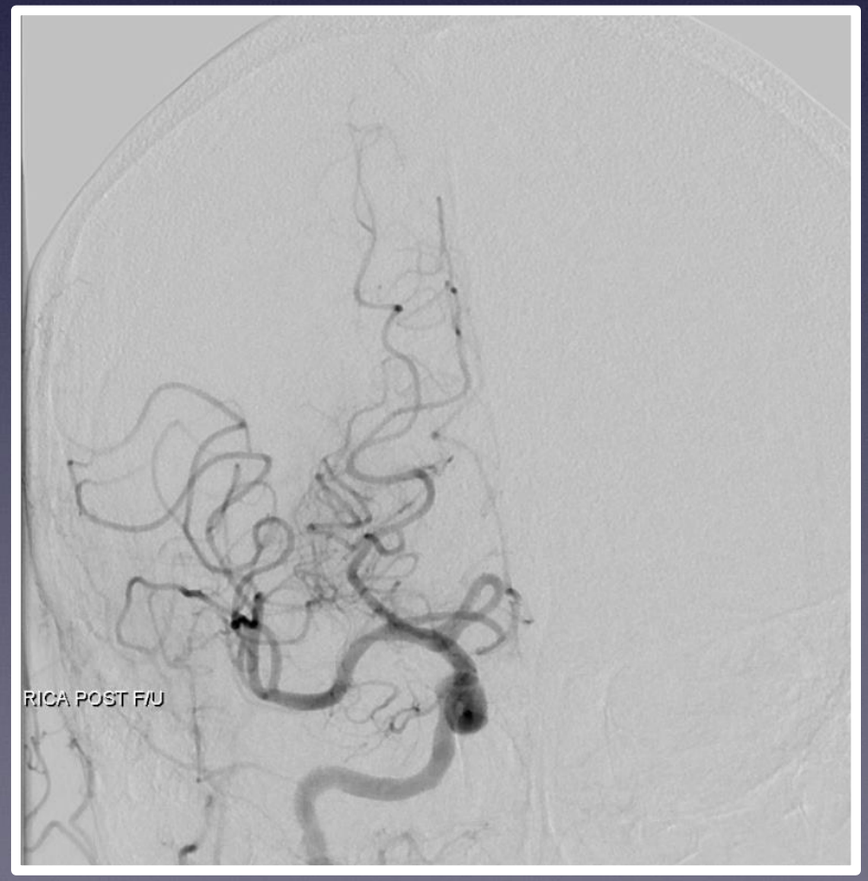
Early ischemic changes NECT

- **Hyperdense vessel sign**
- Parenchymal changes secondary to increased water accumulation and neuronal death:
  - Loss of gray/white matter differentiation (‘insular ribbon sign’)
  - Swelling (sulcal/ventricular effacement)
  - Hypodensity

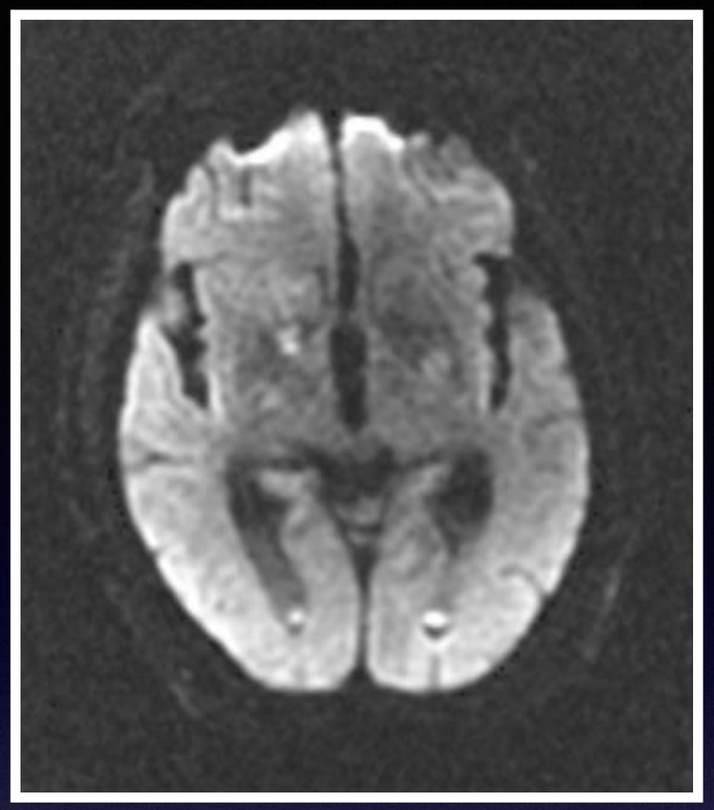


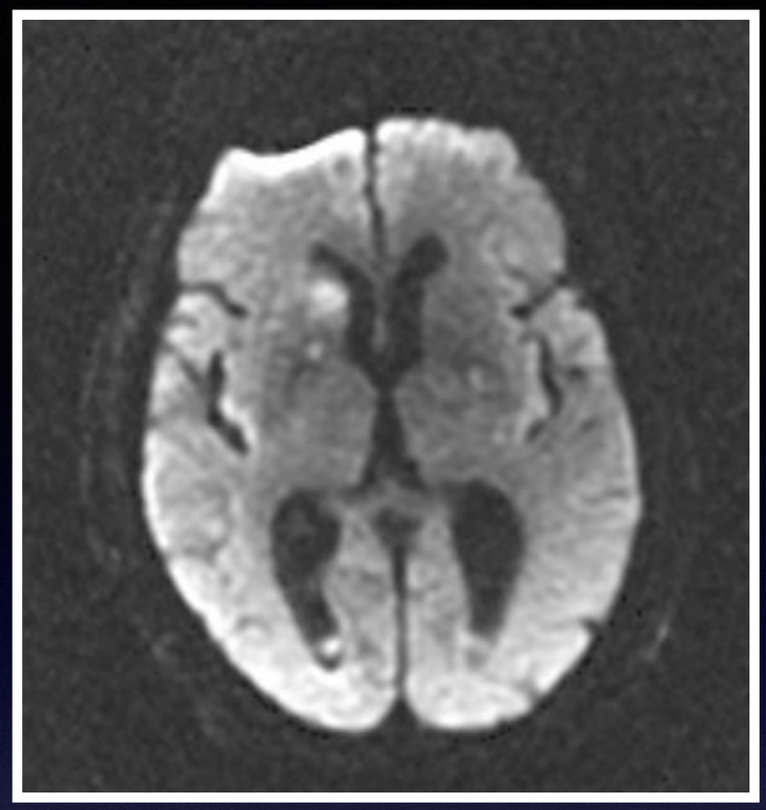
84 yo with sudden loss of consciousness, GCS 4

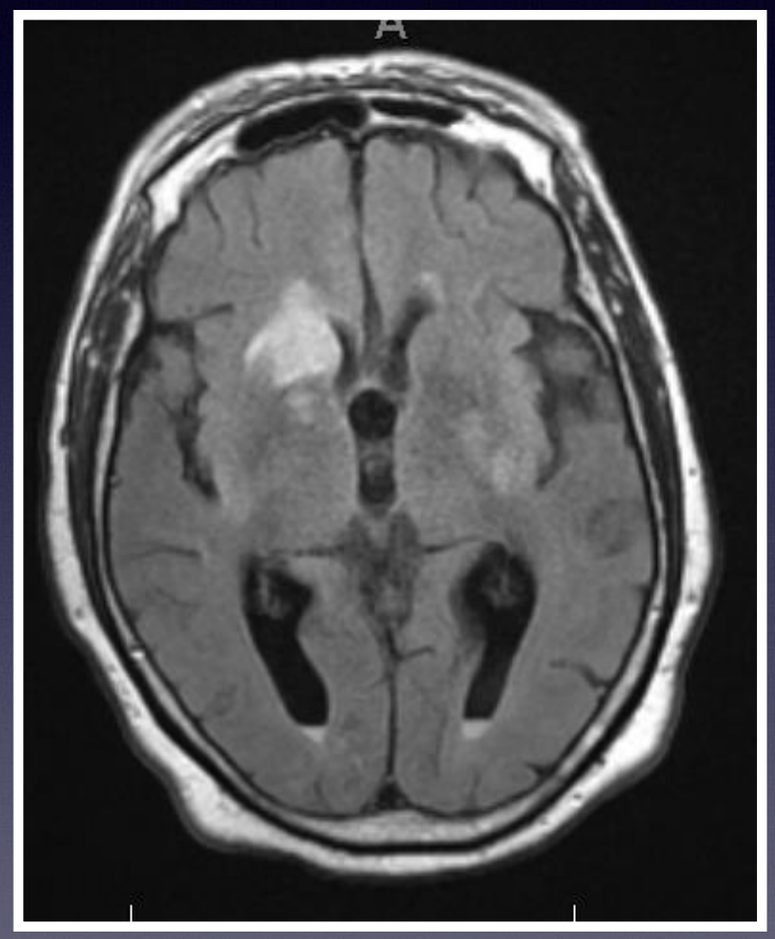

RCCA


RICA POST F/U


LICA POST







MRI 48 hrs later

Early ischemic changes NECT

- Hyperdense vessel sign
- **Parenchymal changes** secondary to increased water accumulation and neuronal death:
  - Loss of gray/white matter differentiation (‘insular ribbon sign’)
  - Swelling (sulcal/ventricular effacement)
  - Hypodensity
- ASPECTS: Alberta Stroke Program Early CT Score

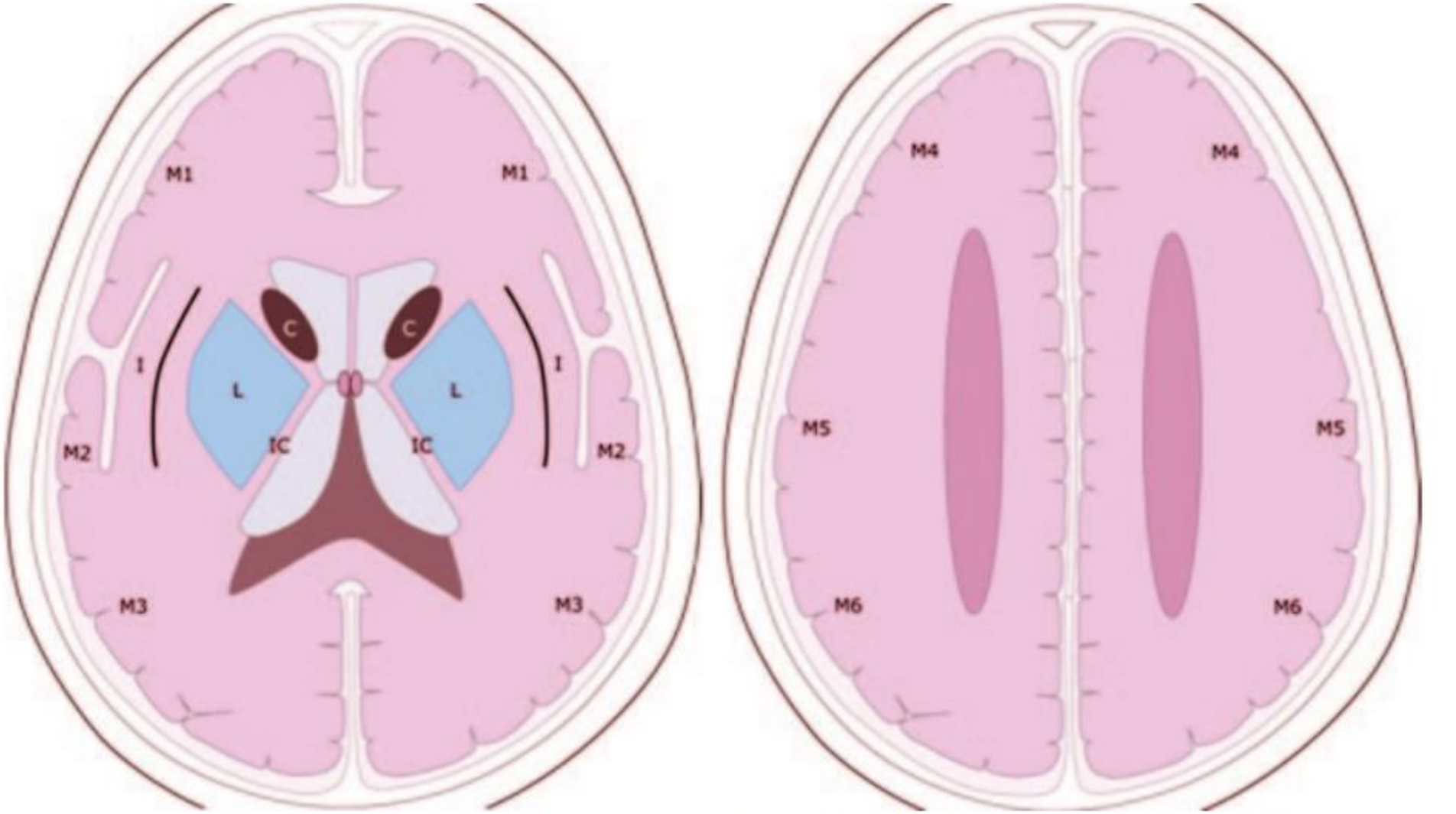
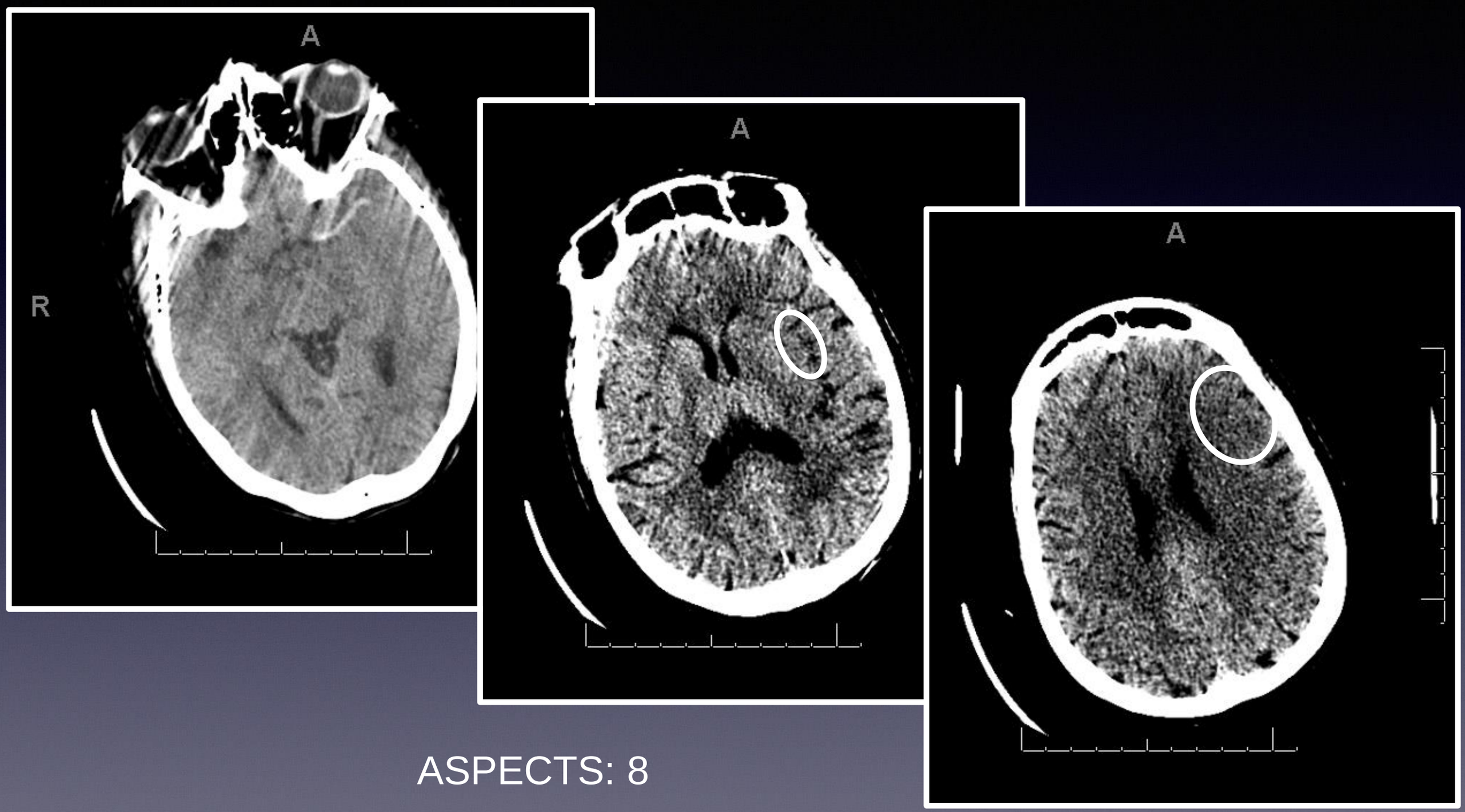
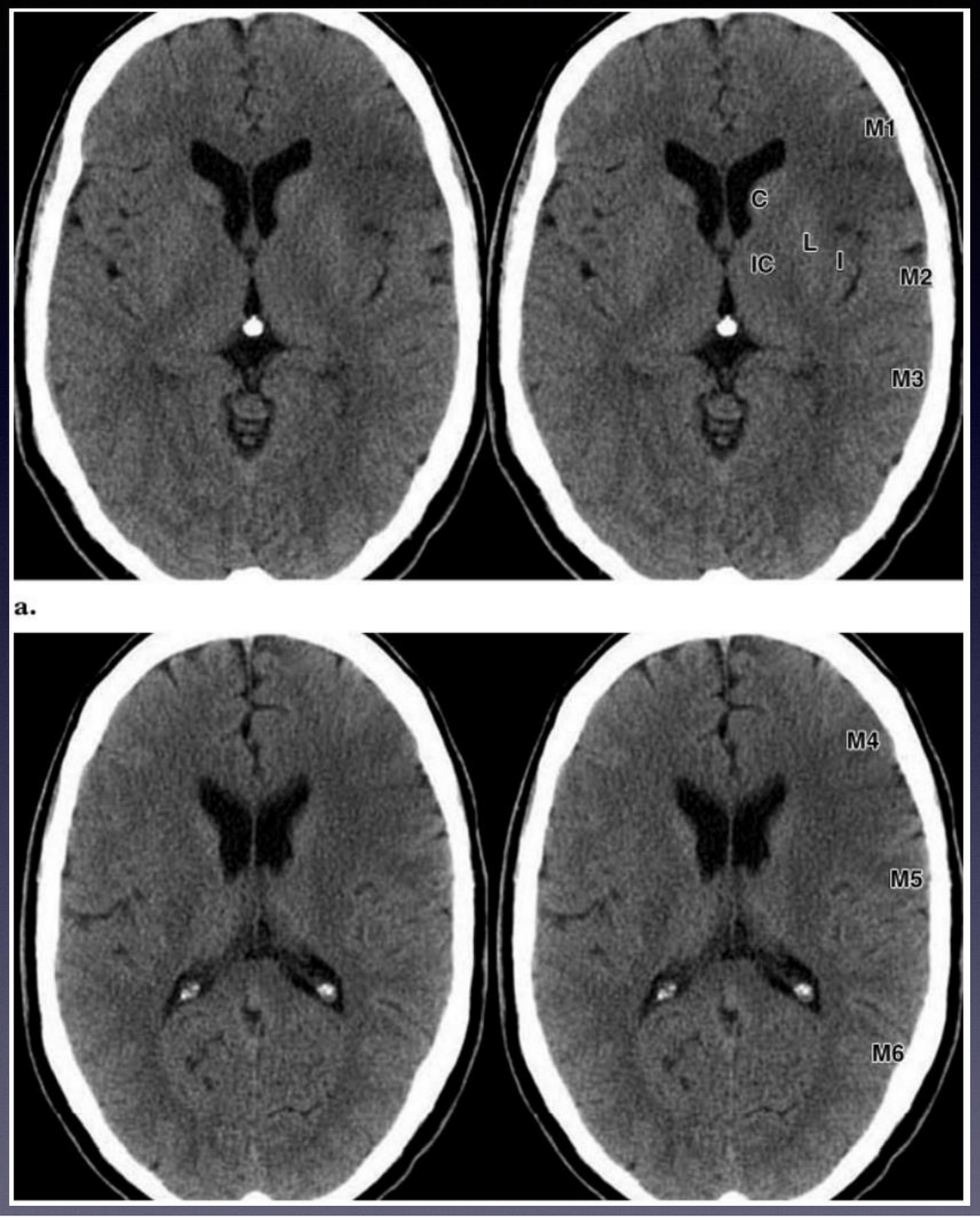


Figure 6. Schematic shows the 10 regions of the MCA distribution, each of which accounts for one point in the ASPECTS system: M1, M2, M3, M4, M5, M6, the caudate nucleus *(C)*, the lentiform nucleus *(L)*, the internal capsule *(IC)*, and the insular cortex *(I)*. For each area involved in ischemia depicted at unenhanced CT, one point is subtracted from the total score of 10.

RadioGraphics 2006; 26:S75–S95 • **Published online** 10.1148/rg.26si065501



ASPECTS: 8



a.

ASPECTS: 7

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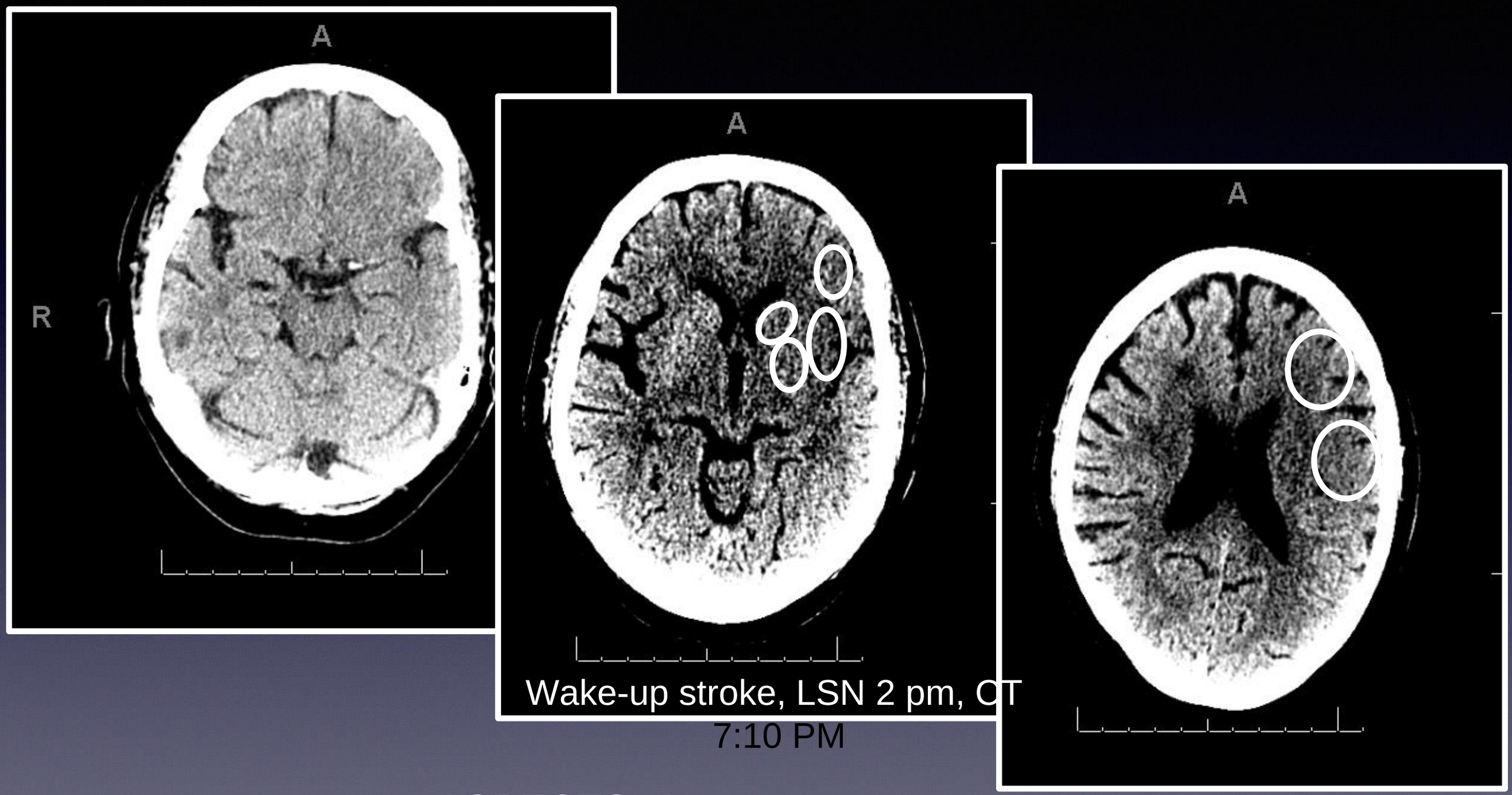
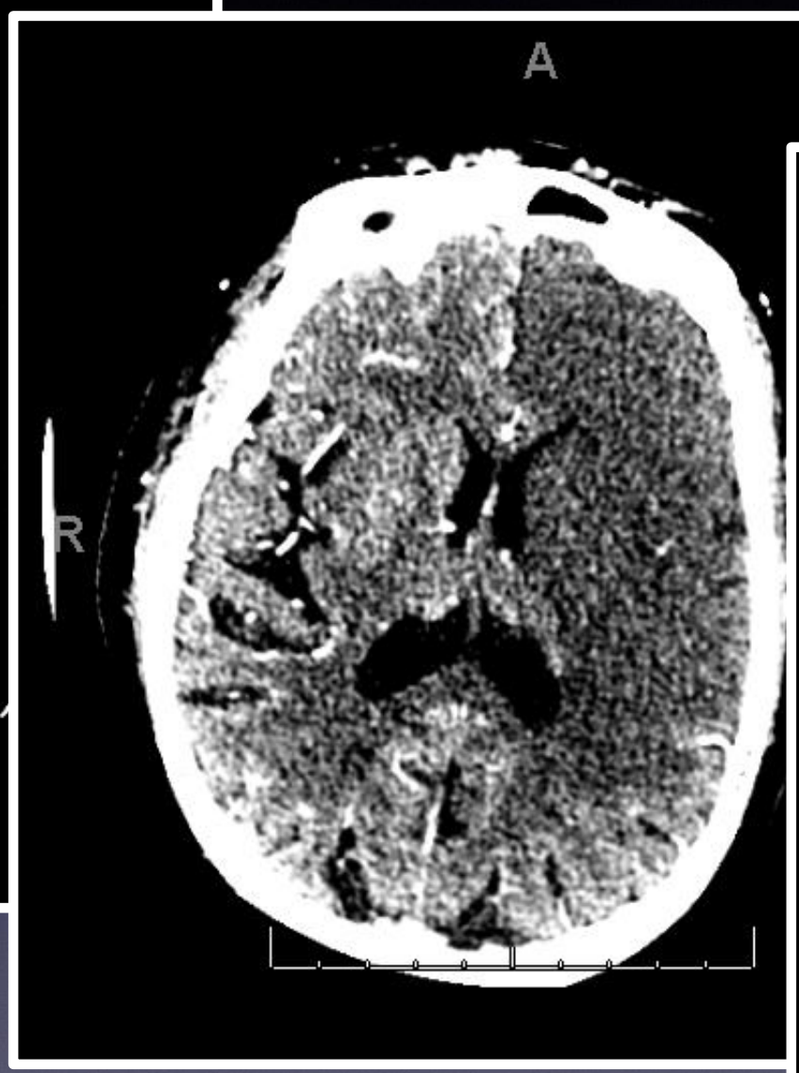
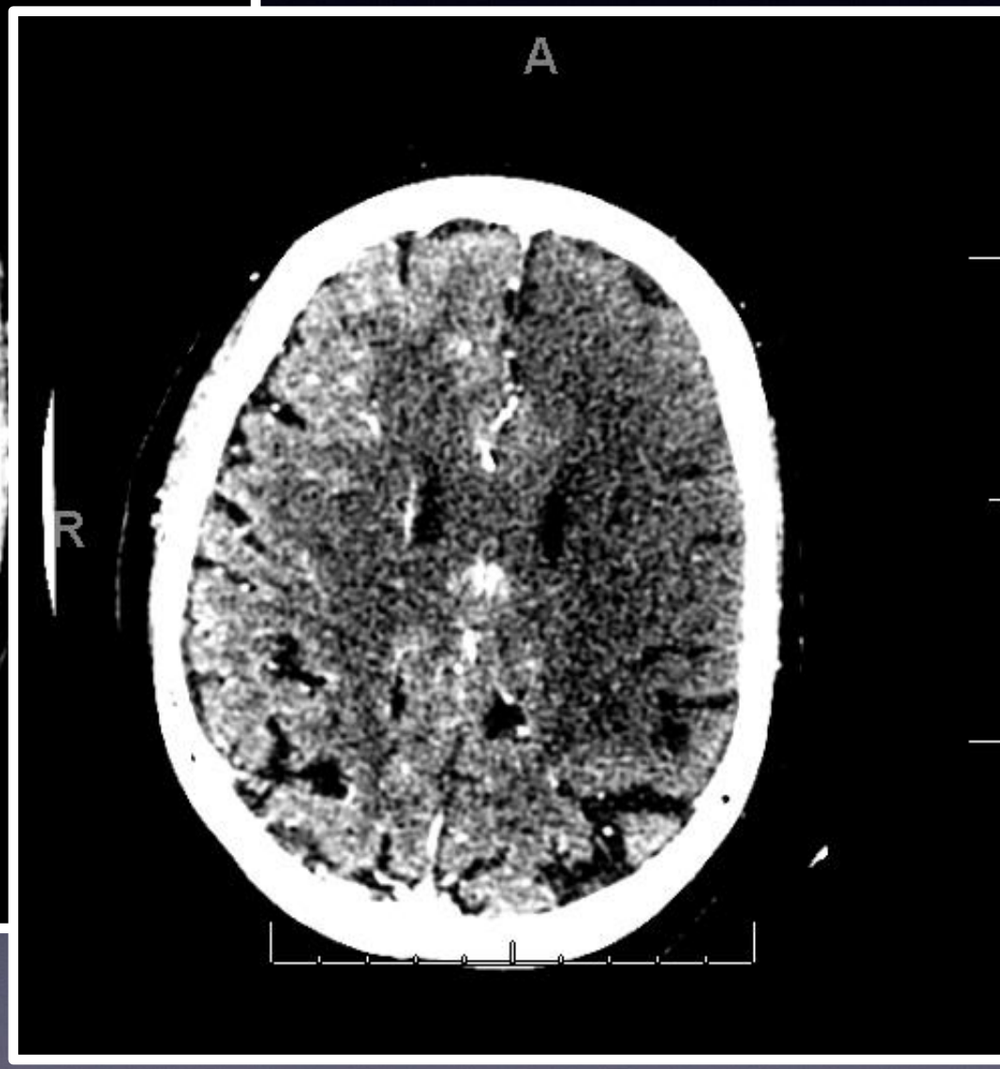


Wake-up stroke, LSN 2 pm, CT 7:10 PM

ASPECTS: 4

CTA





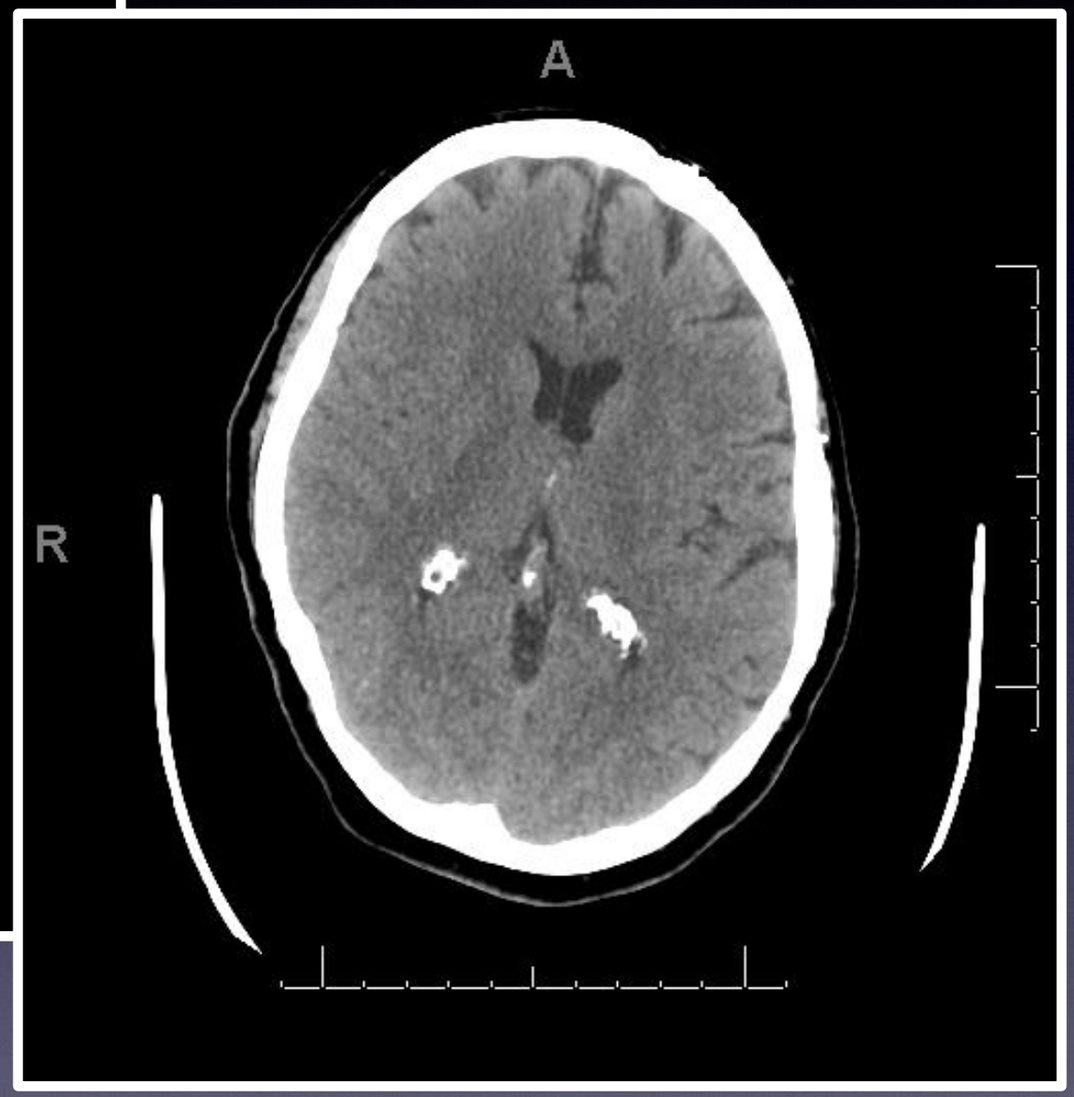
Wake-up stroke, LSN 2 pm, CTA:
8:00 PM

II. What is the role of imaging?

- Patient with acute onset neurologic deficit.
- Rule-out hemorrhage
- Rule out other pathology
- Identify and quantify early ischemic changes
- Evaluate for large vessel occlusion
- Evaluate for collateral flow

CTA in acute stroke

- Evaluate for large vessel occlusion
- Evaluate for collateral flow
- [Identify and quantify early ischemic changes]
- Help in procedural planning
- Evaluate for tandem occlusion, arch disease, multiple occlusions



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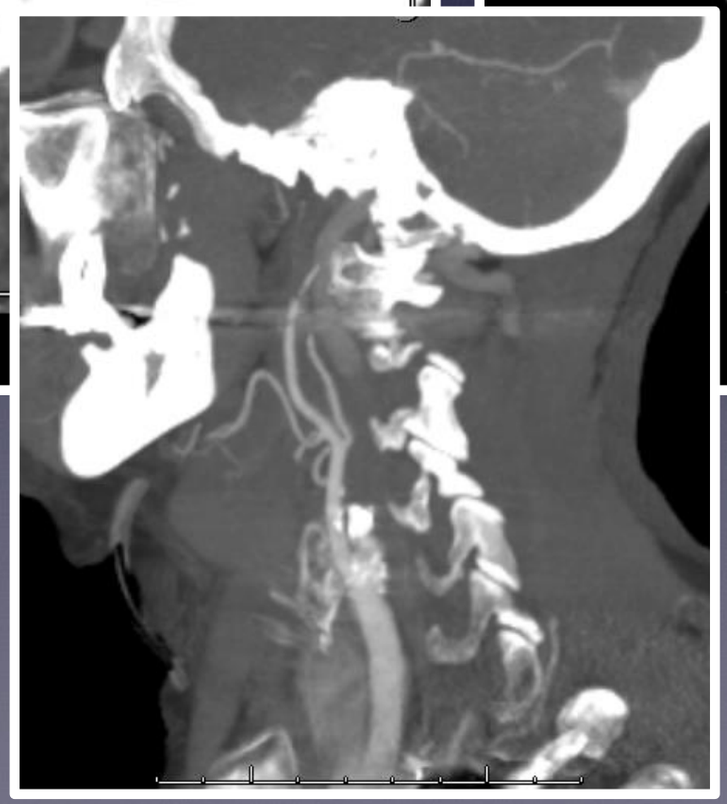
16:40



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A
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A
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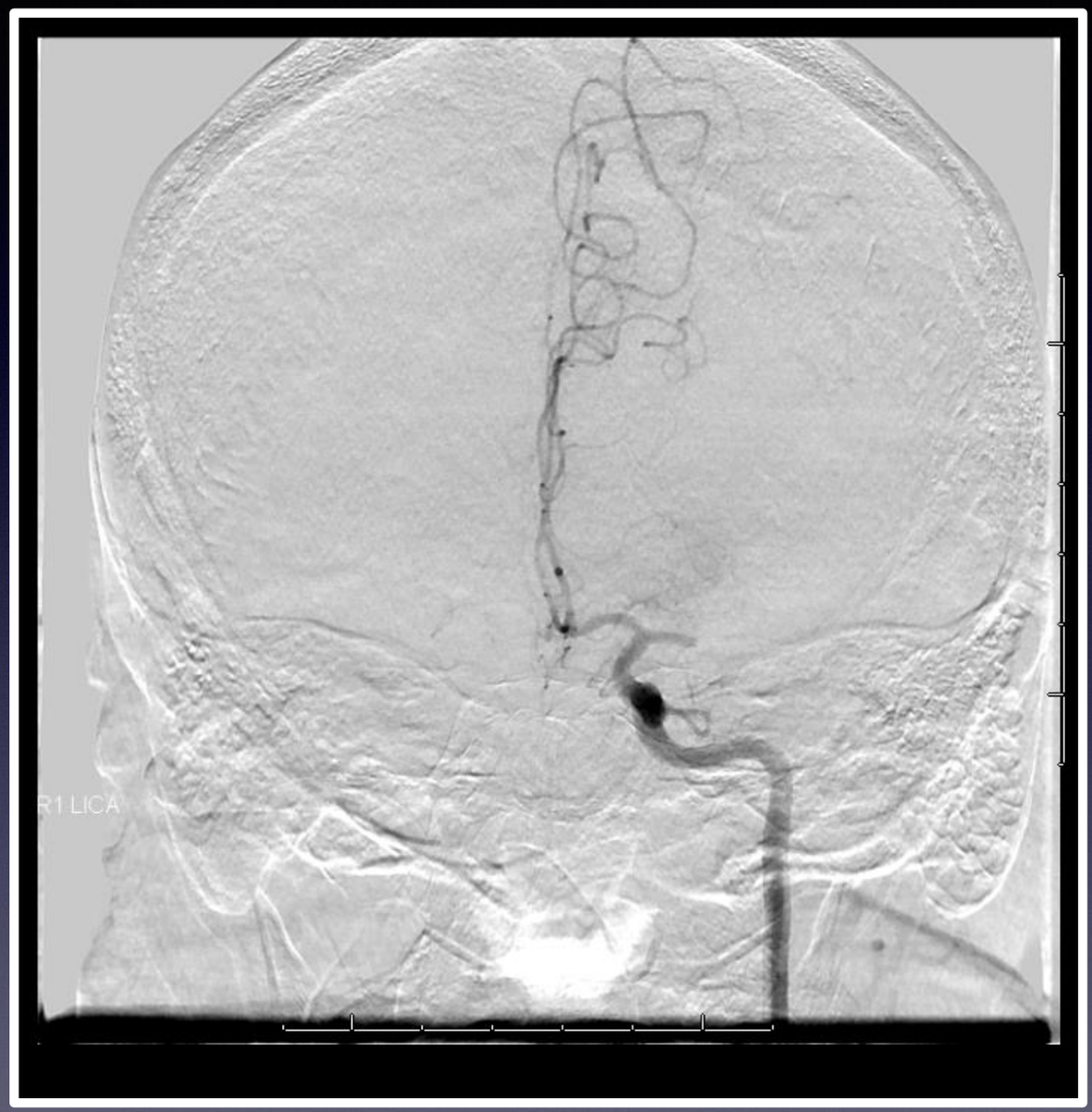
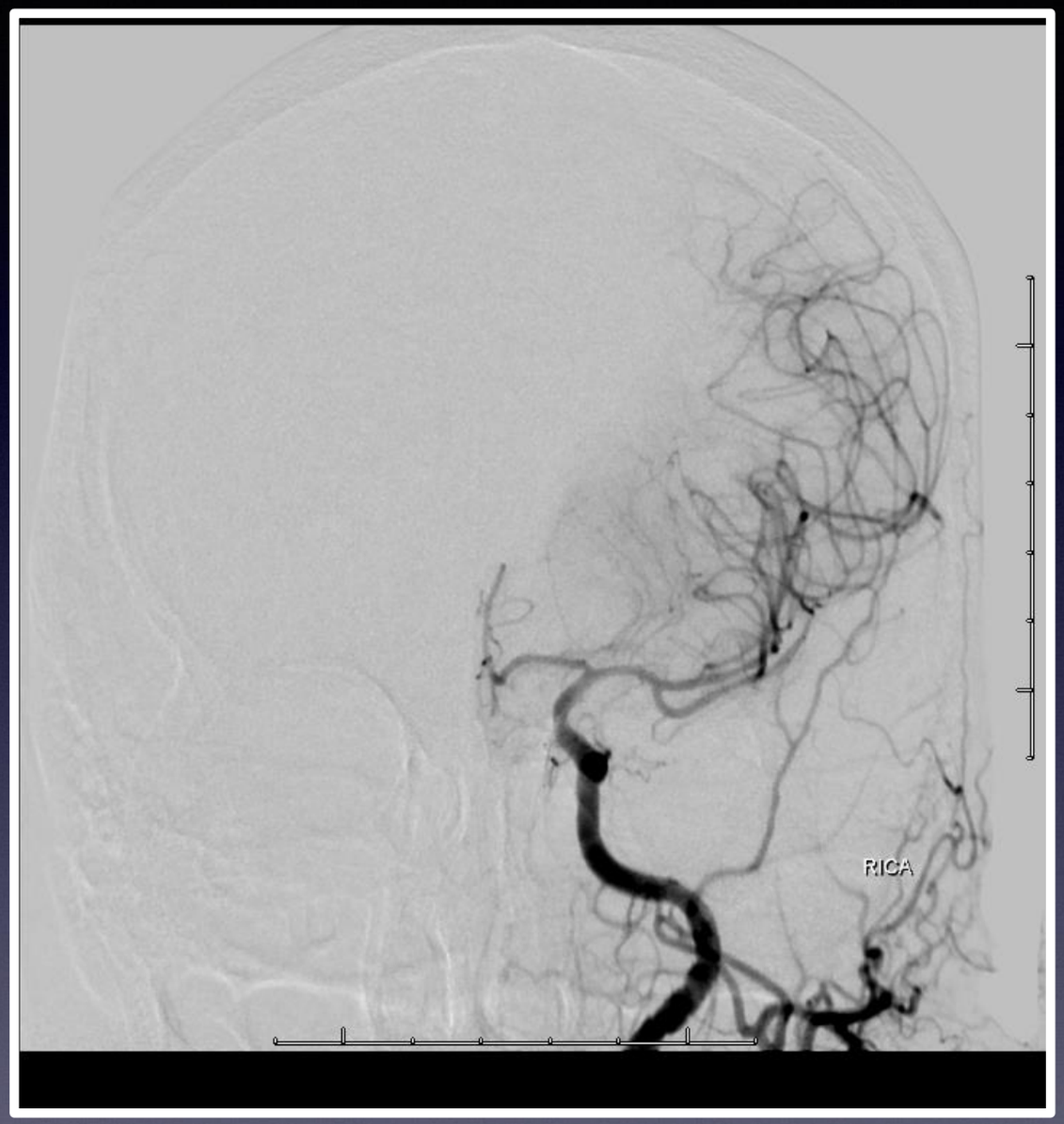
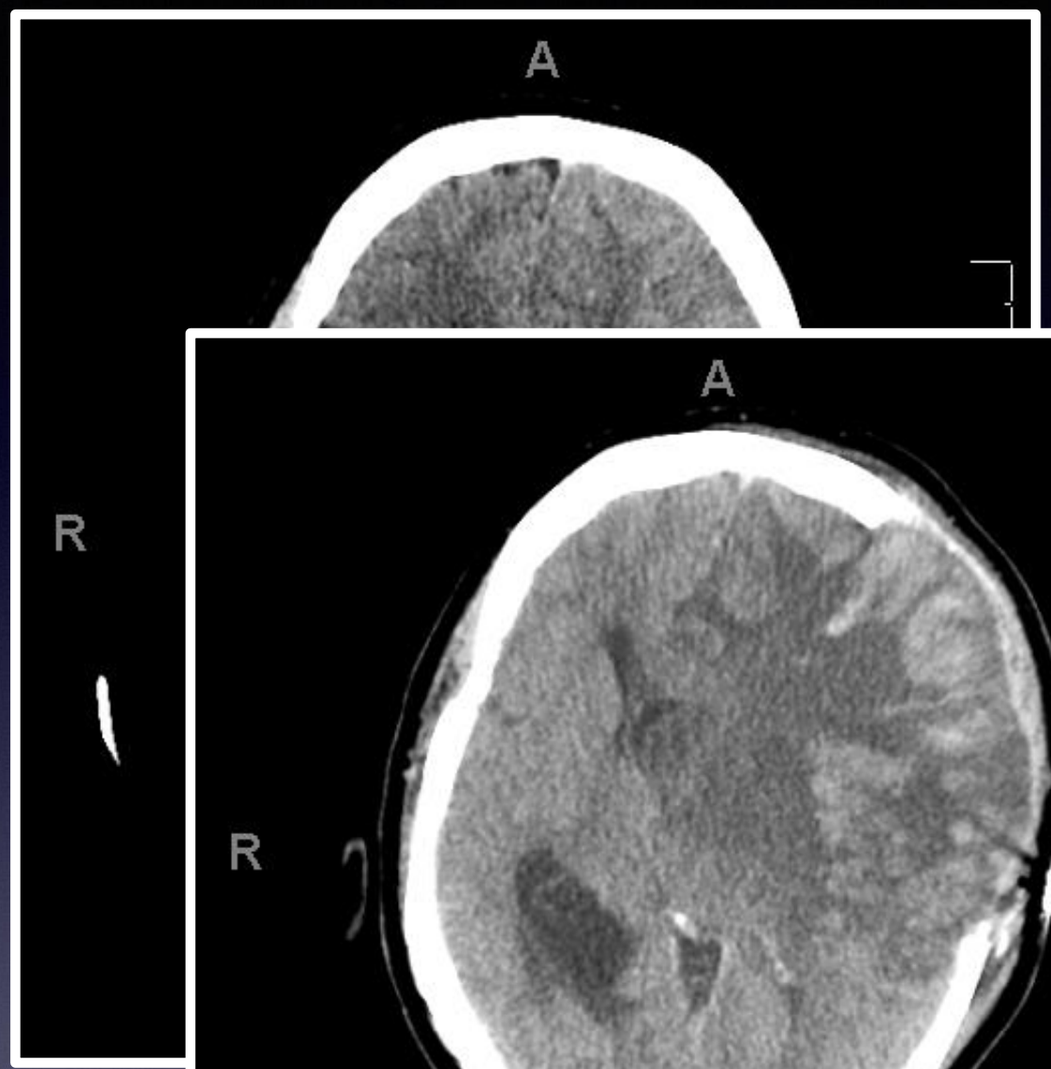
LT


R1 LICA


RICA


R4 LICAP/1PAS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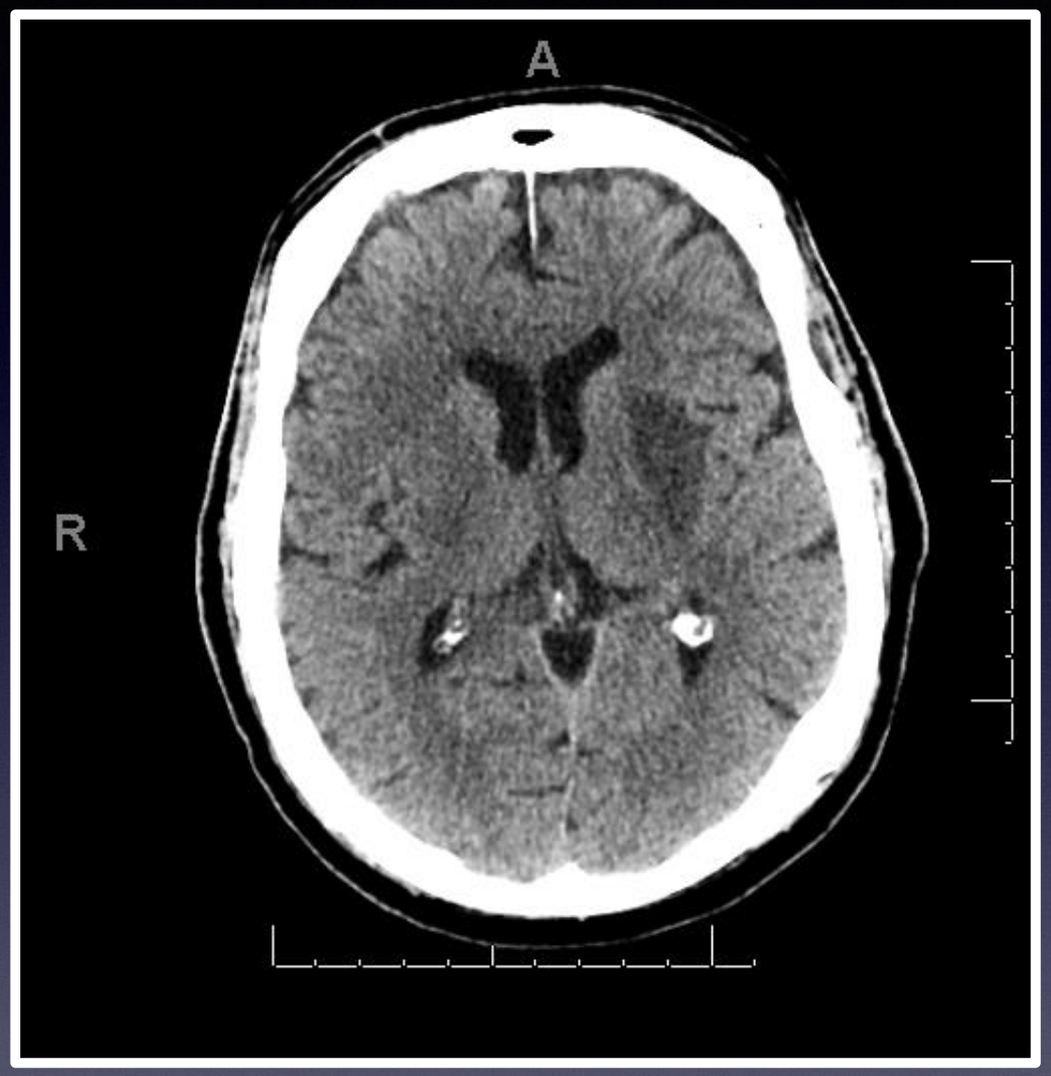
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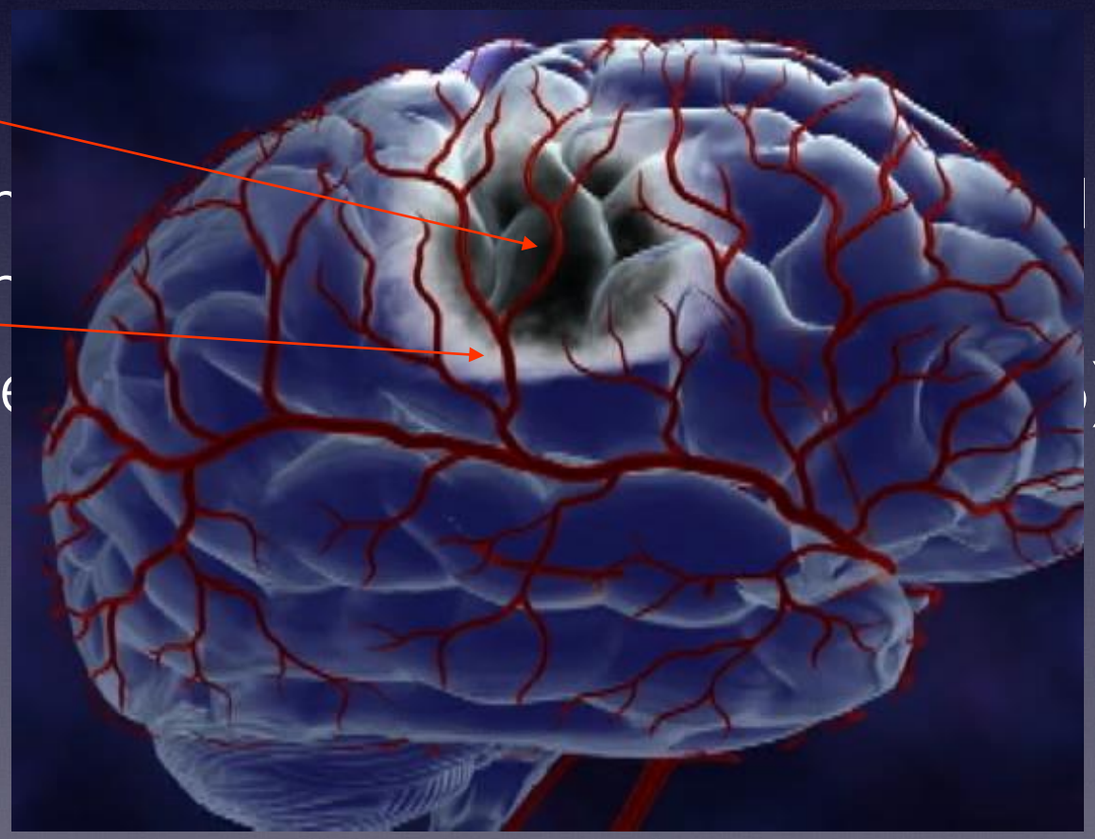
III. What is the role of imaging?

- Patient with acute onset neurologic deficit.
  - Rule-out hemorrhage
  - Rule out other pathology
  - Identify and quantify early ischemic changes
  - Evaluate for large vessel occlusion
  - Evaluate for collateral flow
  - Evaluate the perfusion status and identify salvageable brain

The Penumbra



- Surrounding this ischer flow called the ischemic per
- The penumbra's cells re)[2]

1. Lo EH, et al. *Neuroscience*. 2003;4:399-415. 2. Lipton P. *Physiol Rev.* 1999;79:1431-1568.

CT Perfusion in Hyperacute Stroke

3 maps:

- Cerebral Blood Volume (CBV) – Infarct core

CBV normal 4–6 ml/100 g

- Mean Transit Time [MTT(MTT = cerebral blood volume (CBV) / cerebral blood flow (CBF)]
- – Penumbra + core

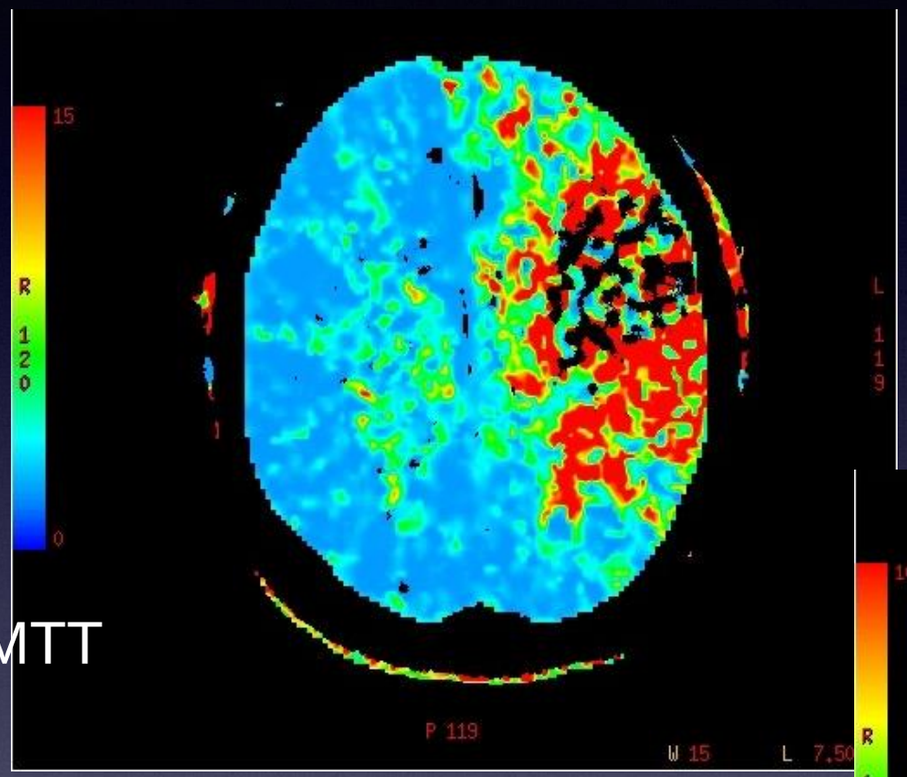
MTT normal < 4 sec

- Cerebral Blood Flow (CBF) – Penumbra + core

CBF normal 50–60 ml/100 g/min

CBF=CBV/MTT

- Automated software can be used: e.g. RAPID


15
R
120
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L
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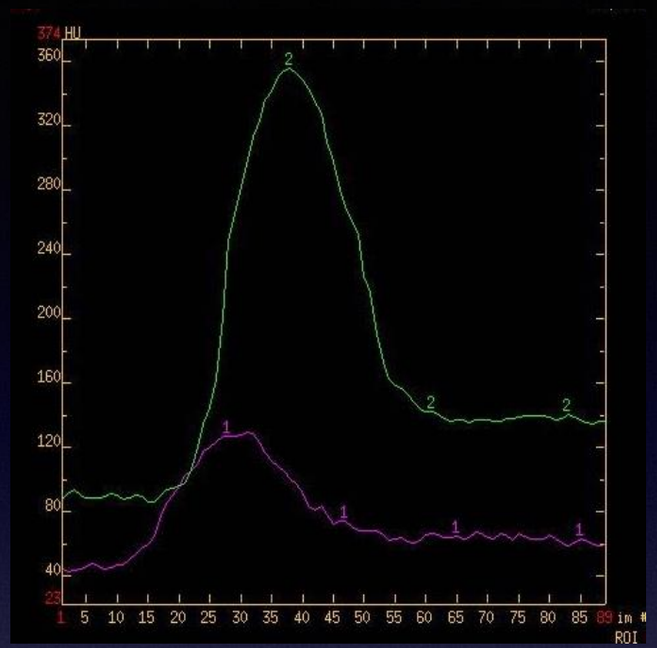
P 119
W 15
L 7.50

MTT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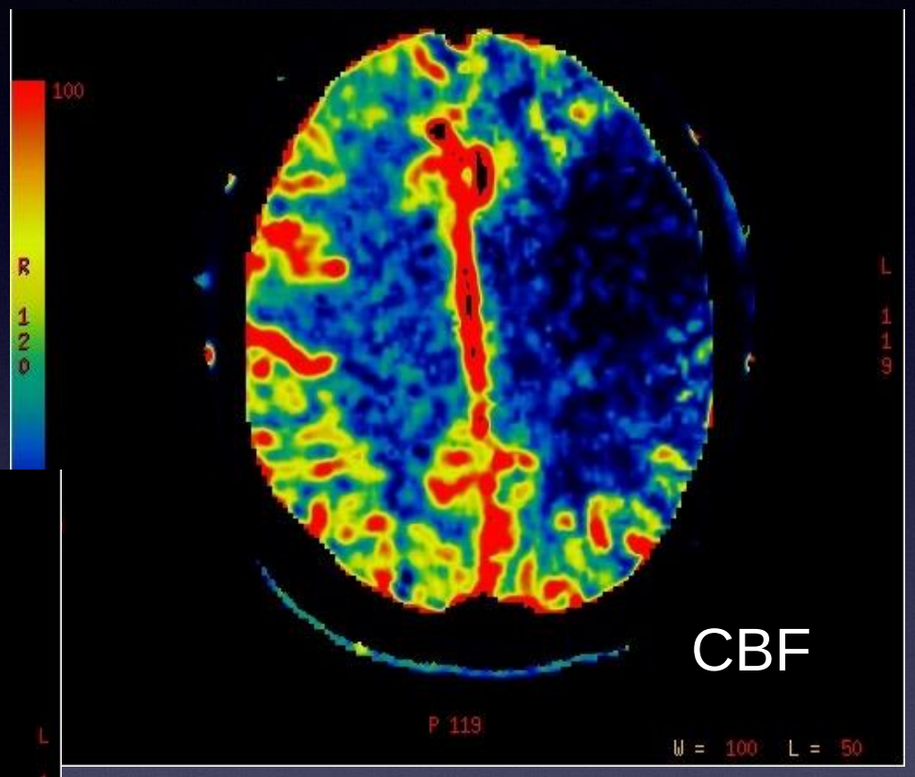
100
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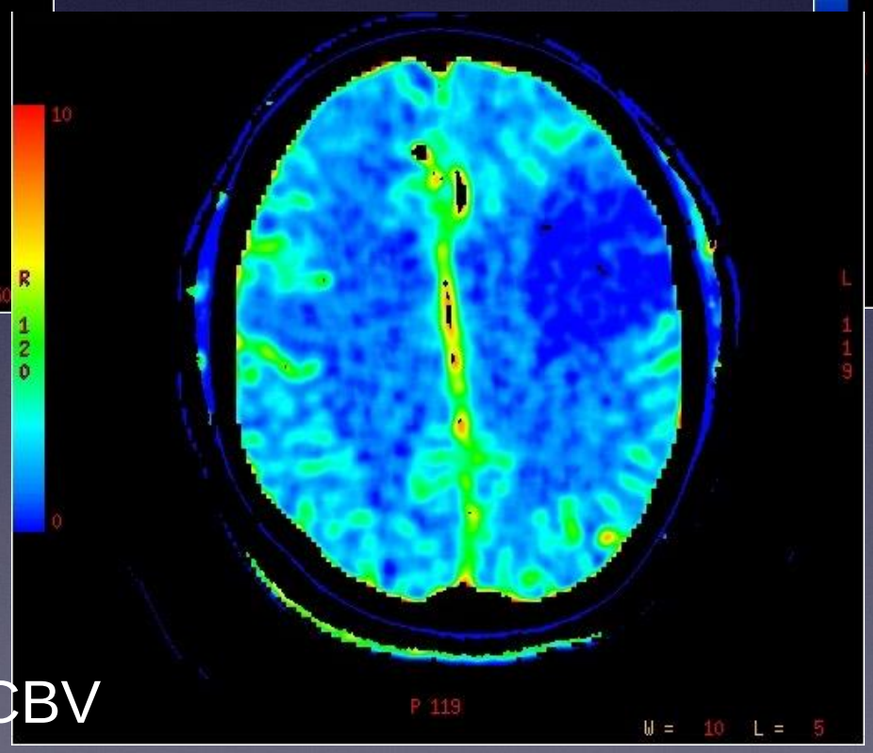
L
119
P 119
W = 100
L = 50

CBF


10
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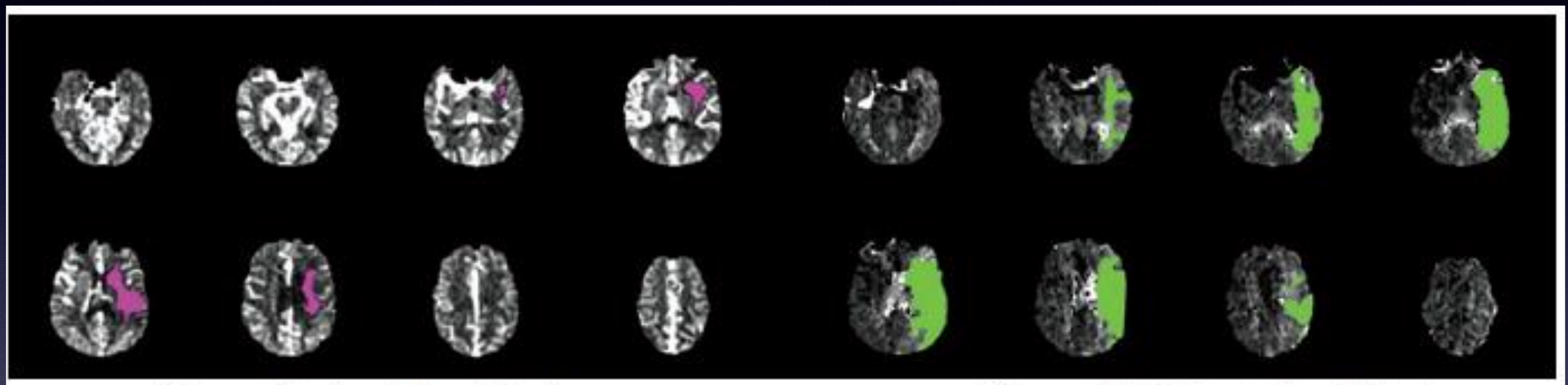
P 119
W = 10
L = 5

CBV

DEFUSE 3 TRIAL PATIENT SELECTION



Volume of Ischemic Core, 23 ml

Volume of Perfusion Lesion, 128 ml

Mismatch volume, 105 ml
Mismatch ratio, 5.6

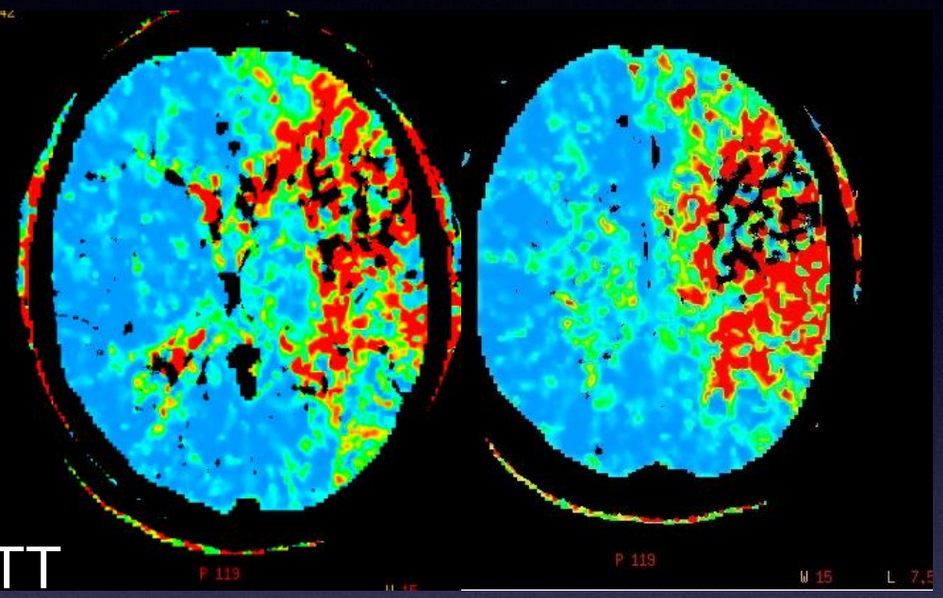
CT Perfusion in Hyperacute Stroke

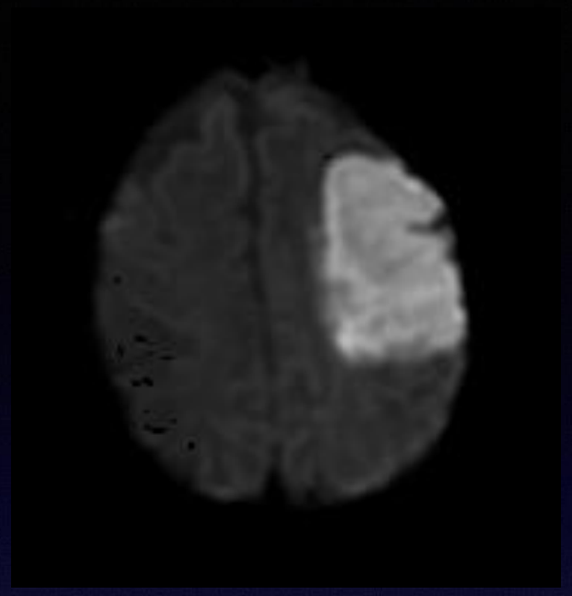
Infarct core

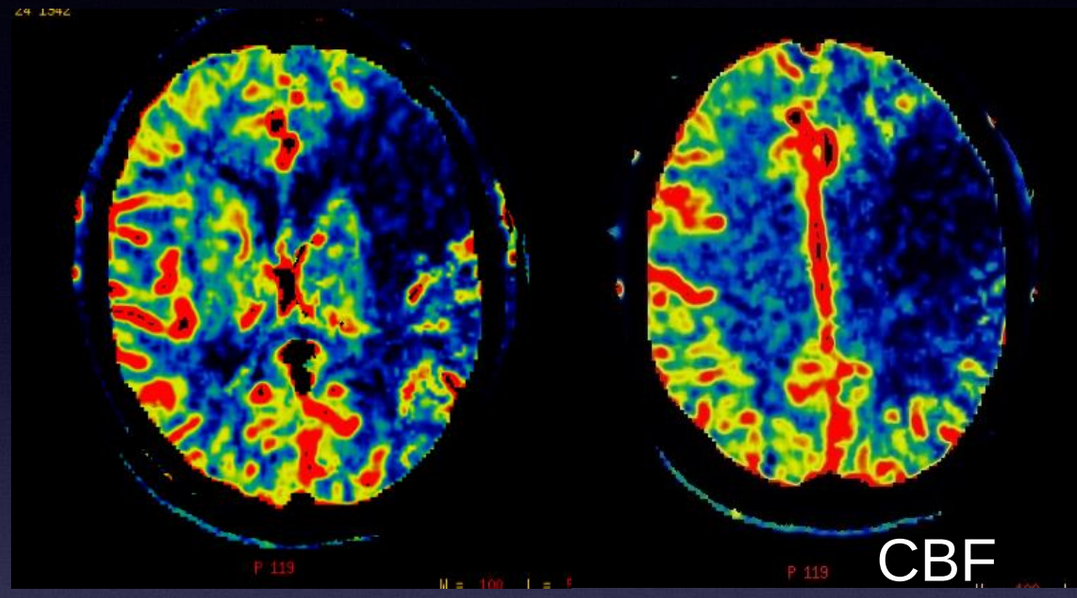
- unsalvageable tissue (better than NECT)
- Area CBF < 30% normal
- Low CBV (<2 ml/100g) / delayed Time to Peak
- Core volume cutoff for treatment: < 70 ml

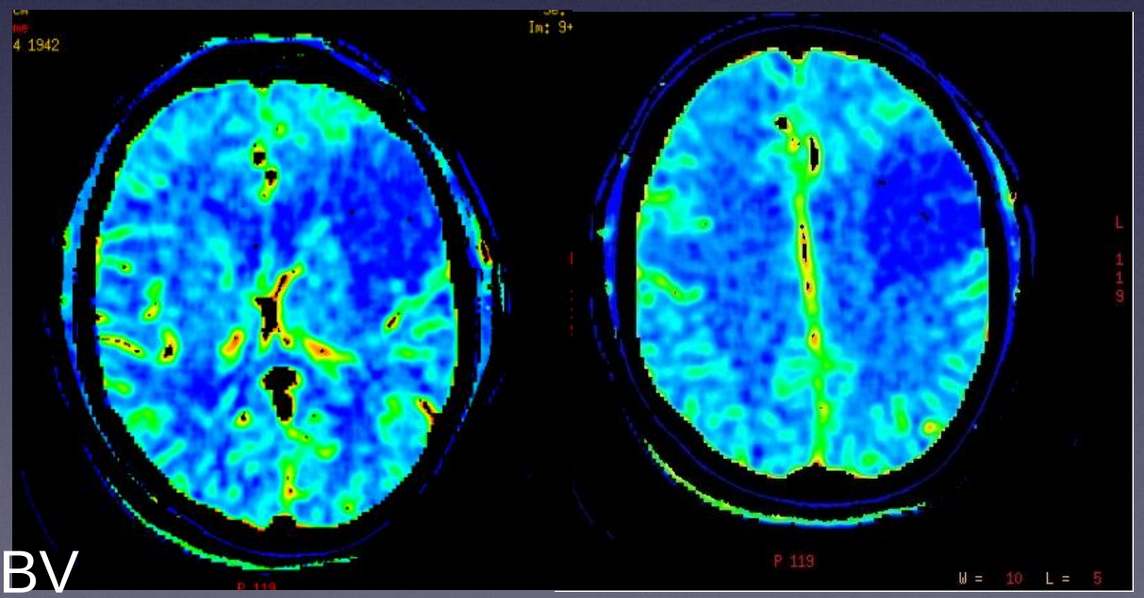
Penumbra

- salvageable tissue with reperfusion
- MTT >6 sec
- Mismatch to benefit from treatment:
- Ratio: Penumbra/core: 1.8
- Volume difference Penumbra - core: >15 ml


TT




CBF


CBV

CT Perfusion in Patient Selection

- **Rule in:**
  - Patients > 6hrs
  - Wake-up strokes
  - ‘Target Mismatch*’
    - a ratio between the hypoperfused tissue (on T_{max}>6 s maps) and ischemic core on DWI maps of ≥1.8, with an absolute difference of ≥15 mL
    - DWI ischemic core volumes ≤70 mL
    - volume of tissue with severe hypoperfusion (T_{max}>10 s) of ≤100 mL

- **Rule out:**
  - Patients with established infarct (large core)
  - Patients with ‘malignant profile**’
  - Patients with stroke mimickers

* patients who would presumably be ideal candidates for reperfusion therapy

** severe cerebral ischemia associated with high likelihood of symptomatic intracranial hemorrhage (SICH) or poor outcome after reperfusion in acute ischemic stroke

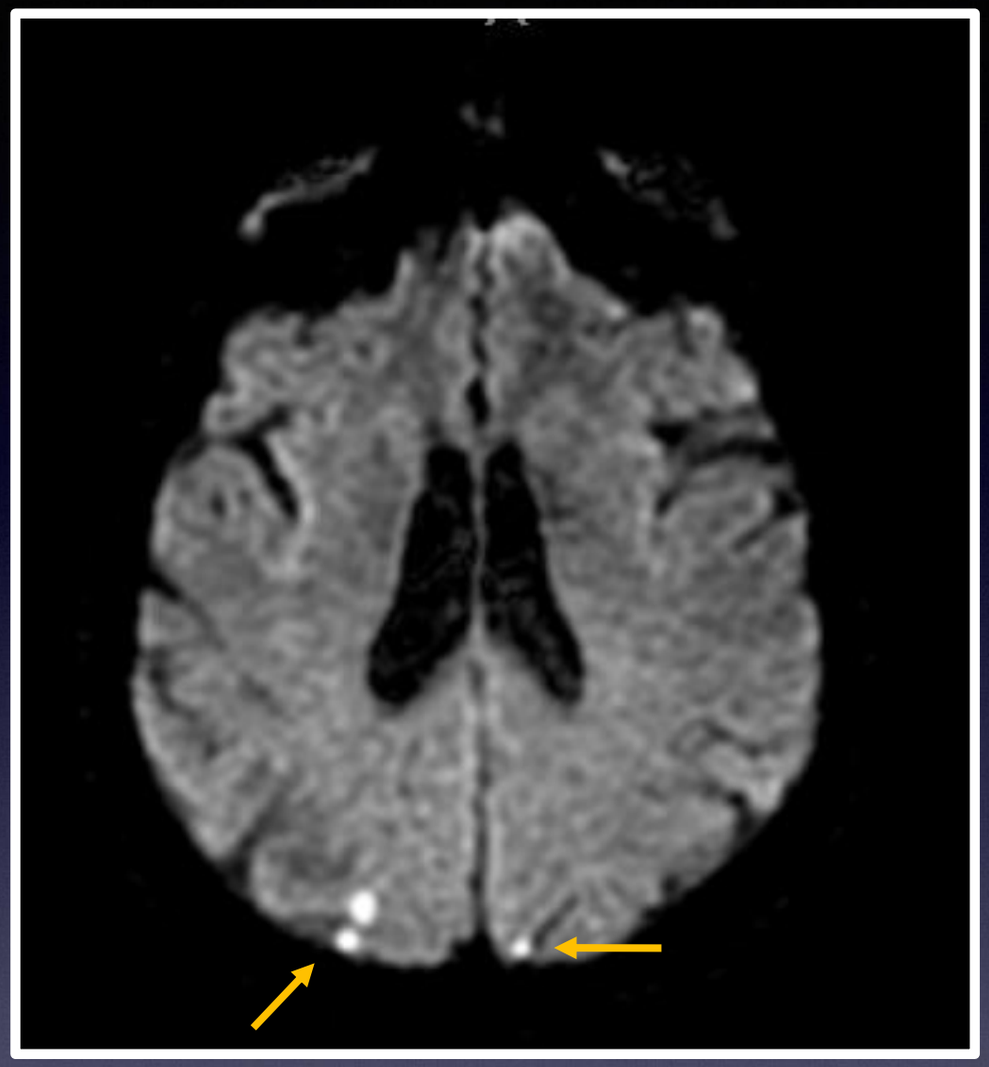
Interventional Stroke Treatment

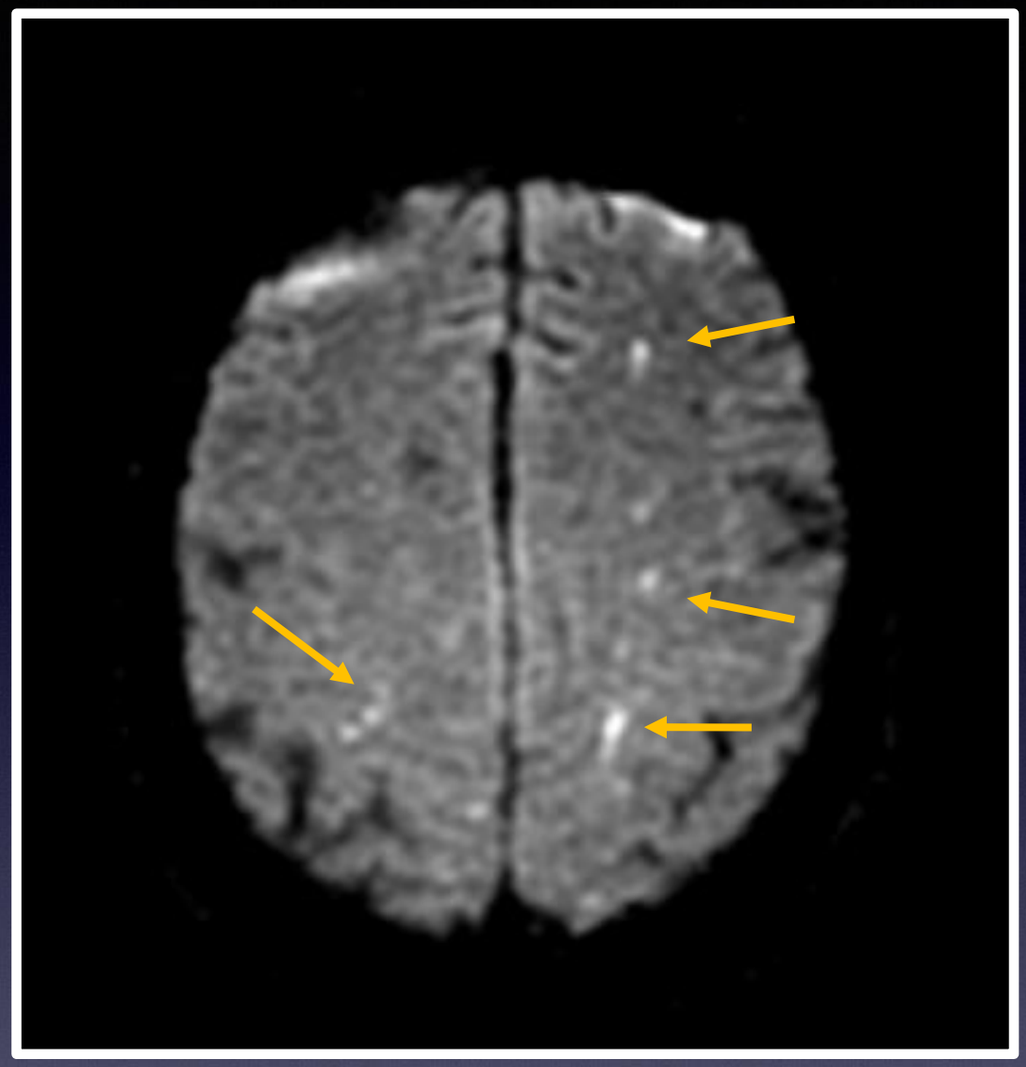
Potential IA candidate?

1. Neurologic deficit - NIHSS > **6**
2. Presence of salvageable brain tissue
   - Time window – **up to 24** hrs
   - ?ASPECTS score ≥3
3. Presence of large vessel occlusion (LVO)

   => vascular imaging (CTA, angio), collateral circulation

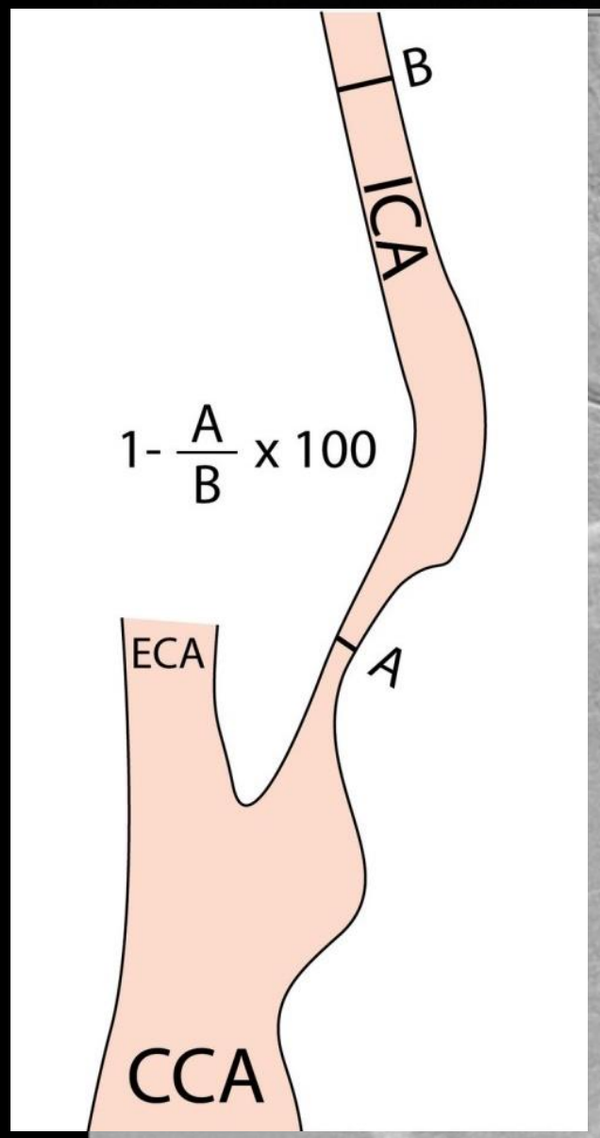
- 75 yo M with shaking weakness of RUE.



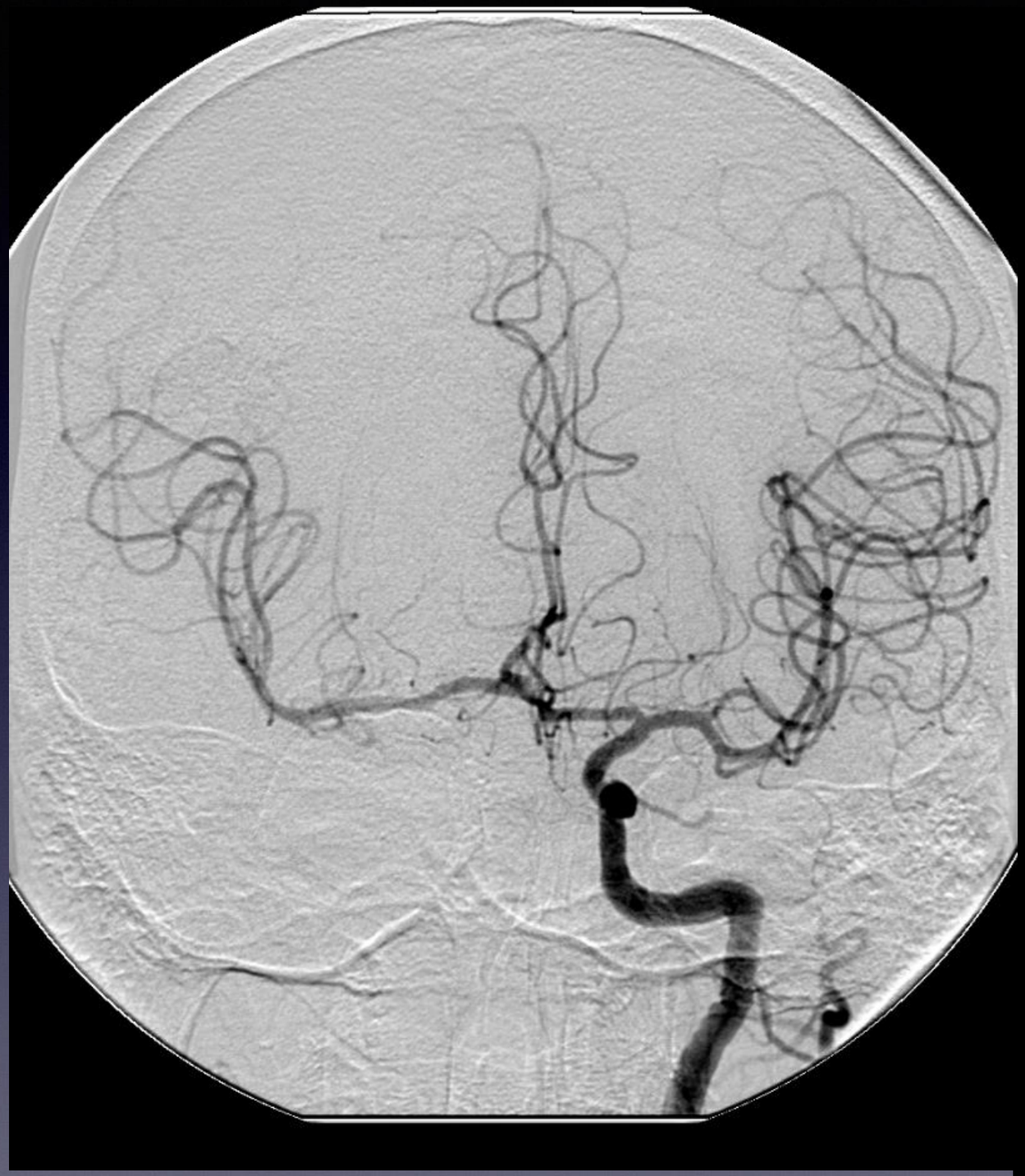


“String of beads” distribution in the deep WM, “deep watershed zone”
Posterior cortical watershed zone (MCA/PCA)
-> hypoperfusion
HEMODYNAMIC ETIOLOGY of the STROKE

Right carotid artery

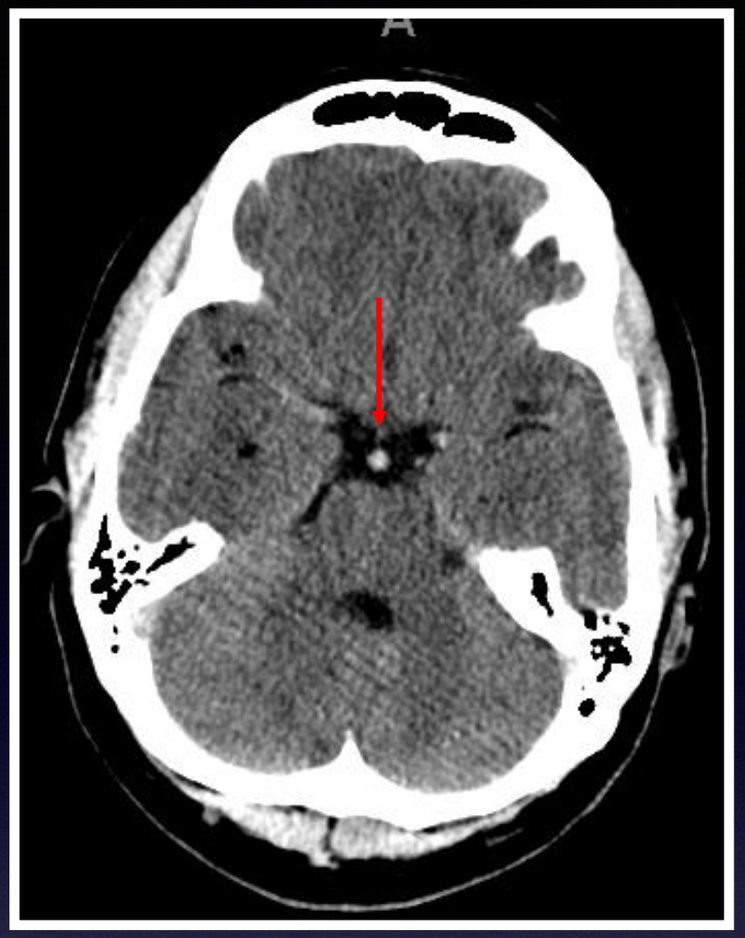


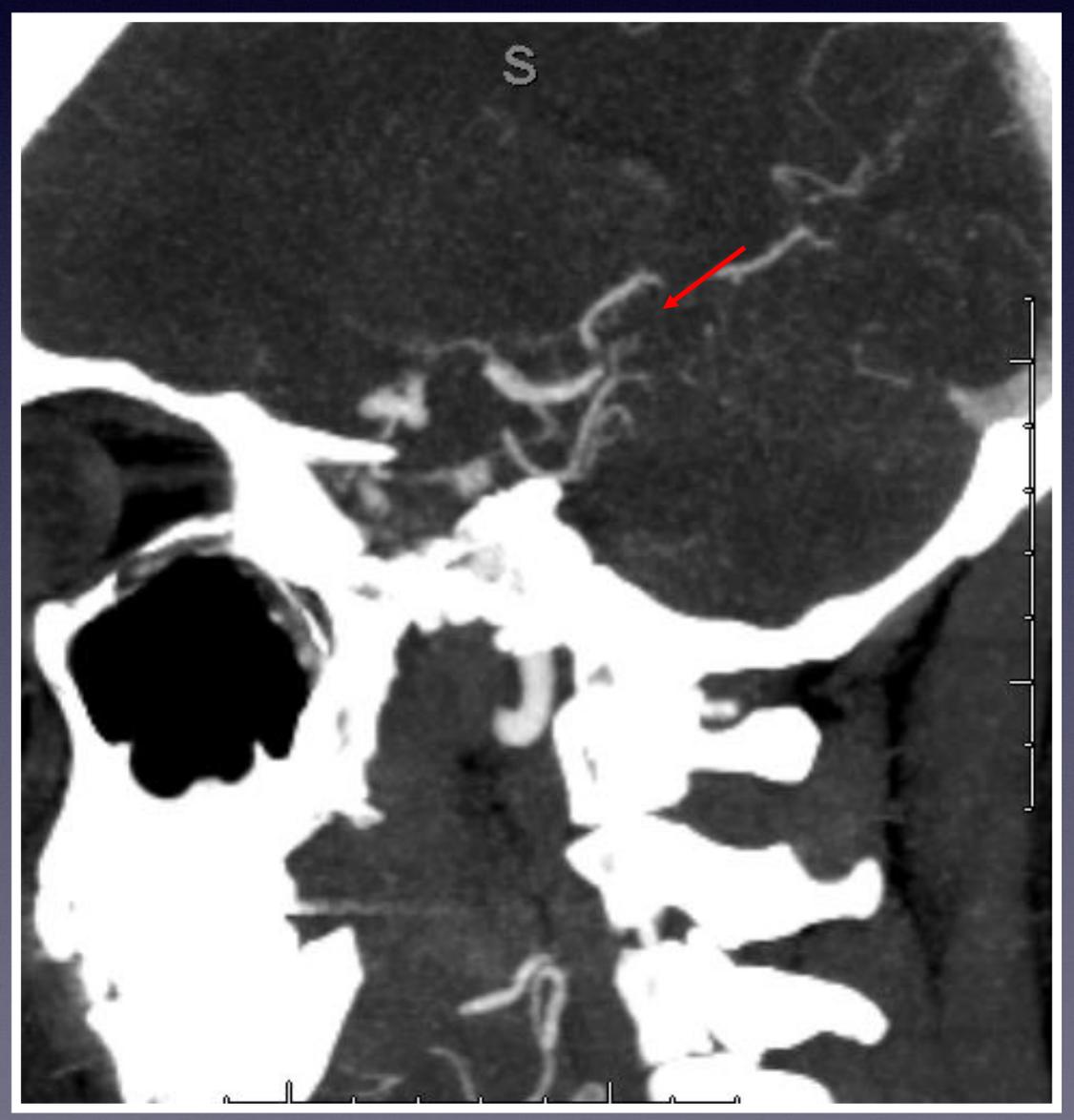
Left carotid artery

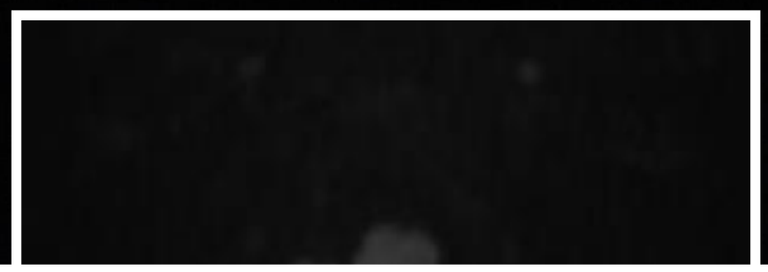


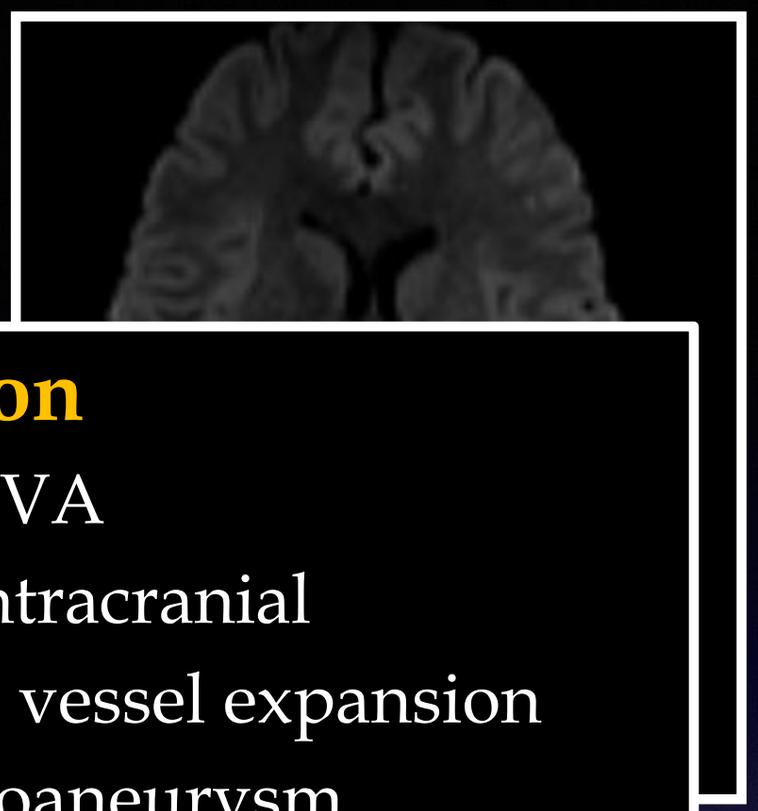
Left carotid artery

30 year old with neck pain followed by vertigo and suddenly became obtunded

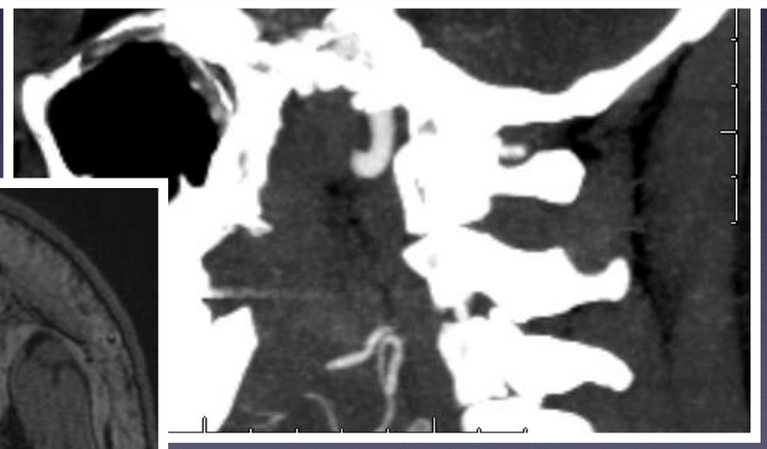


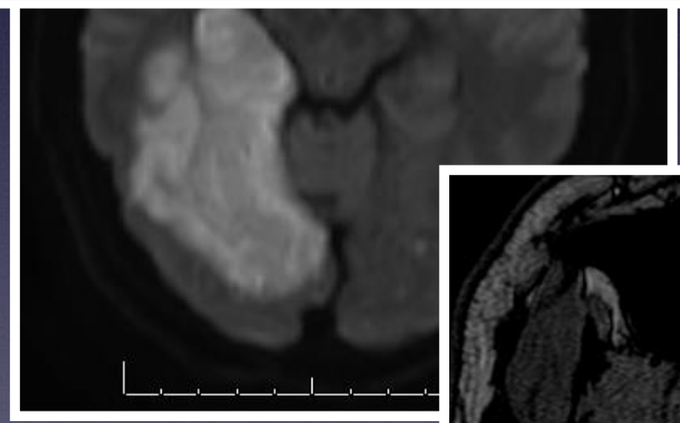


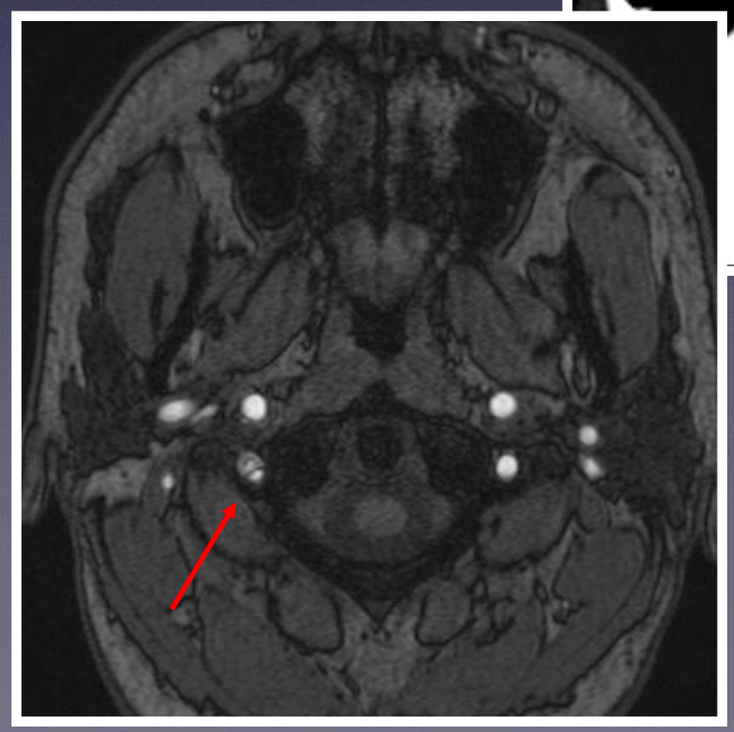


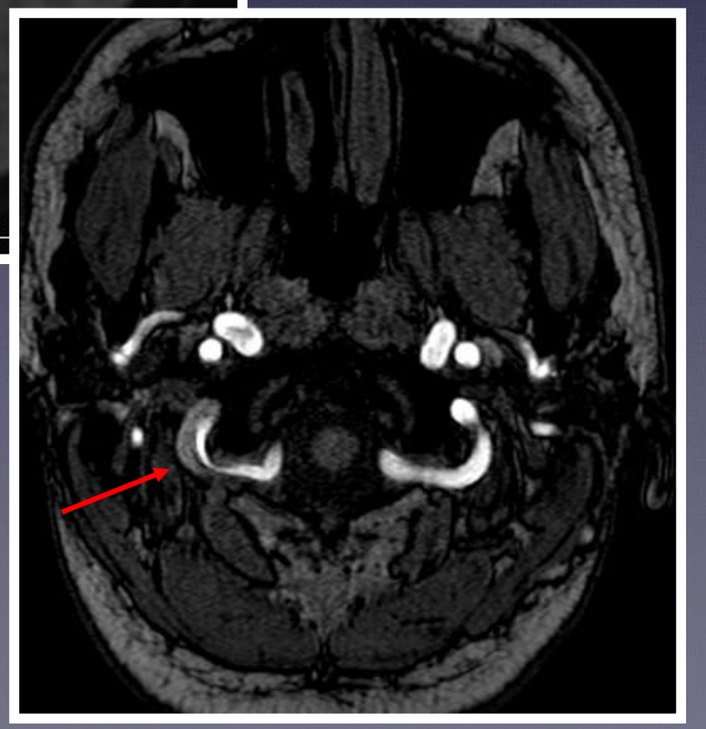


- **Arterial dissection**
  - High cervical ICA/VA
  - Extracranial, can extend intracranial
  - Mural hematoma, dissection flap, vessel expansion
  - Luminal narrowing, pseudoaneurysm
  - Hypoperfusion/emboli

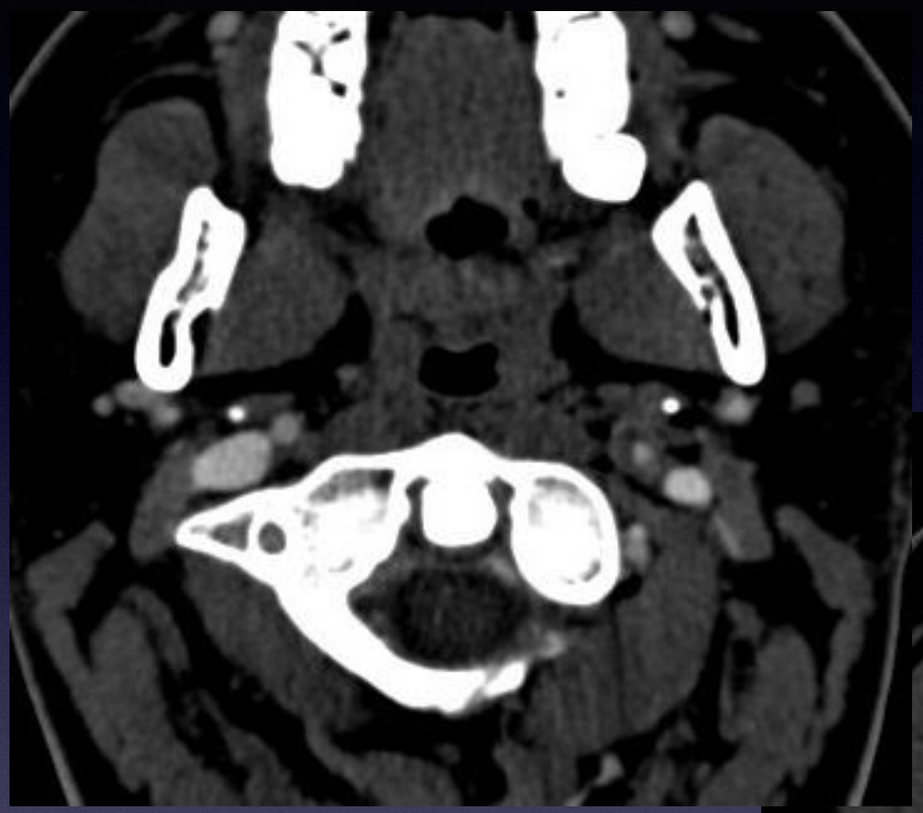


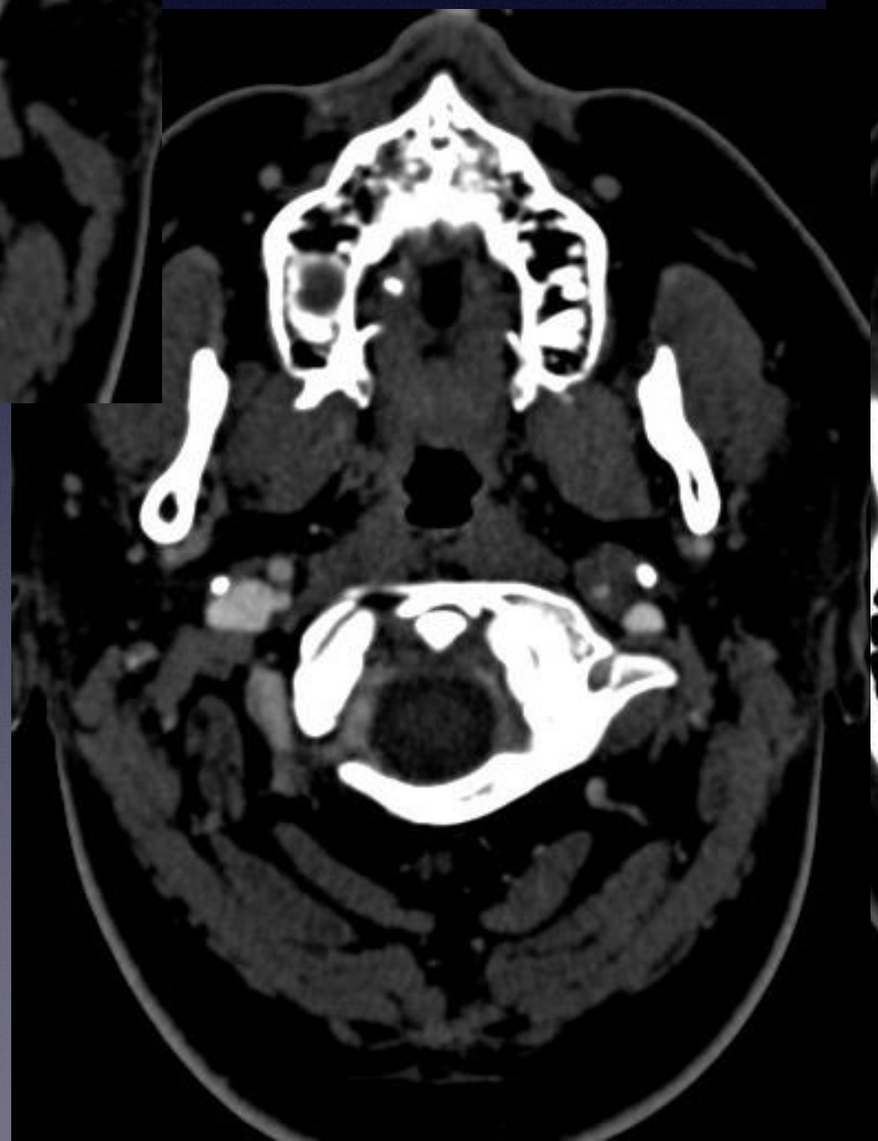


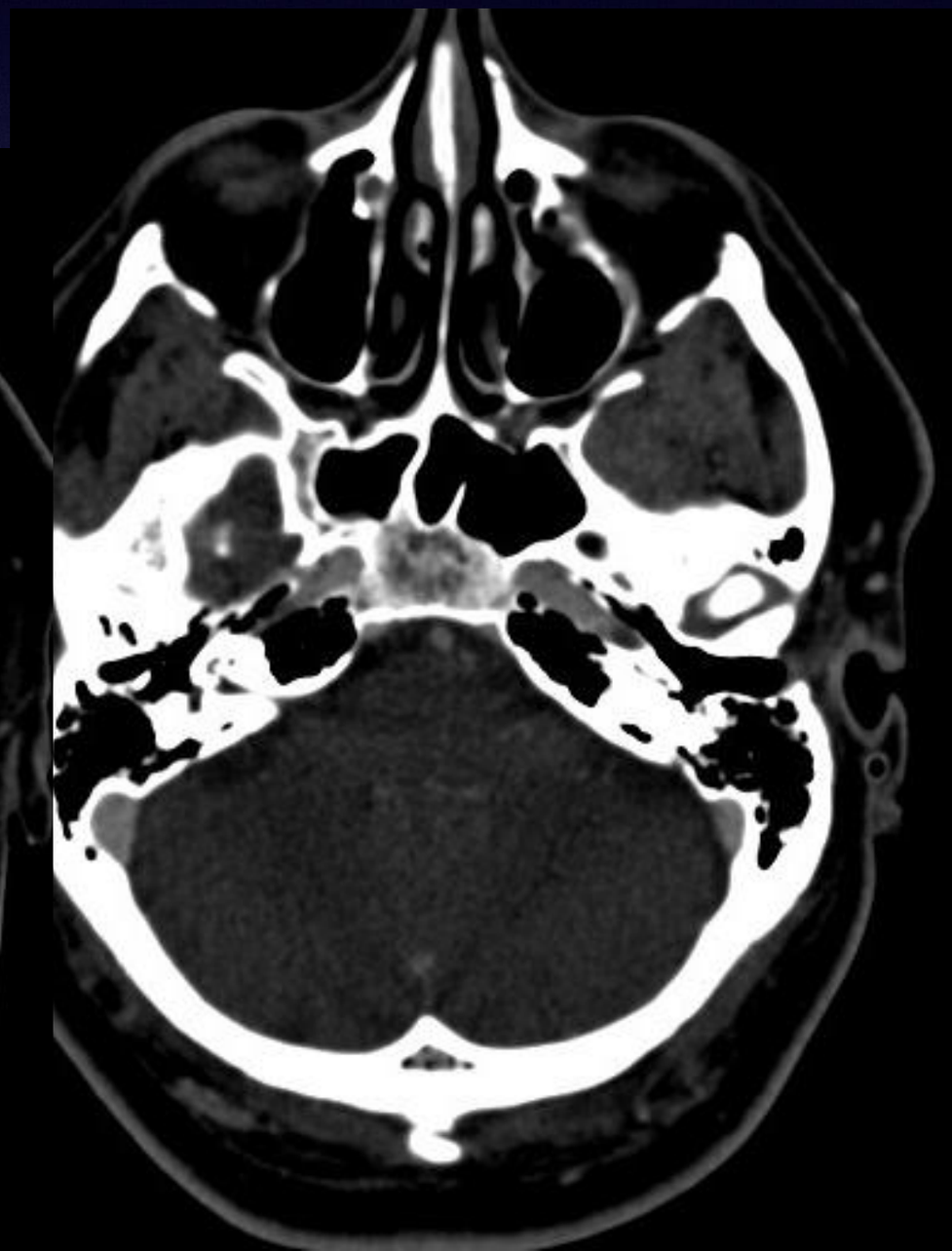




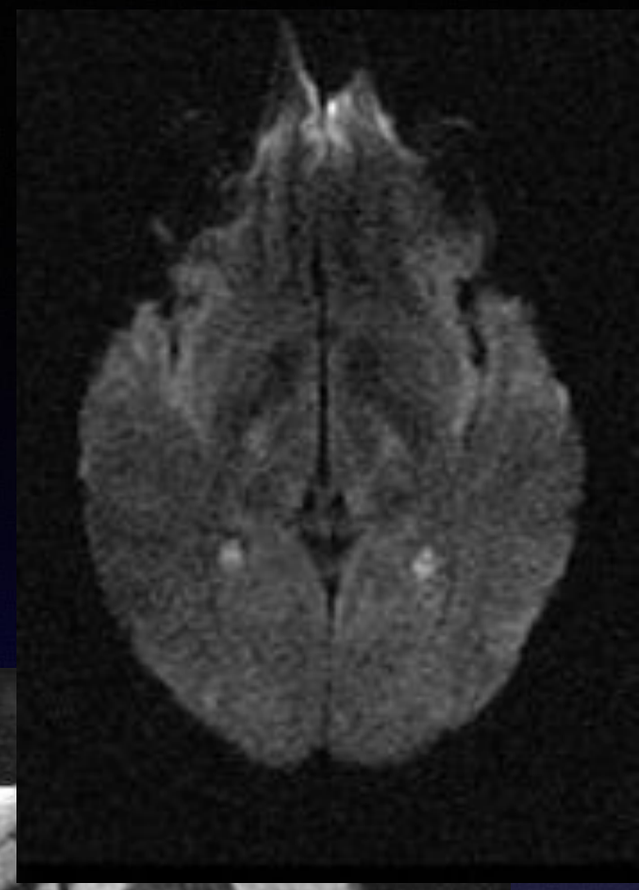
Ασθενής 48 ετών με Horner αριστερά, αίσθημα ζάλης και κεφαλαλγία αριστερά

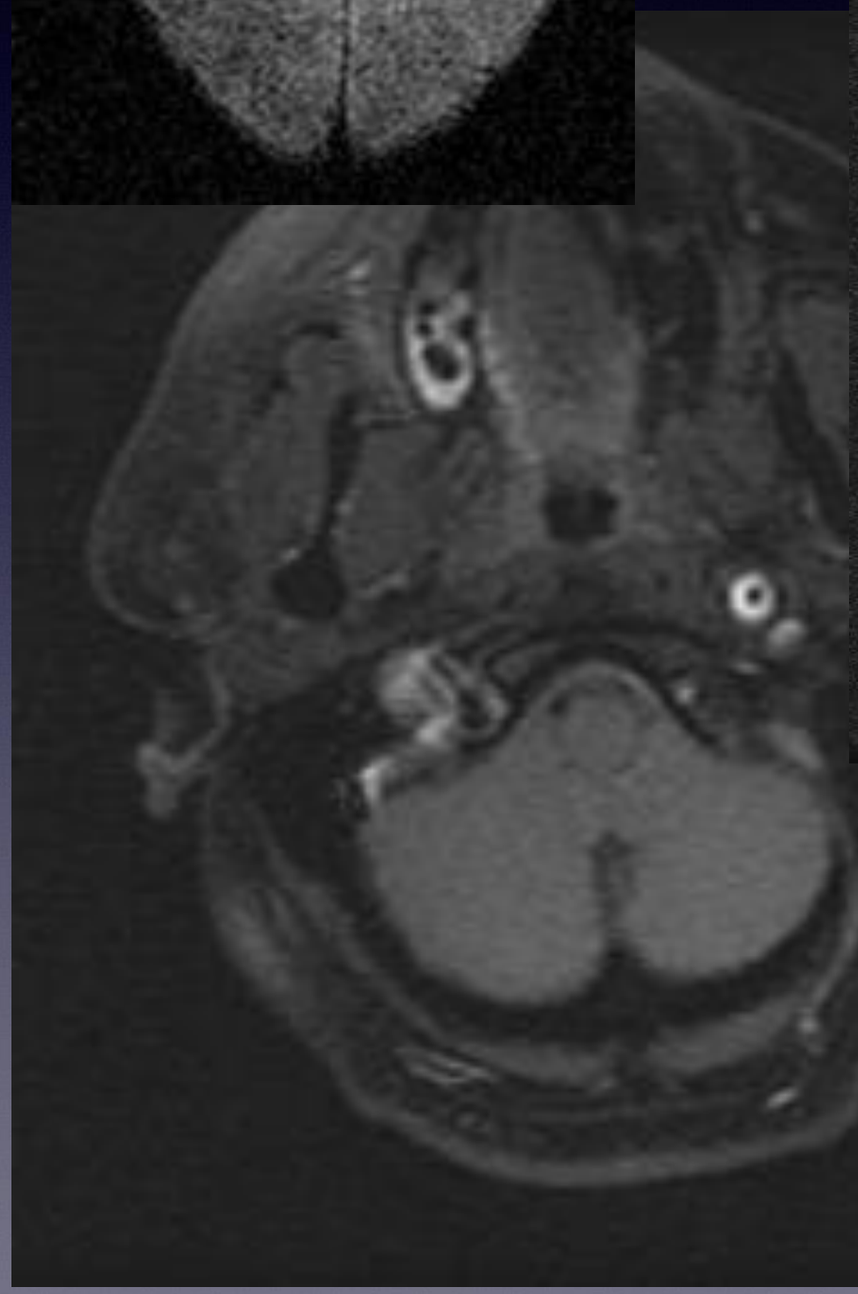


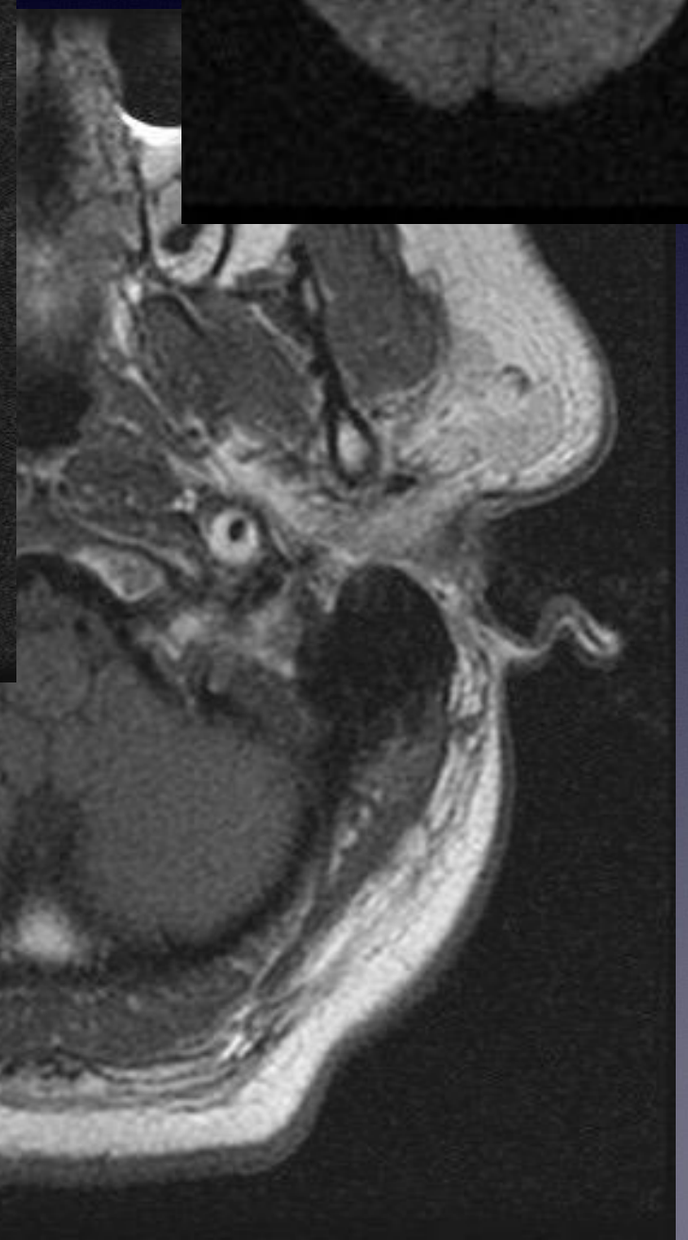




MRI







SYSTEMS
omens

RICA

5
14

: 512
4

CG/KF

M Aug 14 1960
LICA

Mar 27 2006
20:38:08

LICA

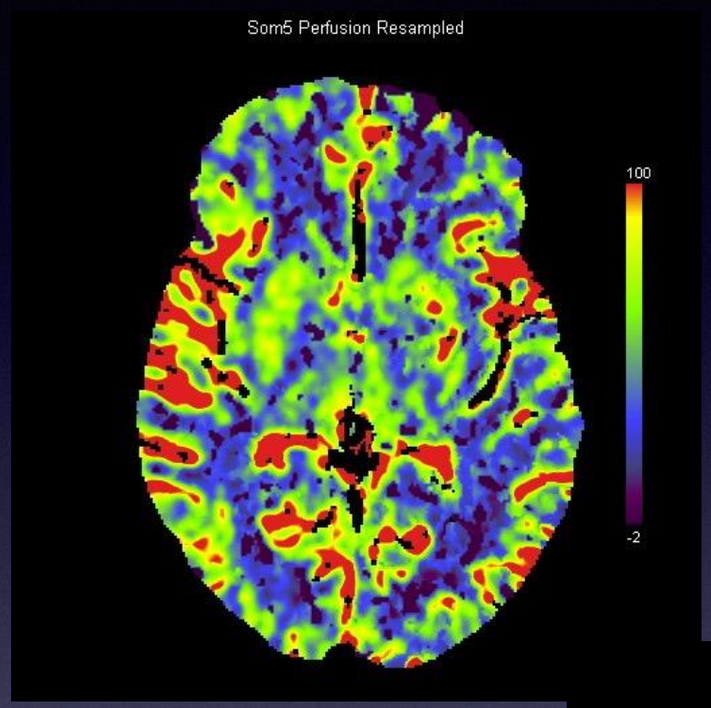
(Shut.)(Filt. 7)

depart. RAO: 5
depart. CAU: 8
depart. L: -2
Mag = 1.00
FL: ROT:
WW: 1024WL: 512
XA 1024x1024

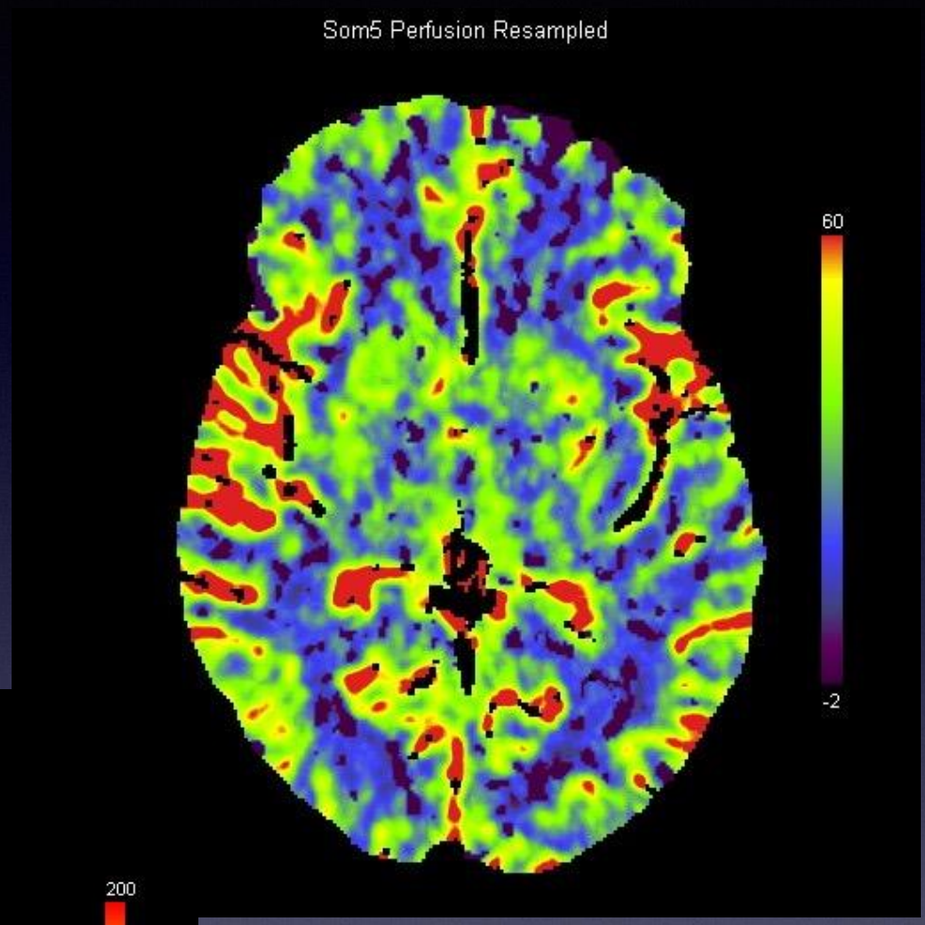
FRNT
Seq: 6
FRAME = 10 / 16
MASK = 1

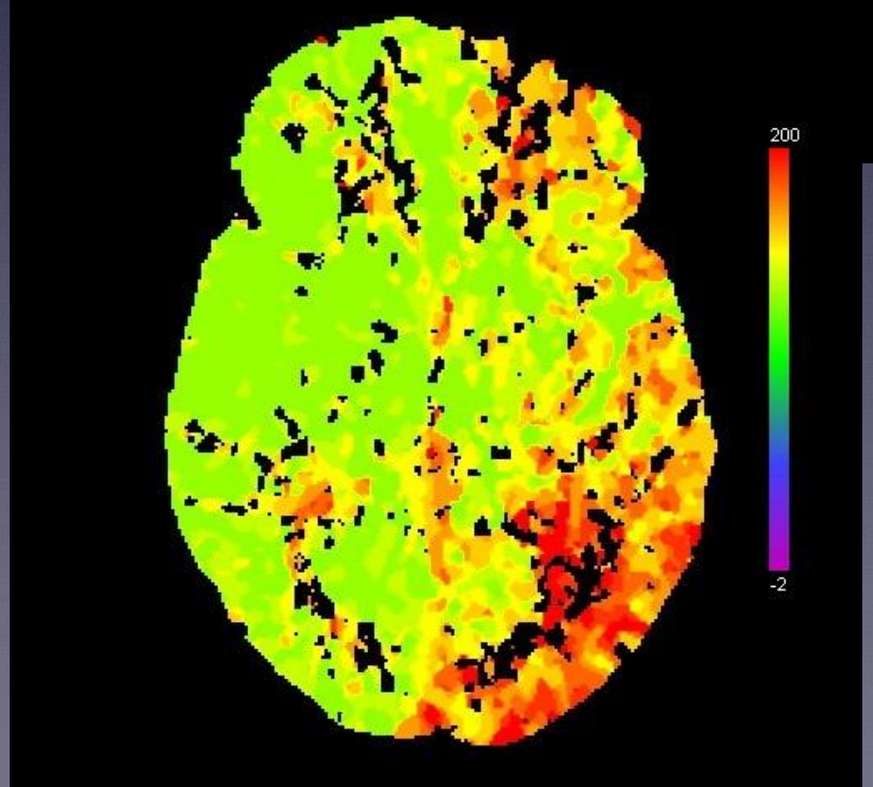

M Aug 14 1960
RT
Mar 2
2
(Shut.)(
FRAME =
MA
E
LICA

CBF CBV TTP


Som5 Perfusion Resampled
100
-2


Som5 Perfusion Resampled

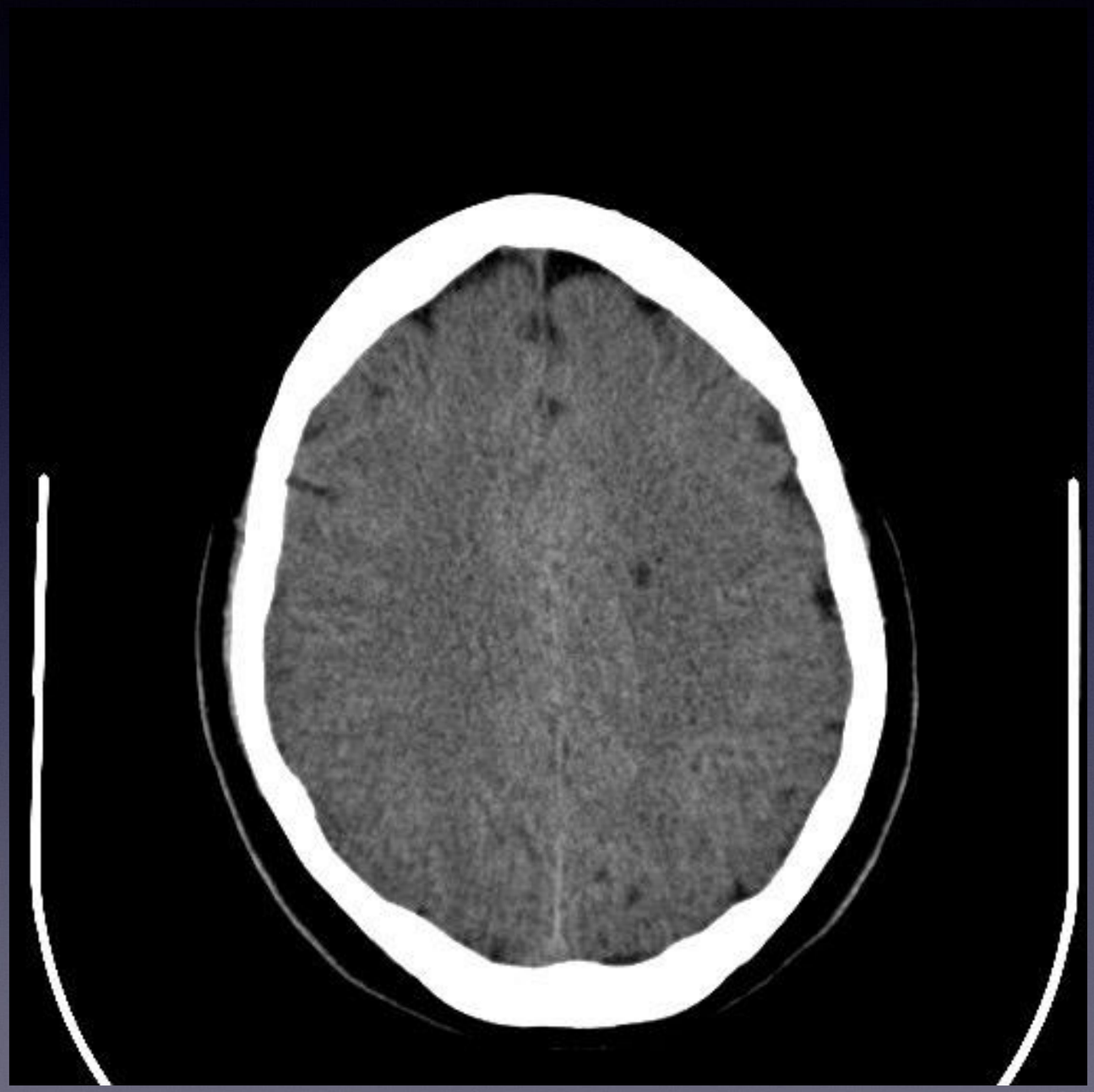

Som5 Perfusion Resampled
60
-2


200
-2

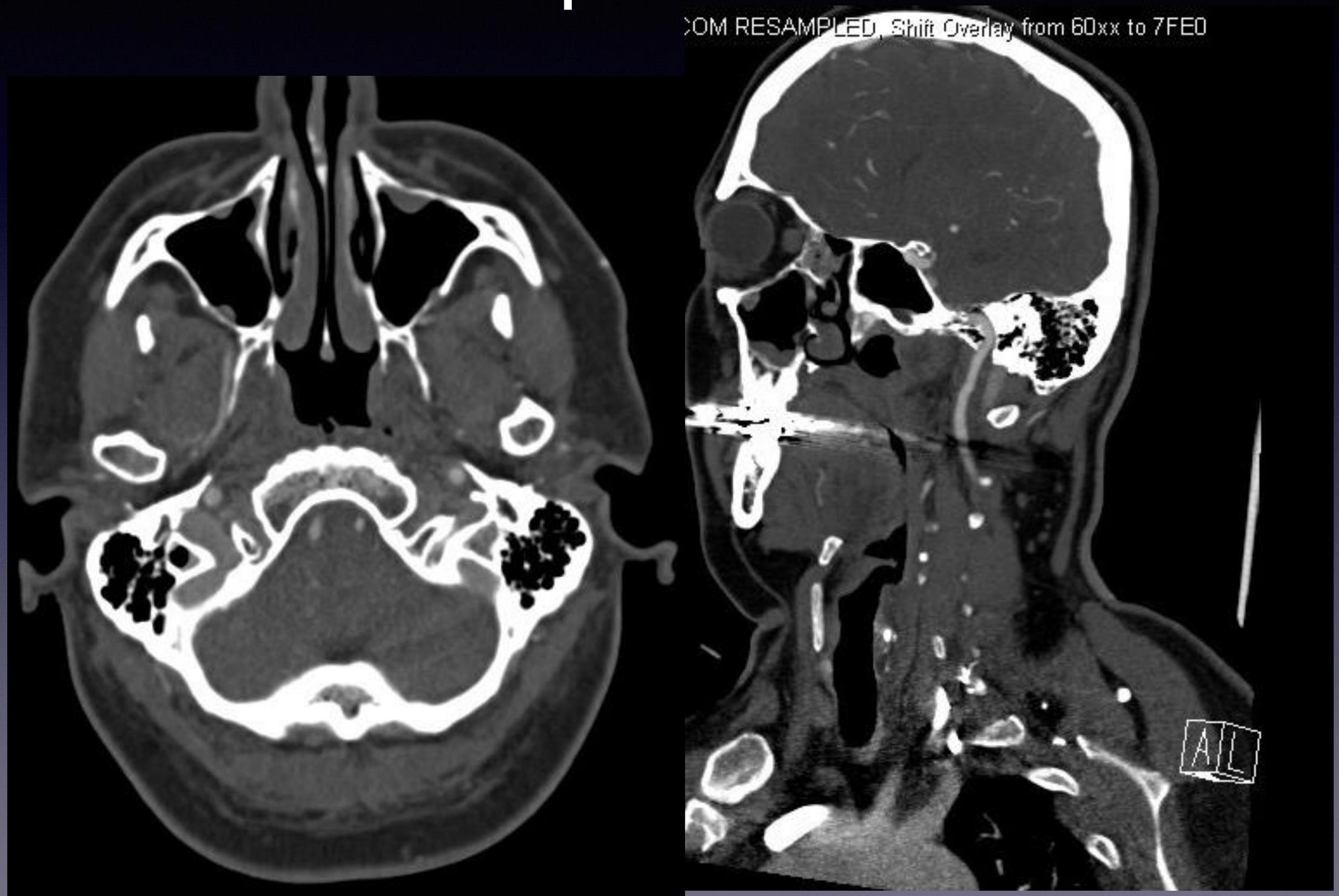
Θεραπεία

- Αντιπηκτική αγωγή για 6 μήνες
- Ασυμπτωματικός

3 MONTH FOLLOW UP CT



Follow up 3 month



Αιτιολογία και απεικόνιση της υπαραχνοειδούς αιμορραγίας

Ανευρύσματα εγκεφάλου

- Ευθύνονται για το 72% των μη τραυματικών υπαραχνοειδών αιμορραγιών

Αιμορραγικά απεικονιστικά πρότυπα

TABLE 1: Differential Diagnosis of Subarachnoid Hemorrhage by Pattern of Hemorrhage

Diffuse	Perimesencephalic	Convexal
Trauma	Trauma	Trauma
Saccular aneurysm	Nonaneurysmal perimesencephalic hemorrhage	Reversible cerebral vasoconstriction syndrome
Nonsaccular aneurysm	Saccular aneurysm	Cerebral amyloid angiopathy
Arterial dissection	Nonsaccular aneurysm	Posterior reversible encephalopathy syndrome
Vascular malformation	Arterial dissection	Cerebral venous thrombosis
Tumor	Vascular malformation (consider spinal)	Septic emboli, septic aneurysm
Vasculitis	Tumor (consider spinal)	Coagulopathy
		Moyamoya disease
		Vascular malformation (superficial)
		Tumor
		Vasculitis

CT

- Sensitivity SAH 95% 24hrs
- 80% 72 hrs
- 50% 1 week
- 30% 2 weeks

- Lumbar puncture: Xanthochomia 2 weeks in 100%, 3-7 weeks in 70% of patients

Fisher grading scale for SAH

Group	Subarachnoid blood	Risk of vasospasm
1	No blood	Low
2	Diffuse or vertical layers <1 mm	Only moderate
3	Localized clot and/or vertical layer >1 mm	High
4	Intracerebral or intraventricular clot with only diffuse or no SAH	

CT angiography-Aneurysm detection

- Sensitivity 99%, Specificity 95.2%, Accuracy 98.3% (Wintermark et al, 2003)
- Απόφαση για τρόπο αντιμετώπισης
- Ακτινοβολία
- Γρήγορη μέθοδος απεικόνισης σε αντίθεση με τη μαγνητική αγγειογραφία(no motion artifact)

Ψηφιακή αγγειογραφία εγκεφάλου

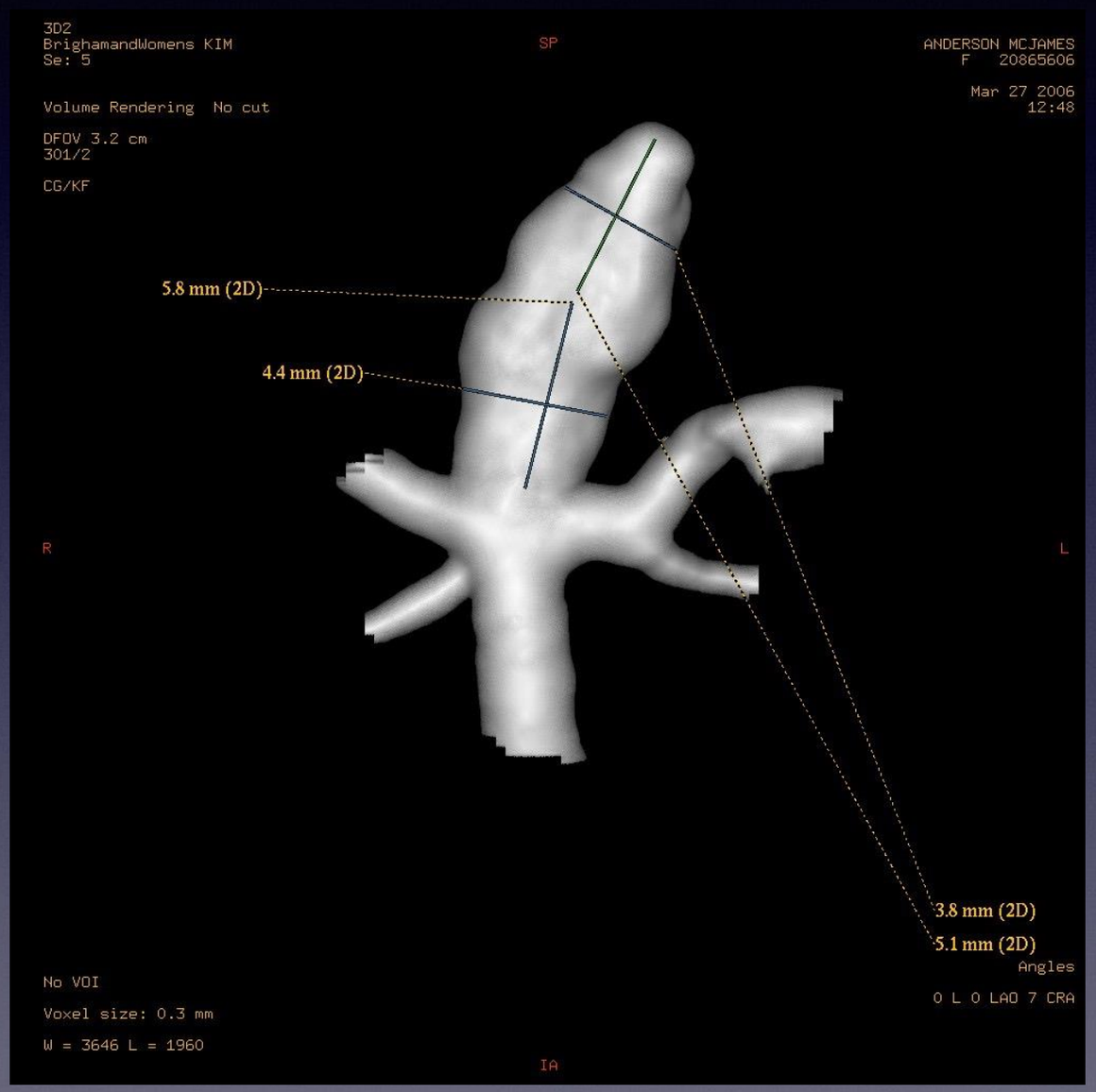
- Εξαιρετική χωρική διακριτική ικανότητα(spatial resolution)
- Gold standard for cerebral aneurysm detection
- Δυναμική μελέτη

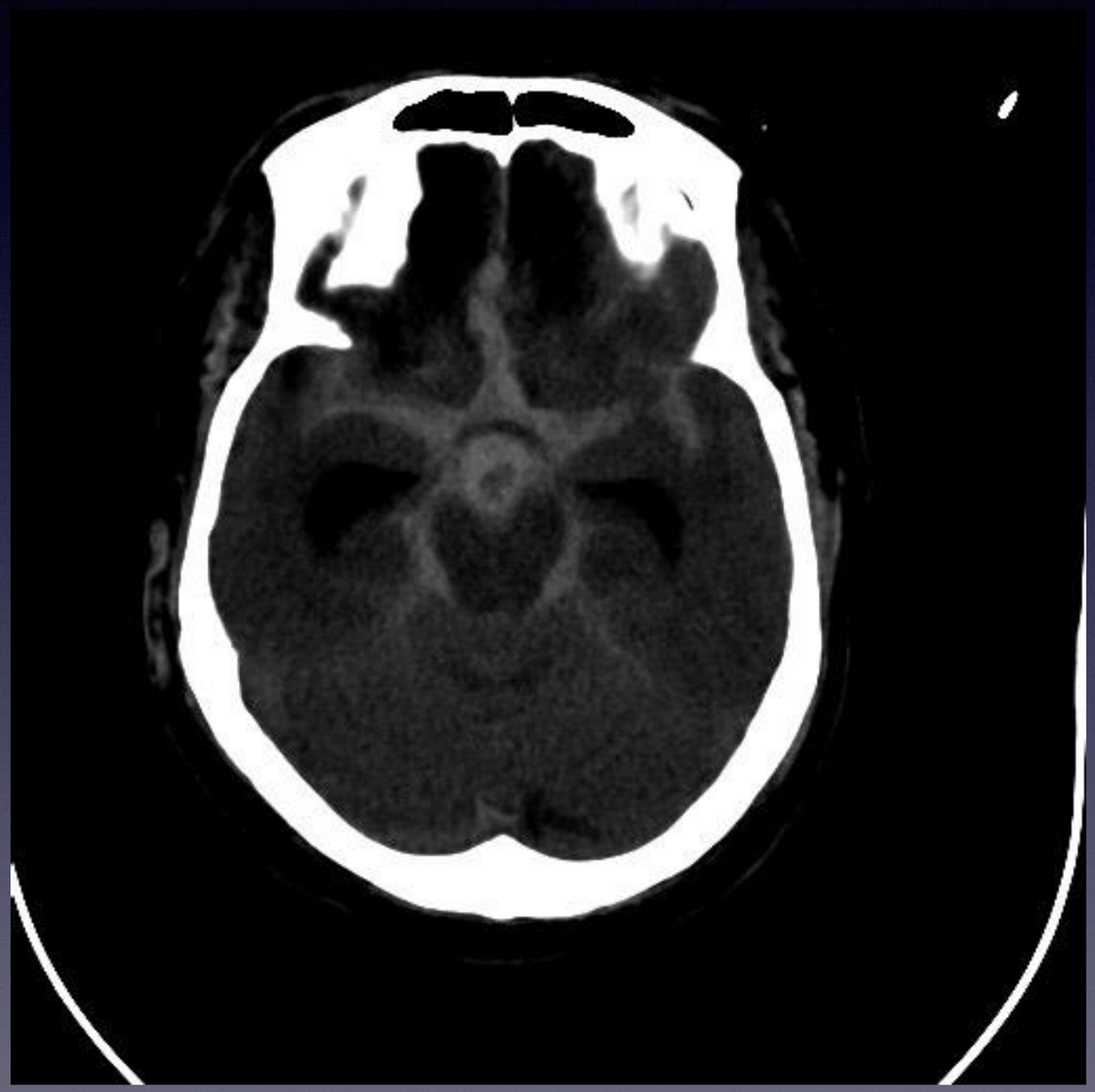
Ψηφιακή αγγειογραφία εγκεφάλου

- Ακτινοβολία
- Επεμβατική μέθοδος(μικρός κίνδυνος εγκεφαλικού, αγγειακής βλάβης, αιμορραγίας)

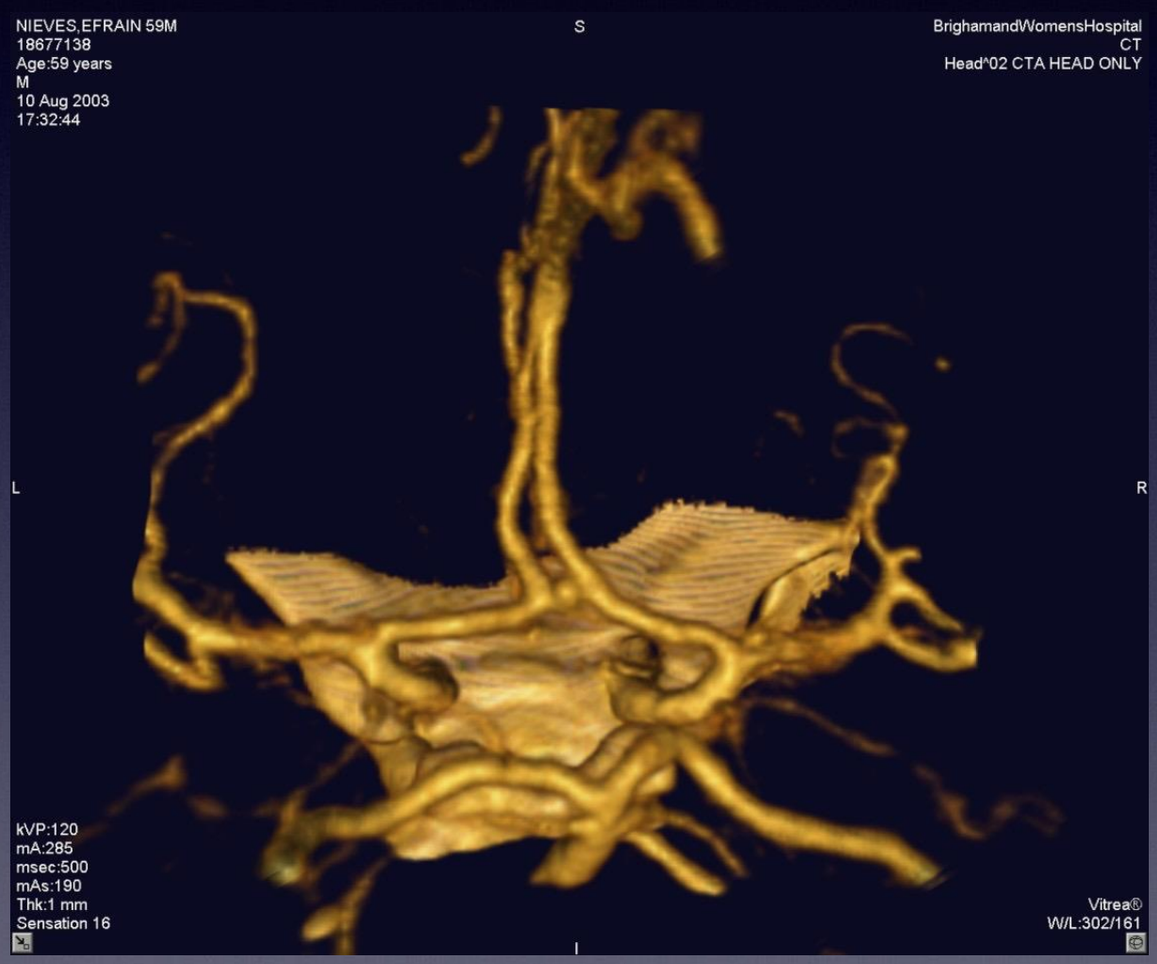
Σακκοειδή ανευρύσματα - Κατανομή

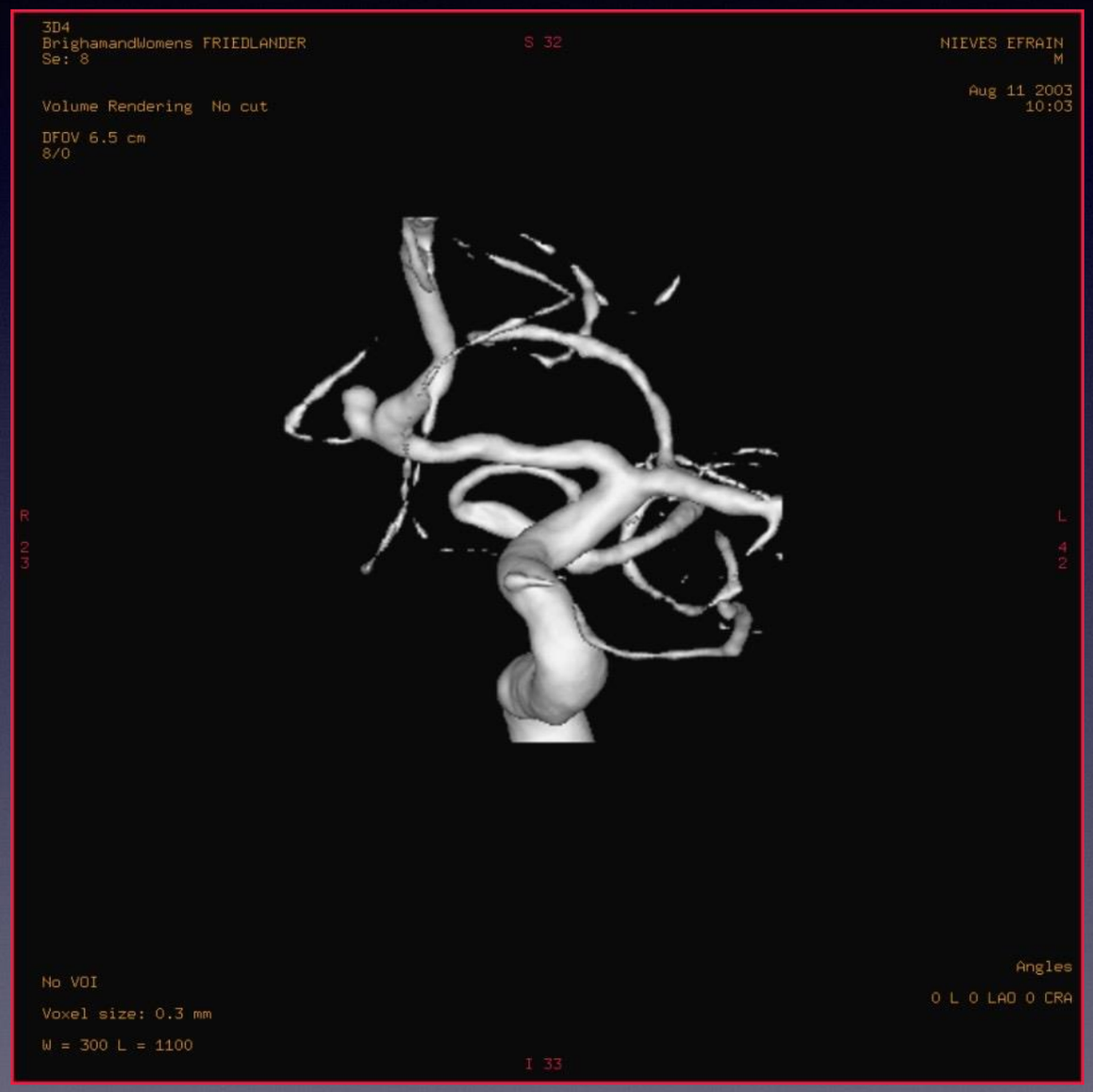
- Πρόσθια αναστομωτική 30-35%
- 15% σπονδυλοβασικό σύστημα
- Οπίσθια αναστομωτική/ έσω καρωτίδα 30%
- Μέση εγκεφαλική 20%


3D2
BrighamandWomens KIM
Se: 5
SP
ANDERSON MCJAMES
F 20865606
Mar 27 2006
12:48
Volume Rendering No cut
DFOV 3.2 cm
301/2
CG/KF
5.8 mm (2D)
4.4 mm (2D)
3.8 mm (2D)
5.1 mm (2D)
R
L
No VOI
Voxel size: 0.3 mm
W = 3646 L = 1960
Angles
0 L 0 LAO 7 CRA
IA

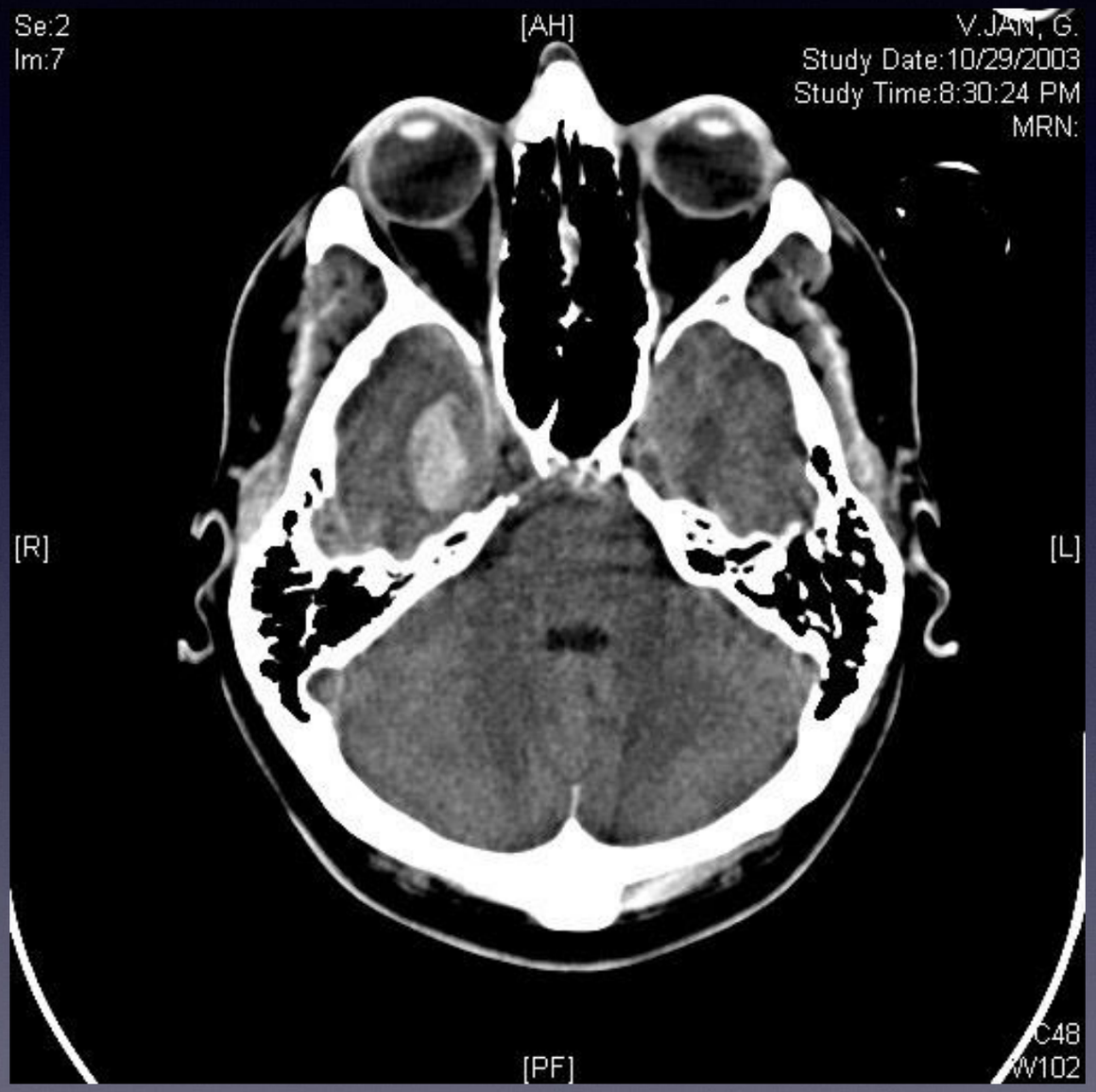


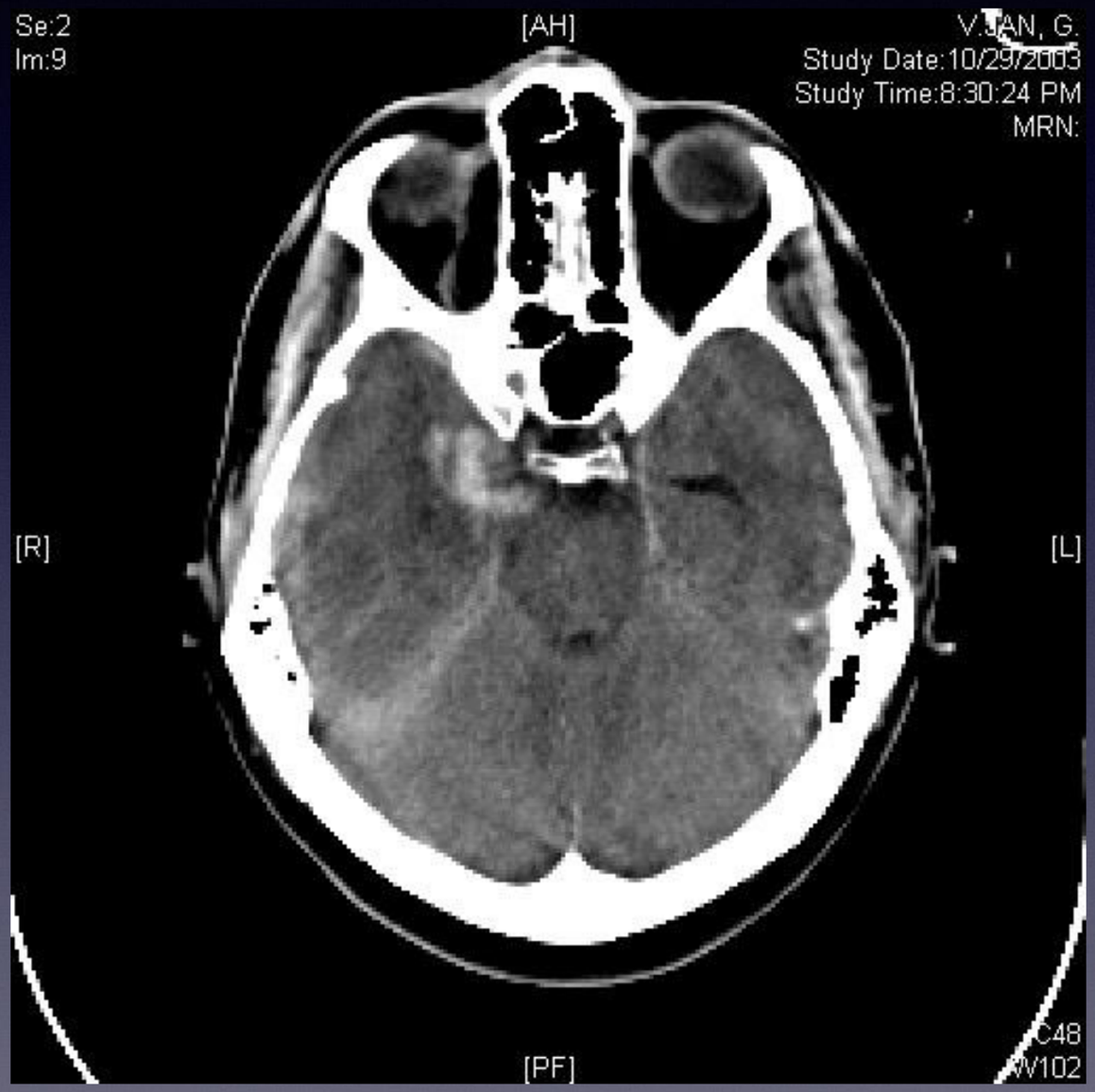
Headache


NIEVES,EFRAIN 59M
18677138
Age:59 years
M
10 Aug 2003
17:32:44
S
BrighamandWomensHospital
CT
Head^02 CTA HEAD ONLY
L
R
I
kVP:120
mA:285
msec:500
mAs:190
Thk:1 mm
Sensation 16
Vitrea®
W/L:302/161


3D4
BrighamandWomens FRIEDLANDER
Se: 8
S 32
NIEVES EFRAIN
M
Aug 11 2003
10:03
Volume Rendering No cut
DFOV 6.5 cm
8/0
R
3
L
4
2
No VOI
Voxel size: 0.3 mm
W = 300 L = 1100
Angles
0 L 0 LAO 0 CRA
I 33

SAH HH 3


Se:2
Im:7
[AH]
V.JAN, G.
Study Date:10/29/2003
Study Time:8:30:24 PM
MRN:
[R]
[L]
[PF]
C48
W102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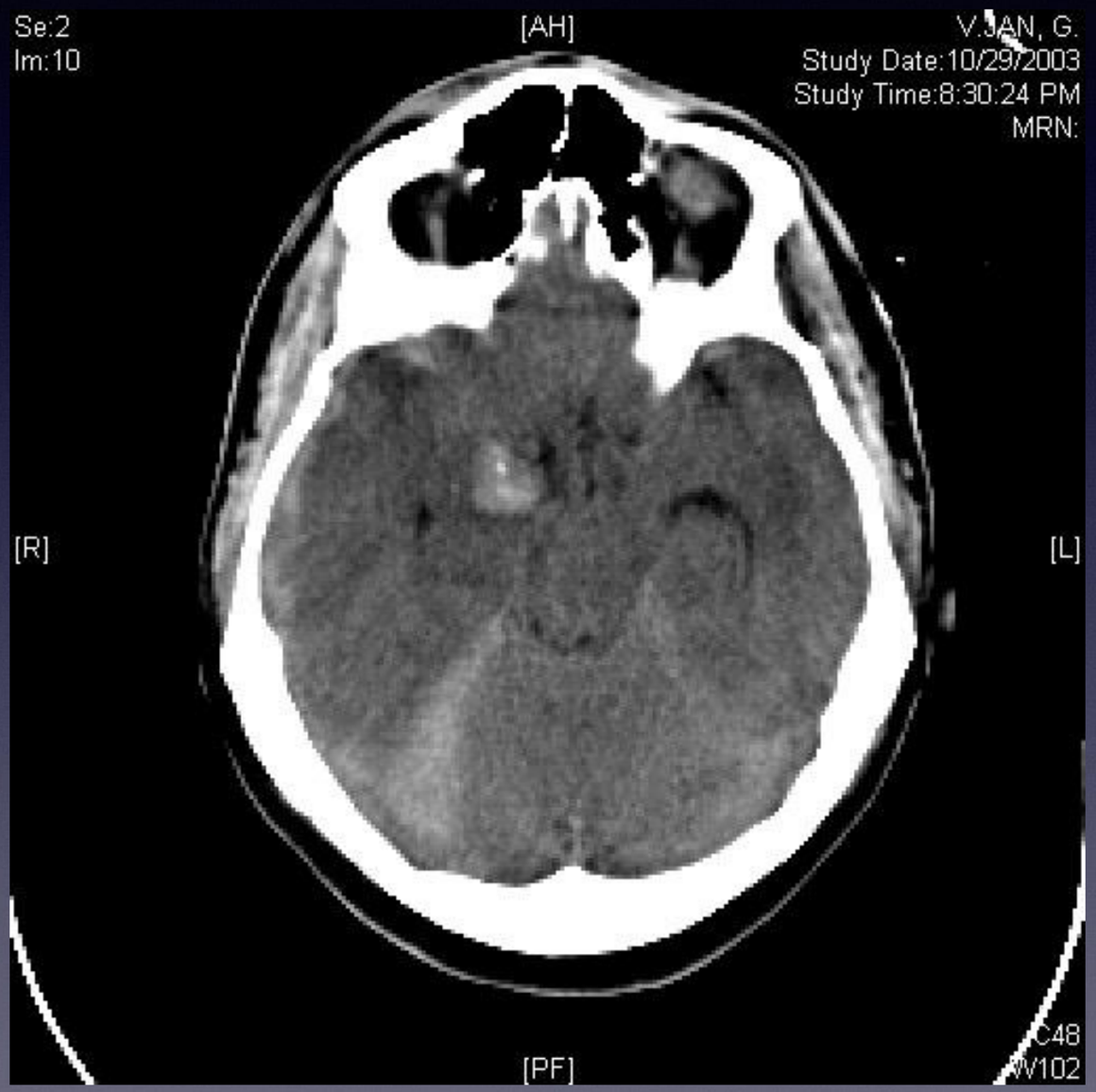
C48
W102


Se:2
Im:10
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V.JAN, G.
Study Date:10/29/2003
Study Time:8:30:24 PM
MRN:
[R]
[L]
[PF]
C48
W102


Se:2
Im:16
[AH]
V.JAN, G.
Study Date:10/29/2003
Study Time:8:30:24 PM
MRN:
[R]
[L]
[PF]
C48
W102


Se:2
Im:141
[A]
V.JAN, G.
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Study Time:9:00:53 PM
MRN:
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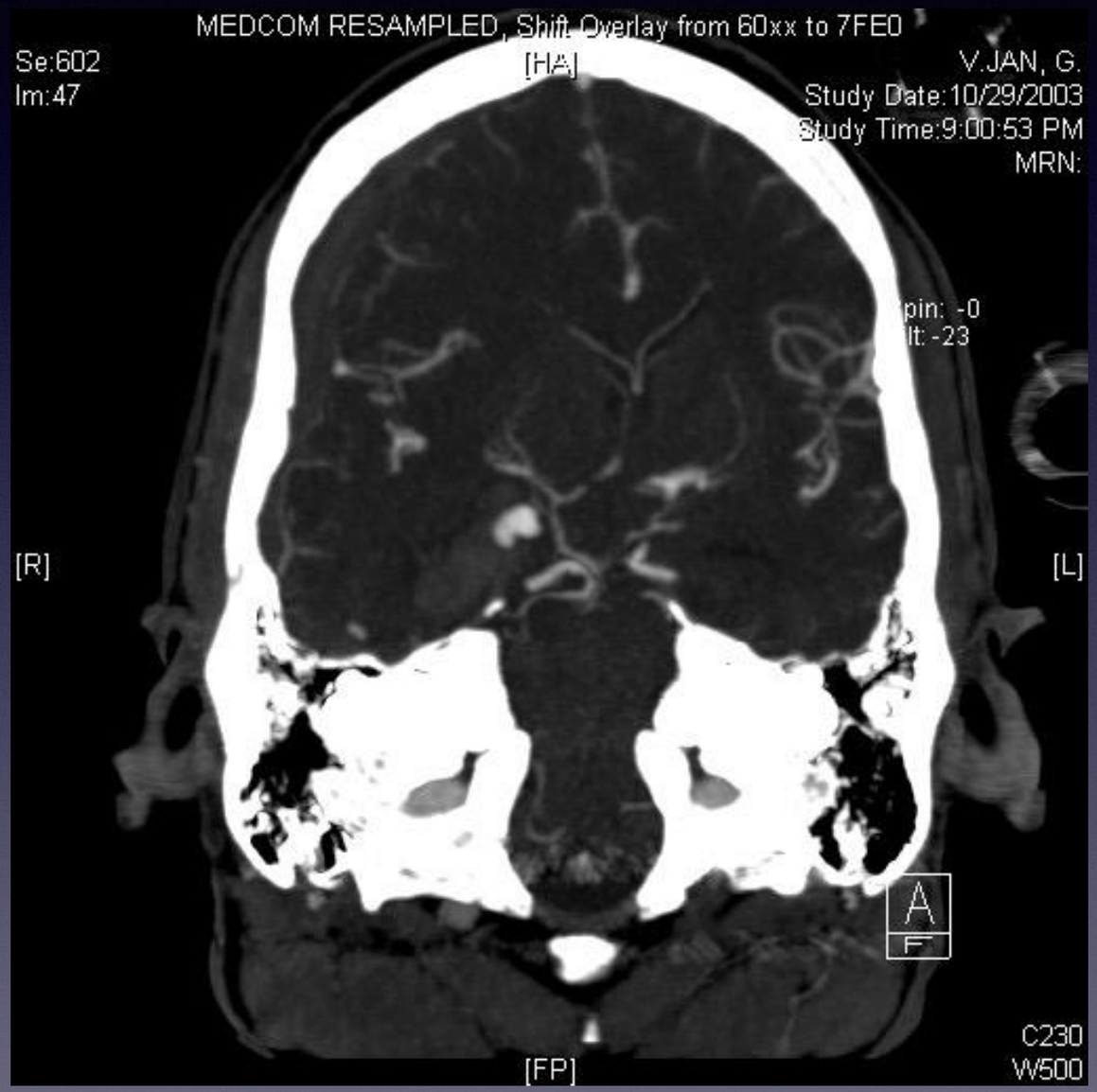
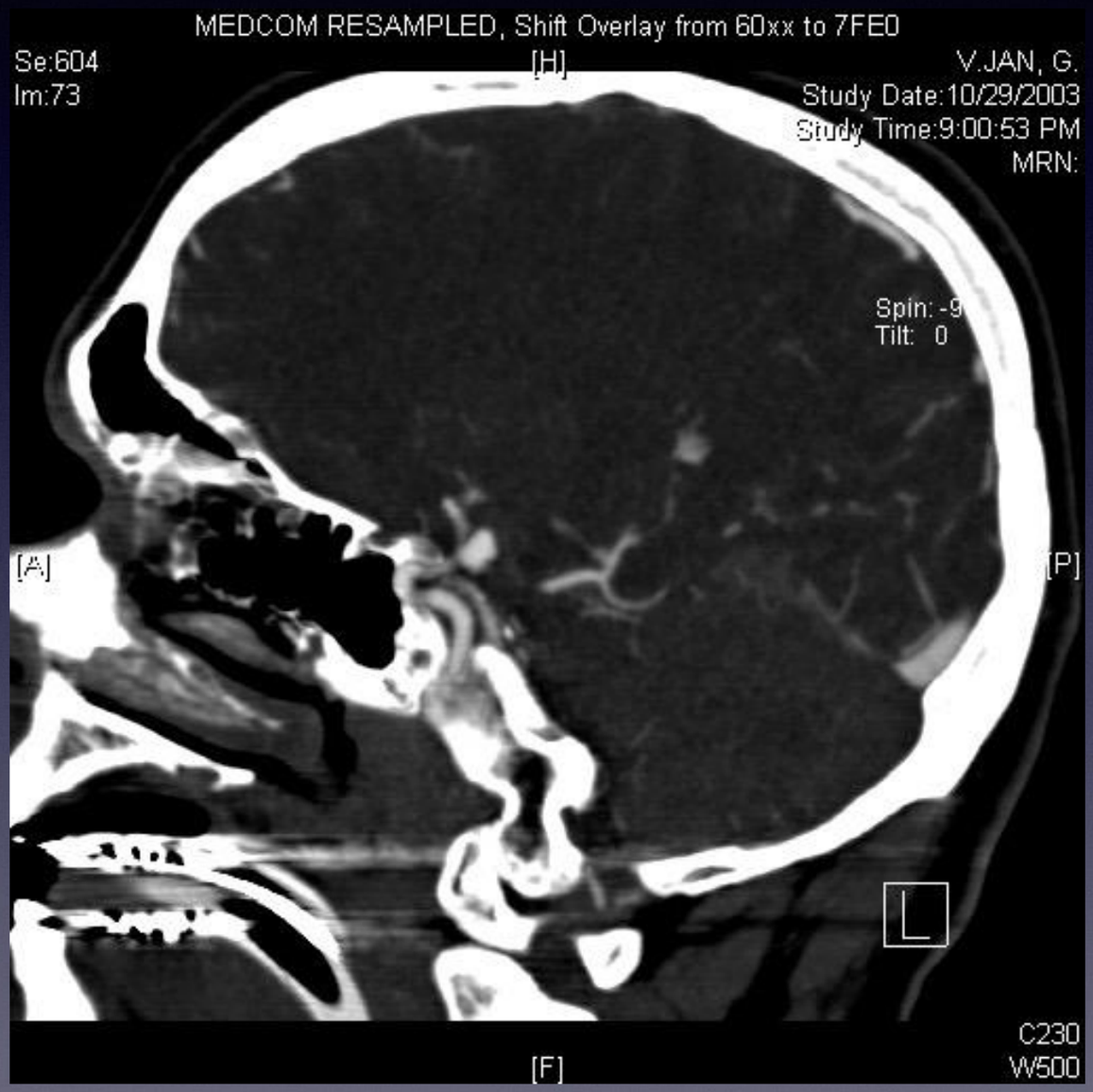
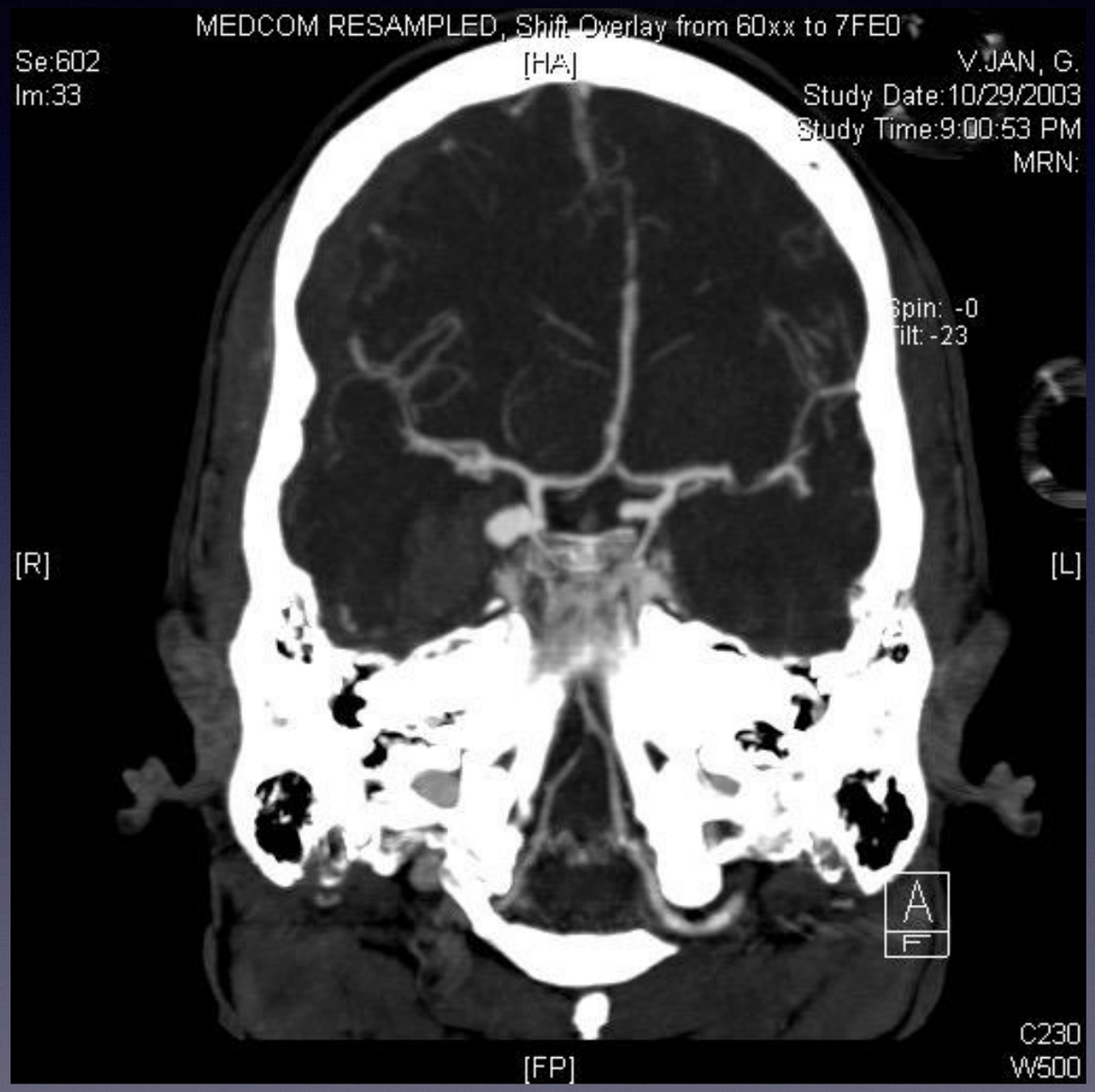
[L]
[P]
C188
W567


MEDCOM RESAMPLED, Shift Overlay from 60xx to 7FE0
Se:602
Im:47
[HA]
V.JAN, G.
Study Date:10/29/2003
Study Time:9:00:53 PM
MRN:
[R]
[L]
[FP]
A
F
C230
W500

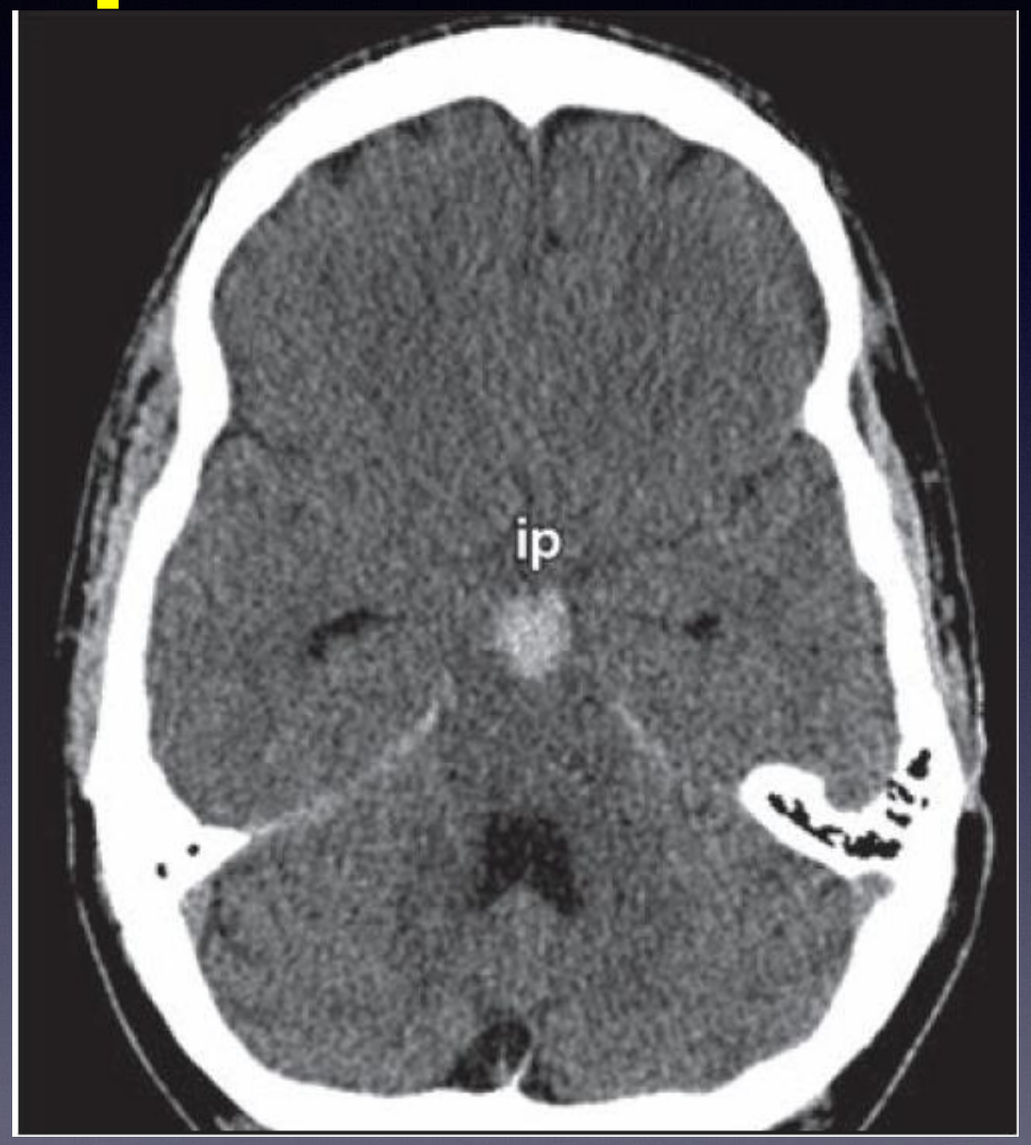
Lateral variant PICOM aneurysm

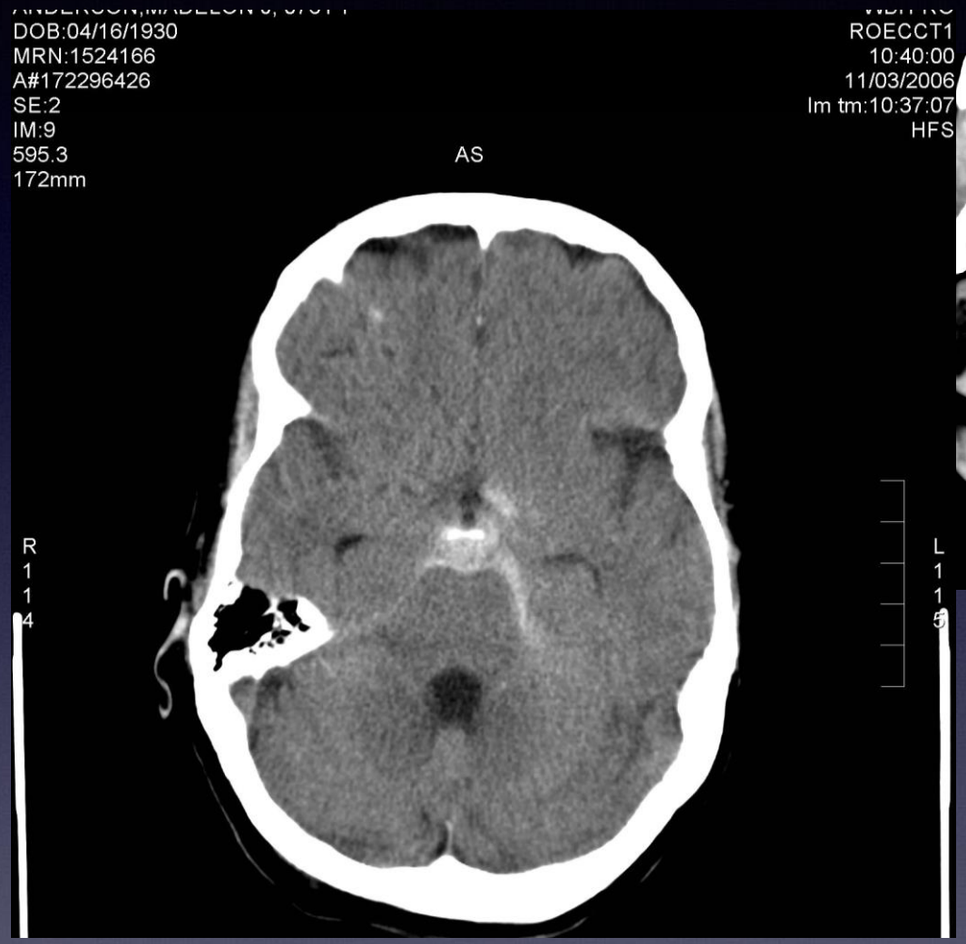




Περιμεσεγκεφαλική αιμορραγία

- 10% των ΥΑ
- Καλοήθης κλινική πορεία

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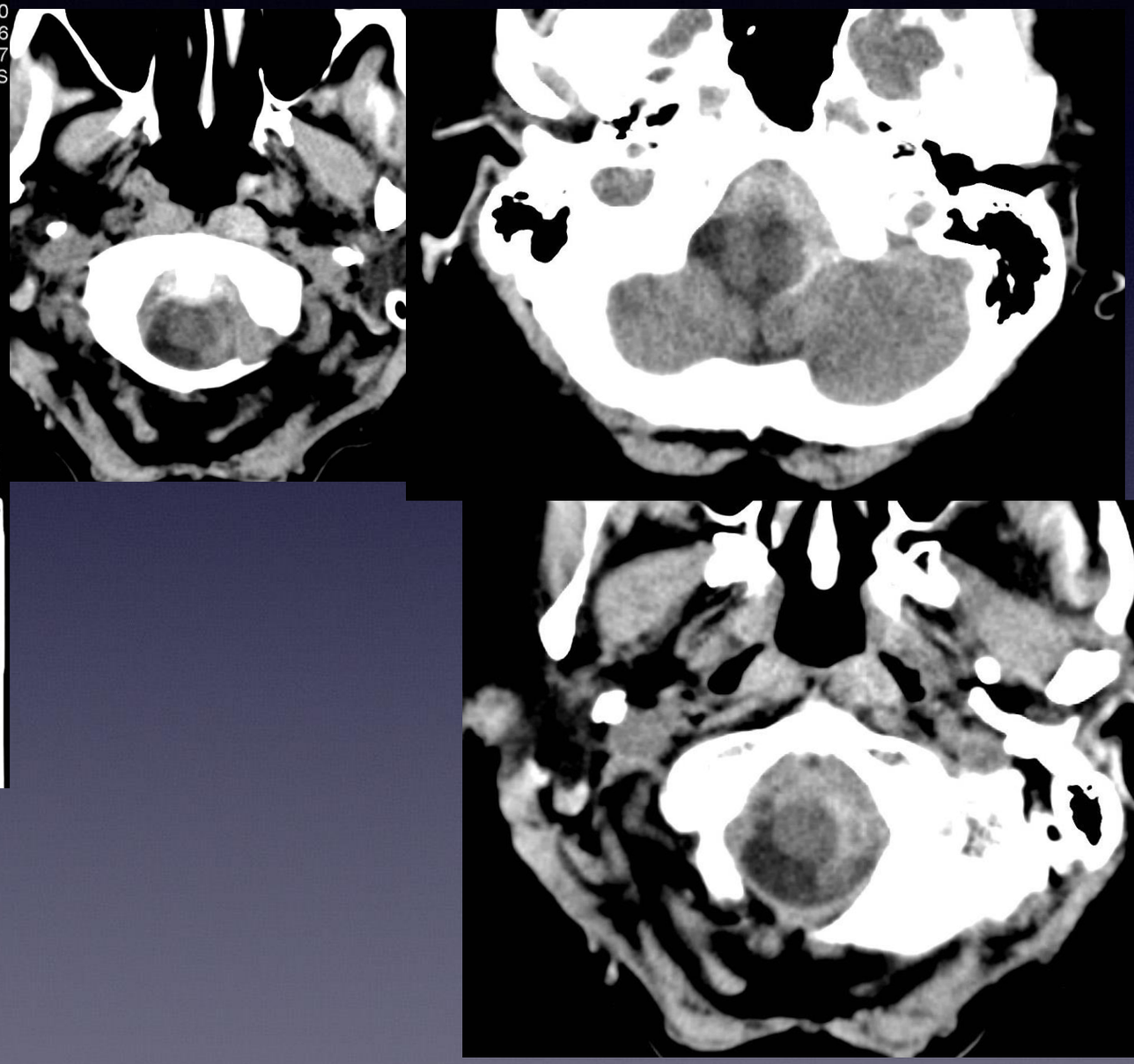
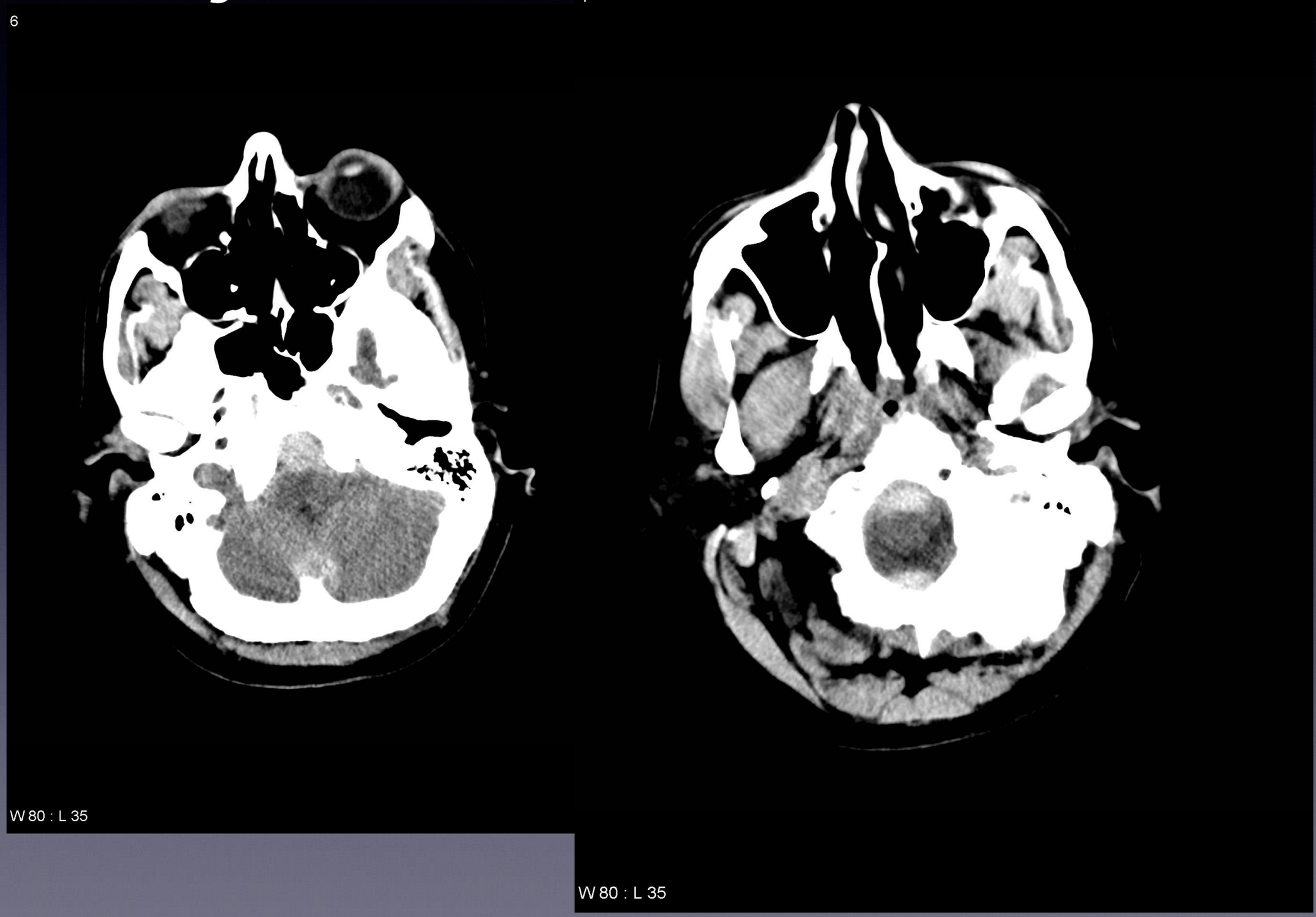
MRN:1524166
A#172296426
SE:2
IM:9
595.3
172mm
AS
ROECCT1
10:40:00
11/03/2006
Im tm:10:37:07
HFS
R
L



52 yr old male with SAH

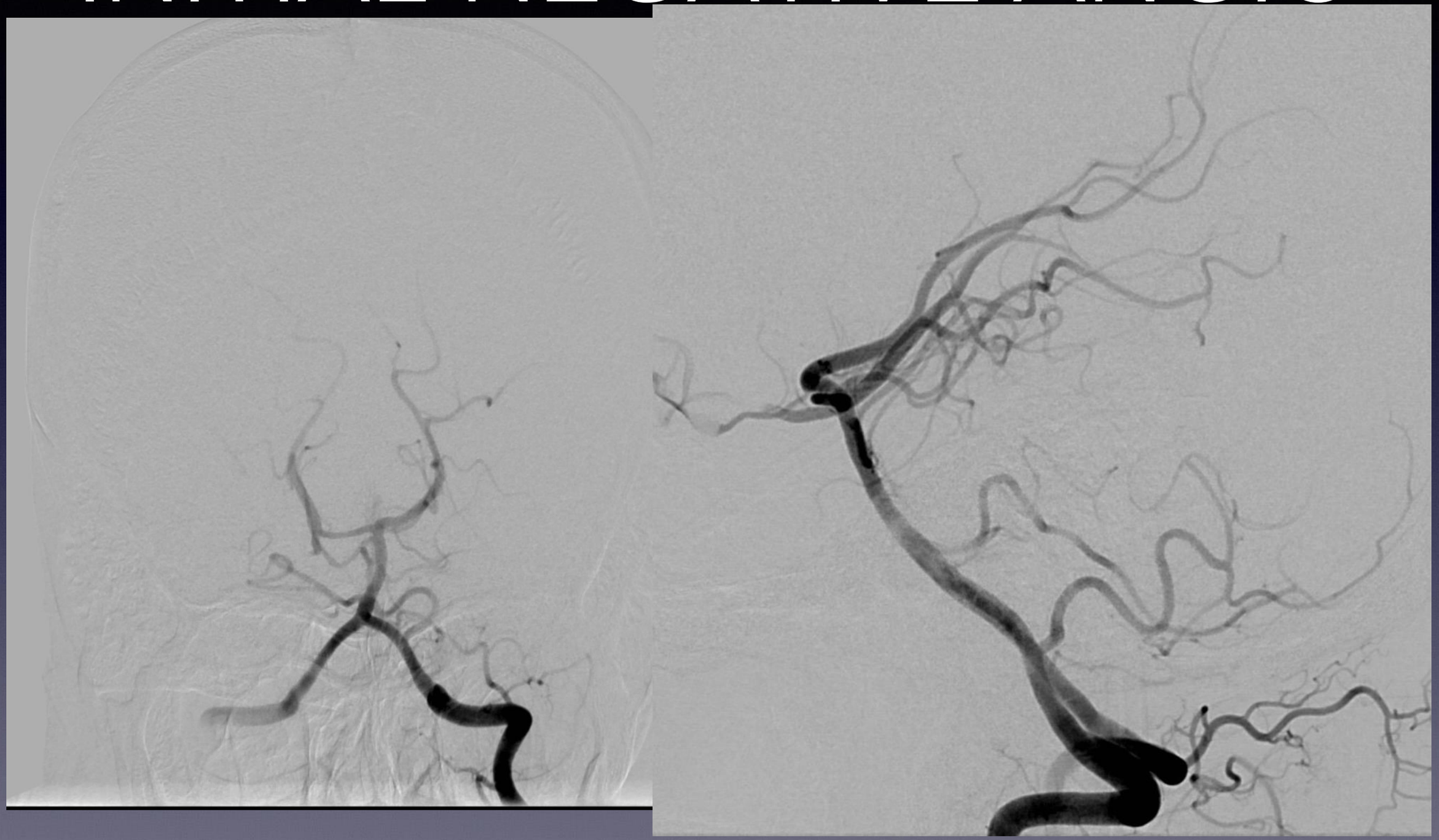



9
W 80 : L 35

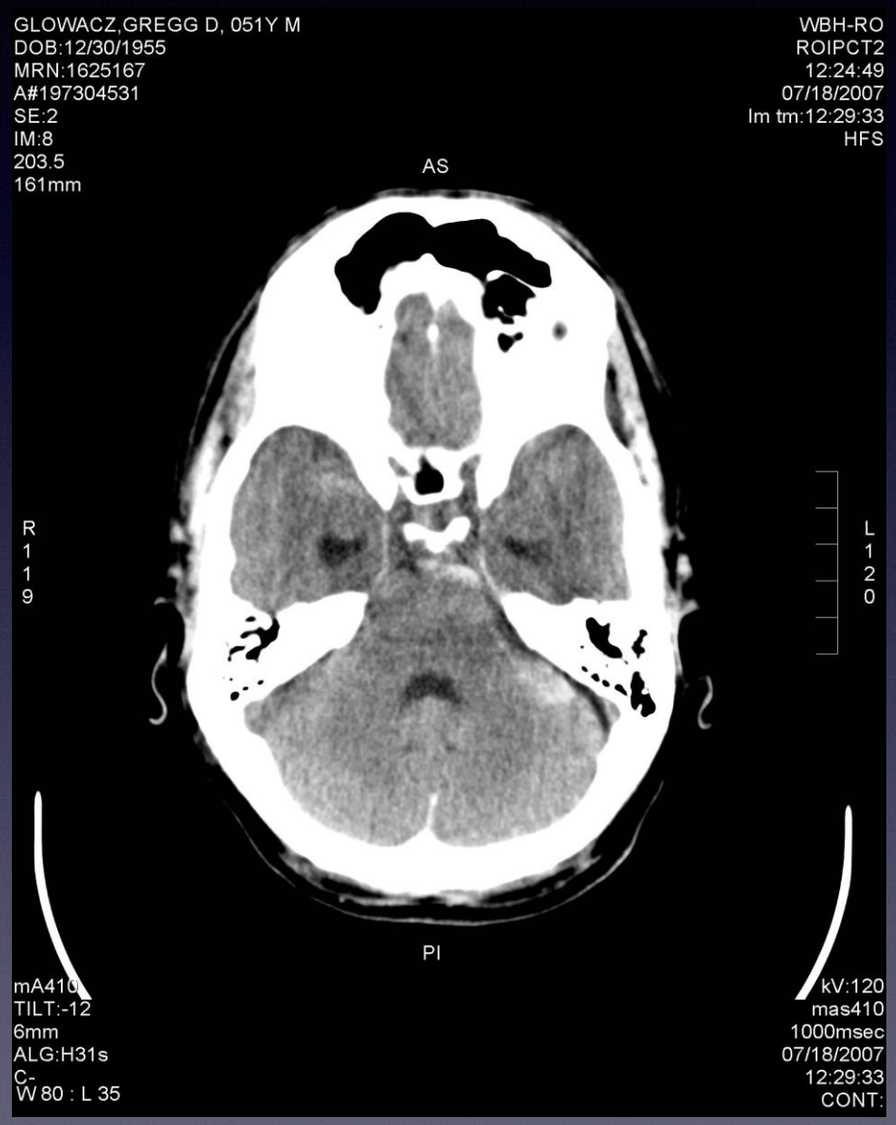

11
W 80 : L 35


12
W 80 : L 35

INITIAL NEGATIVE ANGIO




GLOWACZ,GREGG D, 051Y M
DOB:12/30/1955
MRN:1625167
A#197304531
SE:2
IM:7
197.4
161mm
WBH-RO
ROIPCT2
12:24:49
07/18/2007
Im tm:12:29:33
HFS
AS
R
1
1
9
L
1
2
0
PI
mA410
TILT:-12
6mm
ALG:H31s
C-
W 80 : L 35
kV:120
mas410
1000msec
07/18/2007
12:29:33
CONT: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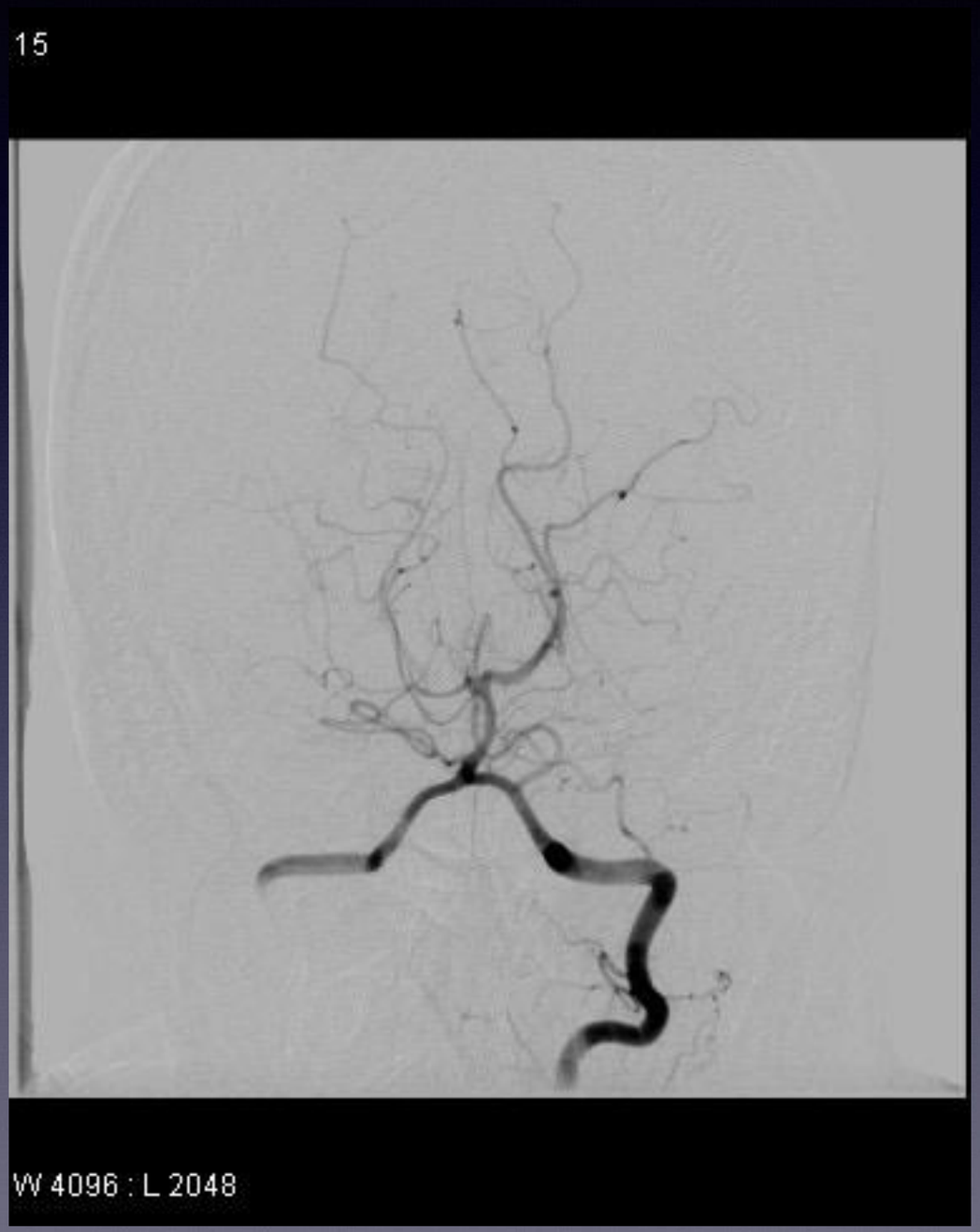
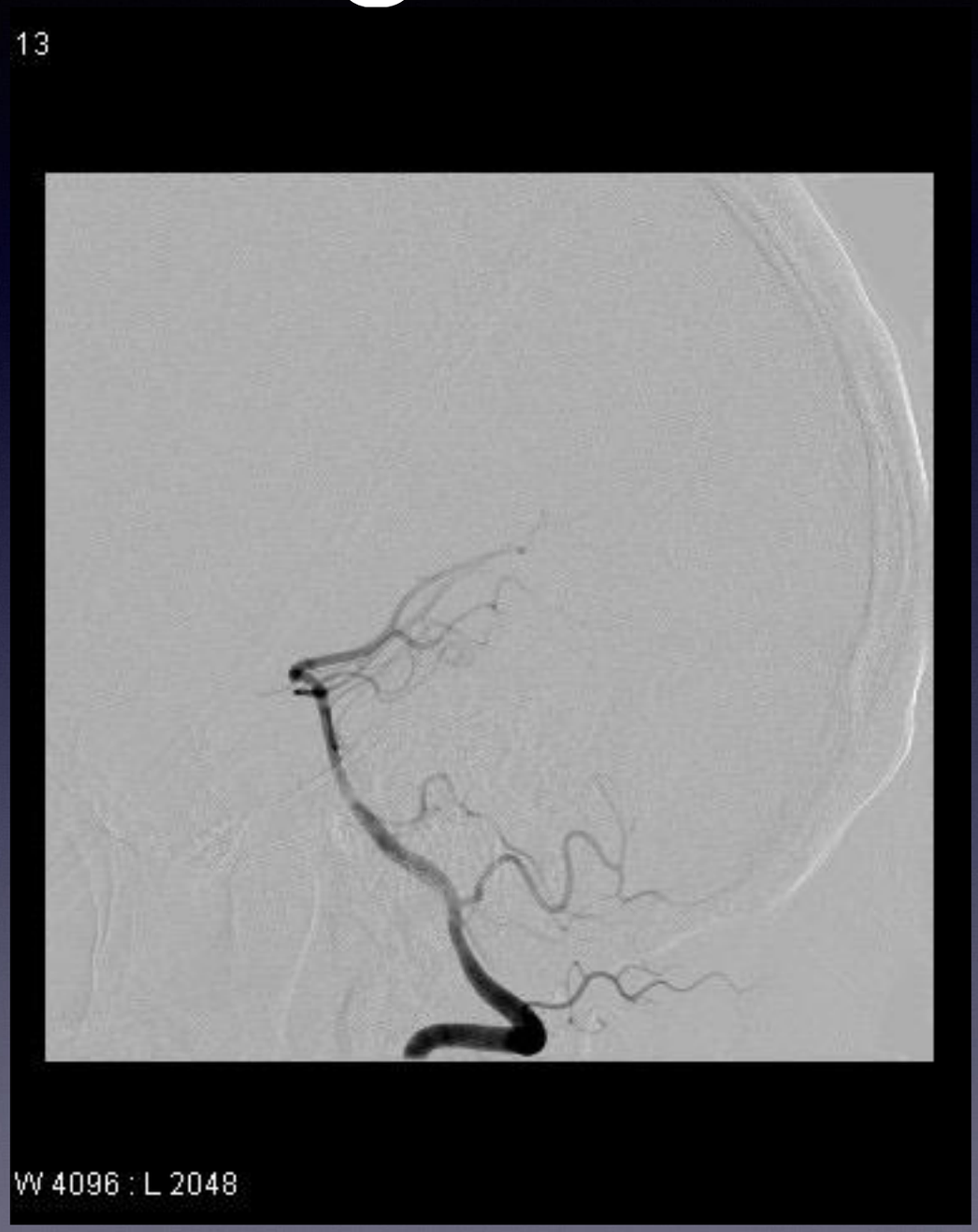
DOB:12/30/1955
MRN:1625167
A#197304531
SE:2
IM:8
203.5
161mm
WBH-RO
ROIPCT2
12:24:49
07/18/2007
Im tm:12:29:33
HFS
AS
R
1
1
9
L
1
2
0
PI
mA410
TILT:-12
6mm
ALG:H31s
C-
W 80 : L 35
kV:120
mas410
1000msec
07/18/2007
12:29:33
CONT:


GLOWACZ,GREGG D 051Y M
DOB:12/30/1955
1625167
A#197435305
SE:3
IM:11
SP:-5.289
William Beaumont Hospital MR3
ROIPMR3A
07/17/2007
17:47:59
HFS
SL
A
1
4
6
P
9
3
17:58:58
07/17/2007
acq tm:17:55:12
Thk :5
OR:0
MA:512 X512
BW:130
t1_se_sag
*se2d1 FL:90
TR:483
TE:7.8
TI: ETL:1
W 627 : L 370
IR

Second angio negative






GLOWACZ,GREGG D, 051Y M
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MRN:1625167
A#198916944
SE:2
IM:8
-156
163mm
WBH-RO
ROECCT2
21:09:05
08/02/2007
Im tm:21:16:37
HFS
AS
R
L
PI
mA500
TILT:-13.5
4.8mm
ALG:H40s
C-
W 90 : L 40
kV:120
mas500
1000msec
08/02/2007
21:16:37
CONT:

GLOWACZ,GREGG D 051Y M
DOB:12/30/1955
1625167
A#198922909
SE:3
IM:13
SP:-1.87

S123

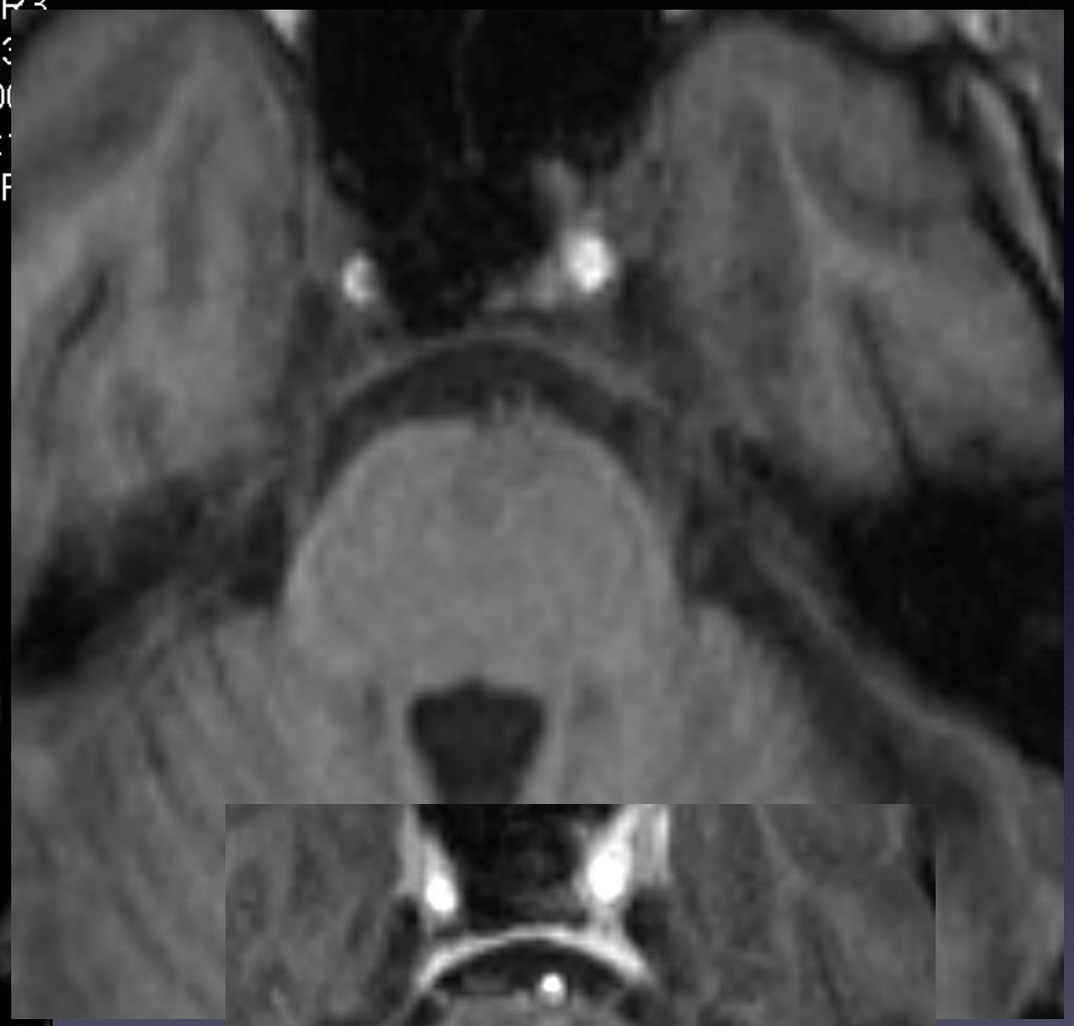
William Beaumont Hospital MR3
ROIPMR3
08/03/20
08:19:

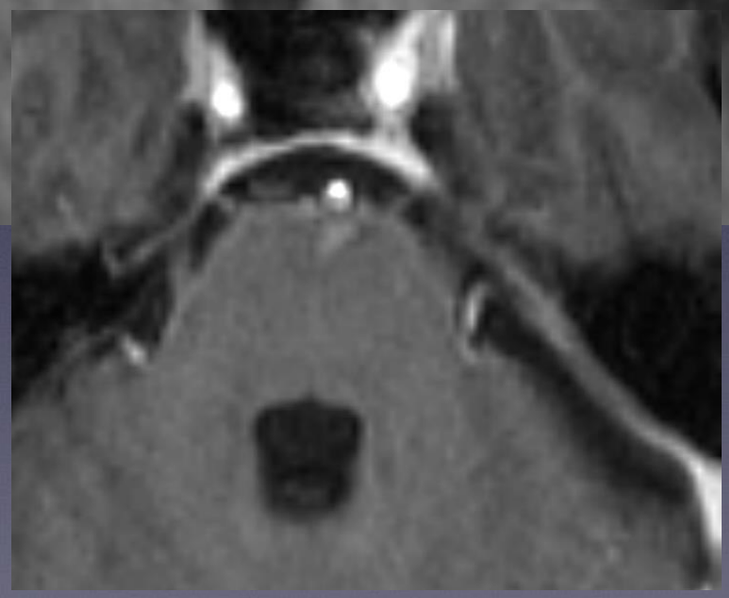
A
1
4
1

08:31:05
08/03/2007
acq tm:08:27:35
Thk :5
OR:0
MA:512 X512
BW:130
t1_se_sag

*se2d1 FL:90
TR:450
TE:7.8
TI: ETL:1
W 725 : L 368

I106





GLOWACZ,GREGG D M
ACCES#200165664
1625167
12/30/1955
051Y
IM:306

Wm Beaumont Hosp./9D70F0/
SYS#@MIXEDXA
08/22/2007
09:44:19

08/22/2007
W 4096 : L 2048

SM
Rt Vertebral
ARTERIOGRAM

GLOWACZ,GREGG D M
ACCES#200165664
1625167
12/30/1955
051Y
IM:1

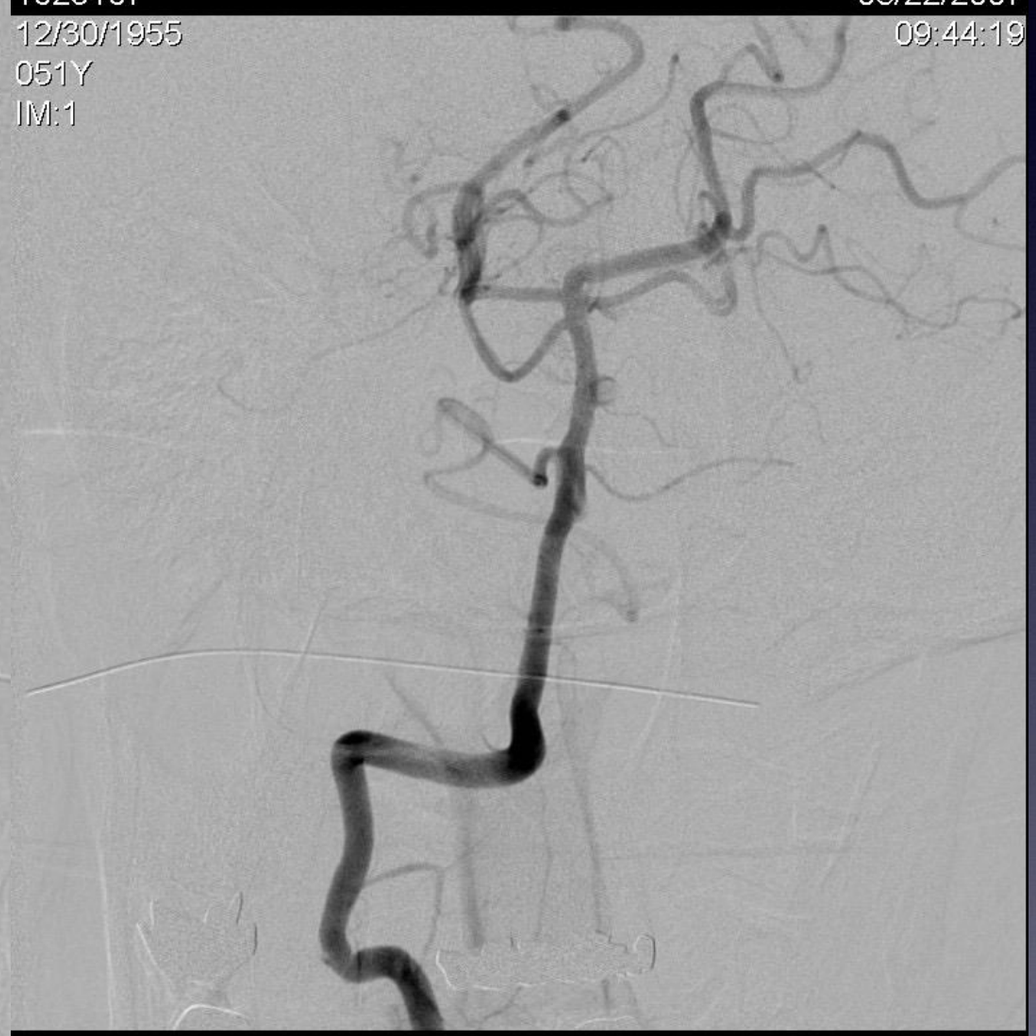
Wm Beaumont Hosp./9D70F0/
SYS#@MIXEDXA
08/22/2007
09:44:19

08/22/2007
W 4096 : L 2048

Rt Vertebral
ARTERIOGRAM

GLOWACZ,GREGG D M
ACCES#200165664
1625167
12/30/1955
051Y
IM:1

Wm Beaumont Hosp./9D70F0/
SYS#@MIXEDXA
08/22/2007
09:44:19

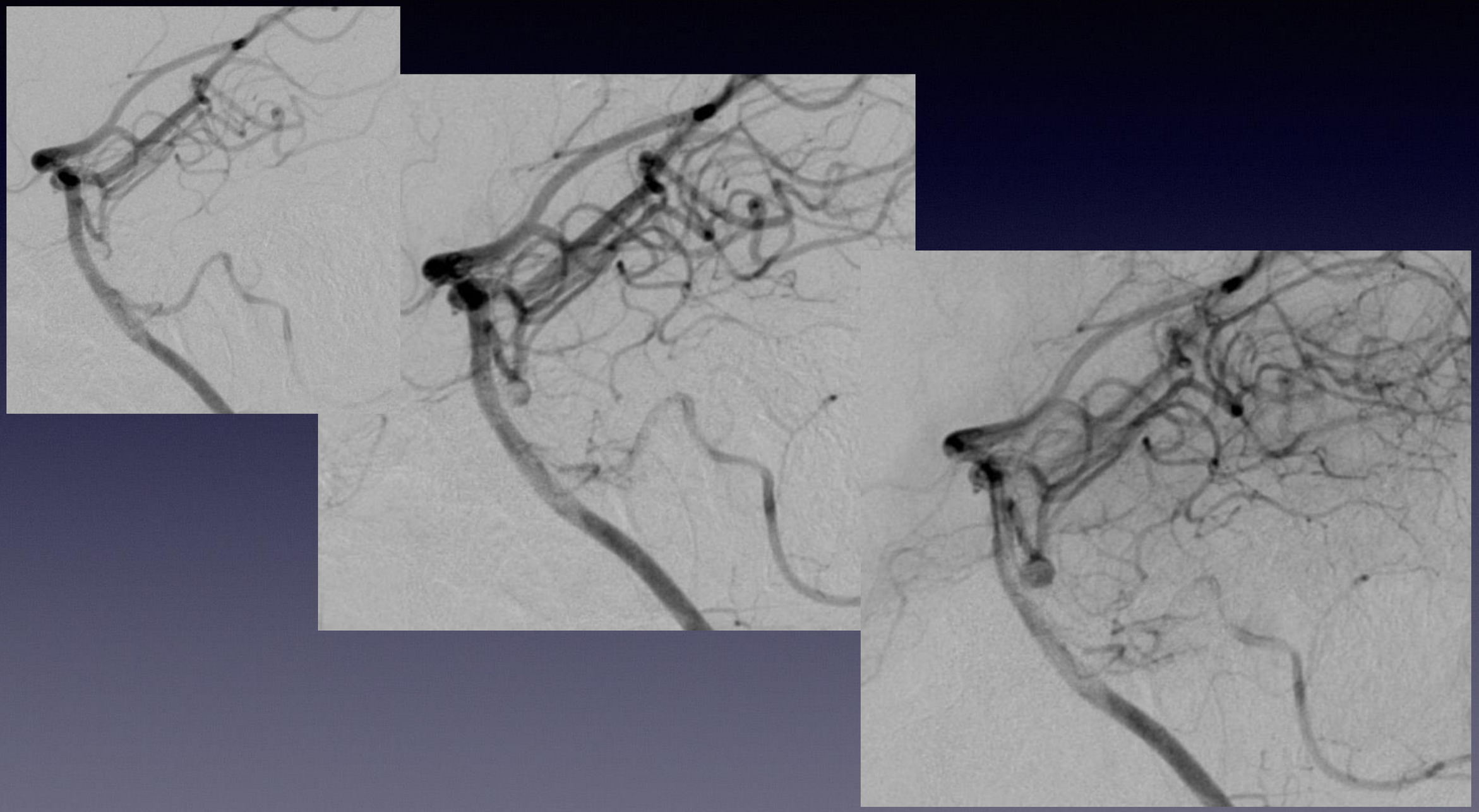


08/22/2007
W 4096 : L 2048

Rt Vertebral
ARTERIOGRAM


GLOWACZ,GREGG D M
ACCES#200165664
1625167
12/30/1955
051Y
IM:1
Wm Beaumont Hosp./9D70F0/
SYS#@MIXEDXA
08/22/2007
09:44:19
08/22/2007
W 4096 : L 2048
Rt Vertebral
ARTERIOGRAM


GLOWACZ,GREGG D M
ACCES#200165664
1625167
12/30/1955
051Y
IM:1
Wm Beaumont Hosp./9D70F0/
SYS#@MIXEDXA
08/22/2007
09:44:19
H
LAO/RAO 71
CRAN/CAUD 2
F
P
08/22/2007
W 249 : L 125
<VRT Collection>
ARTERIOGRAM




68


GG D M
668

Διαχωριστικά ανευρύσματα

- Σπάνια αιτία υπαραχνοειδούς αιμορραγίας
- 4.5% of autopsy SAH cases (Sakaki et al 1991)
- Importance of serial imaging

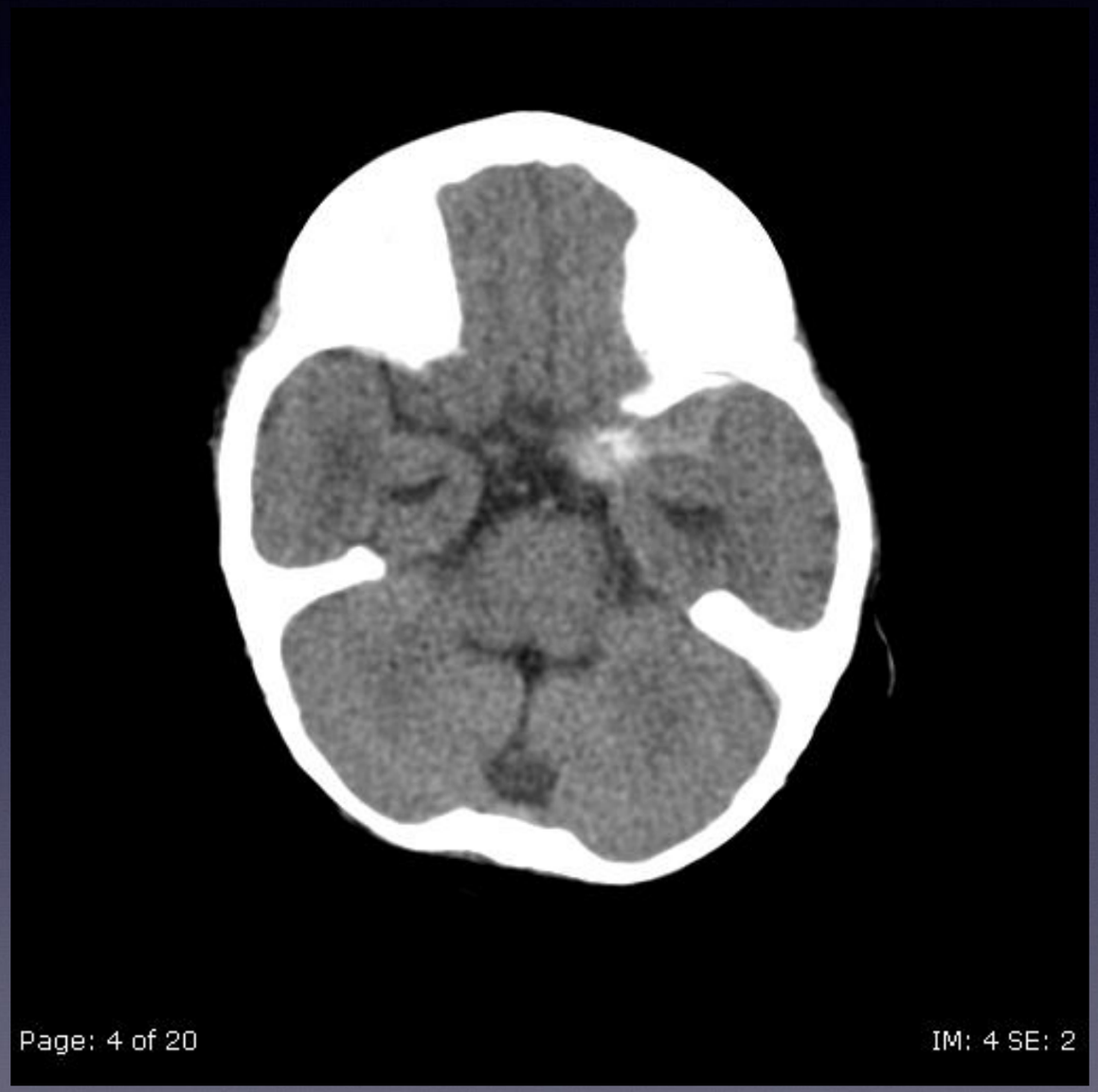
2241221
12/21/1938
067Y
IM:303

1

Infant with aneurysm

- The child was premature baby delivered by C-section 26 week gestation . The pregnancy was diagnosed 2 weeks prior to C-section on abdominal XRay performed for hip pain. The child was exposed tp chemotherapy with 3 cycles of (Toxol,cyclophosphamide, adriamycin) due to maternal breast cancer.
- At birth the child weight was 745 grams and was noted to have low set ears, absent left thumb and small right thumb.
- A VSD was noted which was successfully closed at 4 months of age.

7 month old



Normandeau, Emma
4057596
1/14/2005
7 MONTH
F

A
Dartmouth Hitchcock Med Center
OUTSIDE MRI IMAGES ON PACS
HD DWI Ax
8/23/2005 6:49:42 PM
10150739

LOC: 28.12
THK: 5 SP: 5
HFS

20
8
1

R

L

HEAD
EC: 1
EP\RM
FA: 90
TR: 10000
TE: 115.90

Z: 2
C: 558
W: 570

Page: 5 of 14

Page: 14 of 46

P

IM: 14 SE: 3

cm

cm


Page: 11 of 140
IM: 11 SE: 4


Page: 6 of 15
IM: 6 SE: 181

A

OUTSIDE MRI IMAGES

1/14/2005
8 MONTH
F

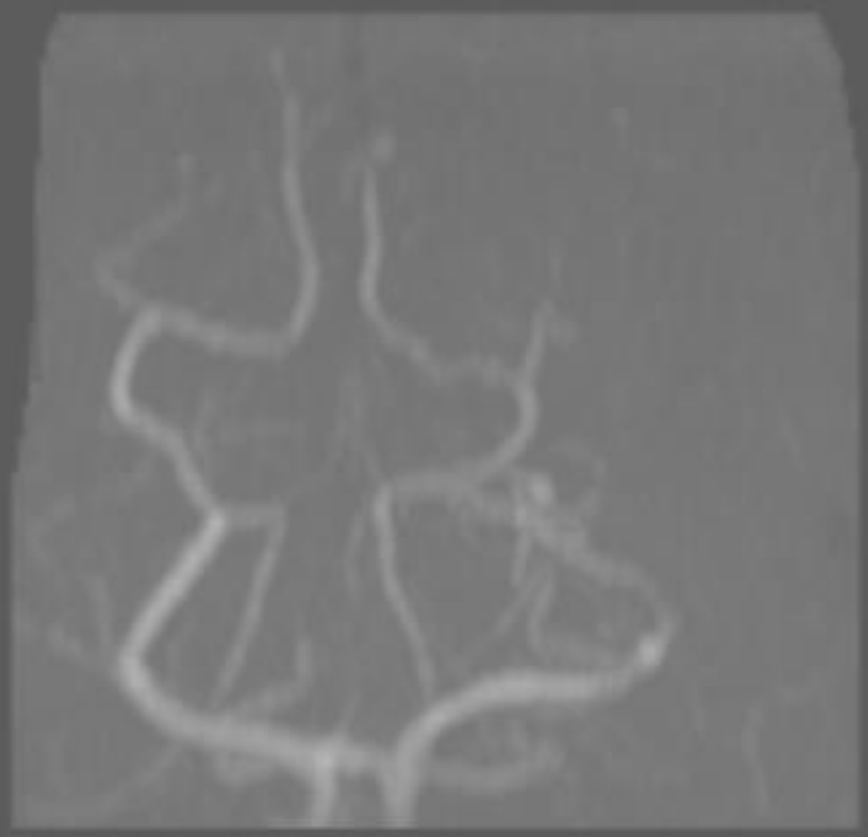
9/27/2005 3:
1

LO
THK: 1.40

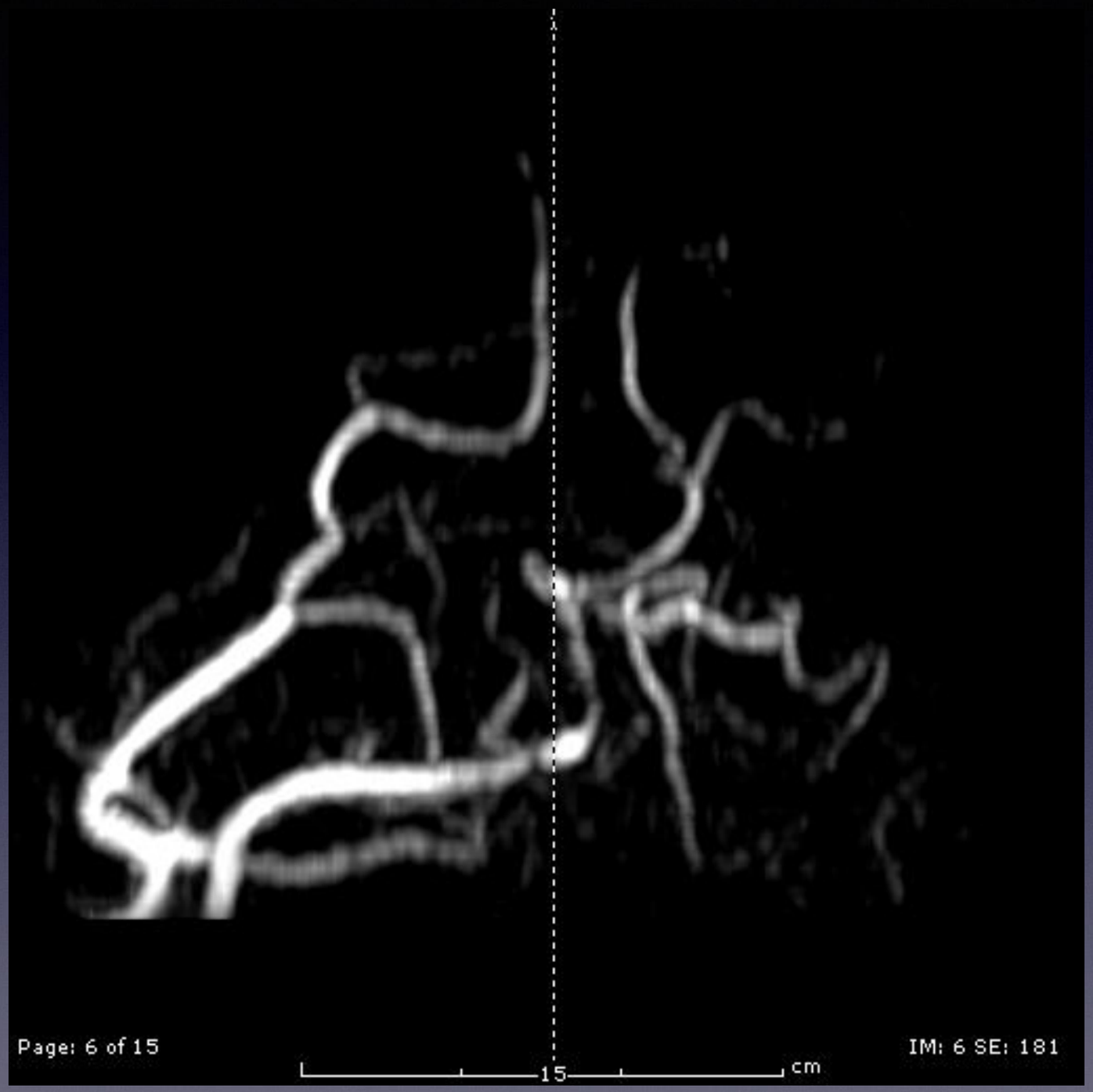
R

HEAD
EC: 1
GR
FA: 20
TR: 36
TE: 6.90

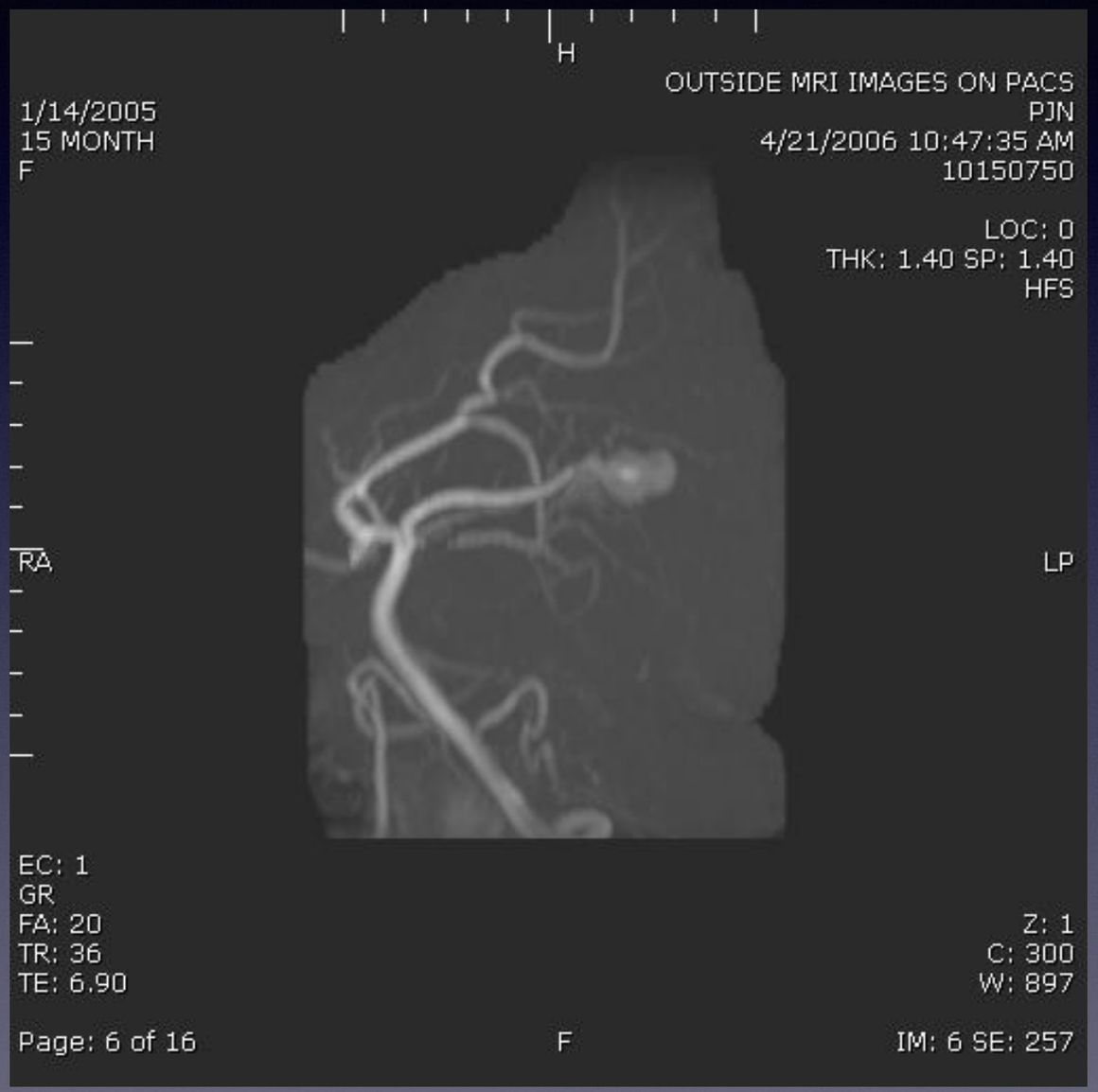
Page: 1 of 92 P IM



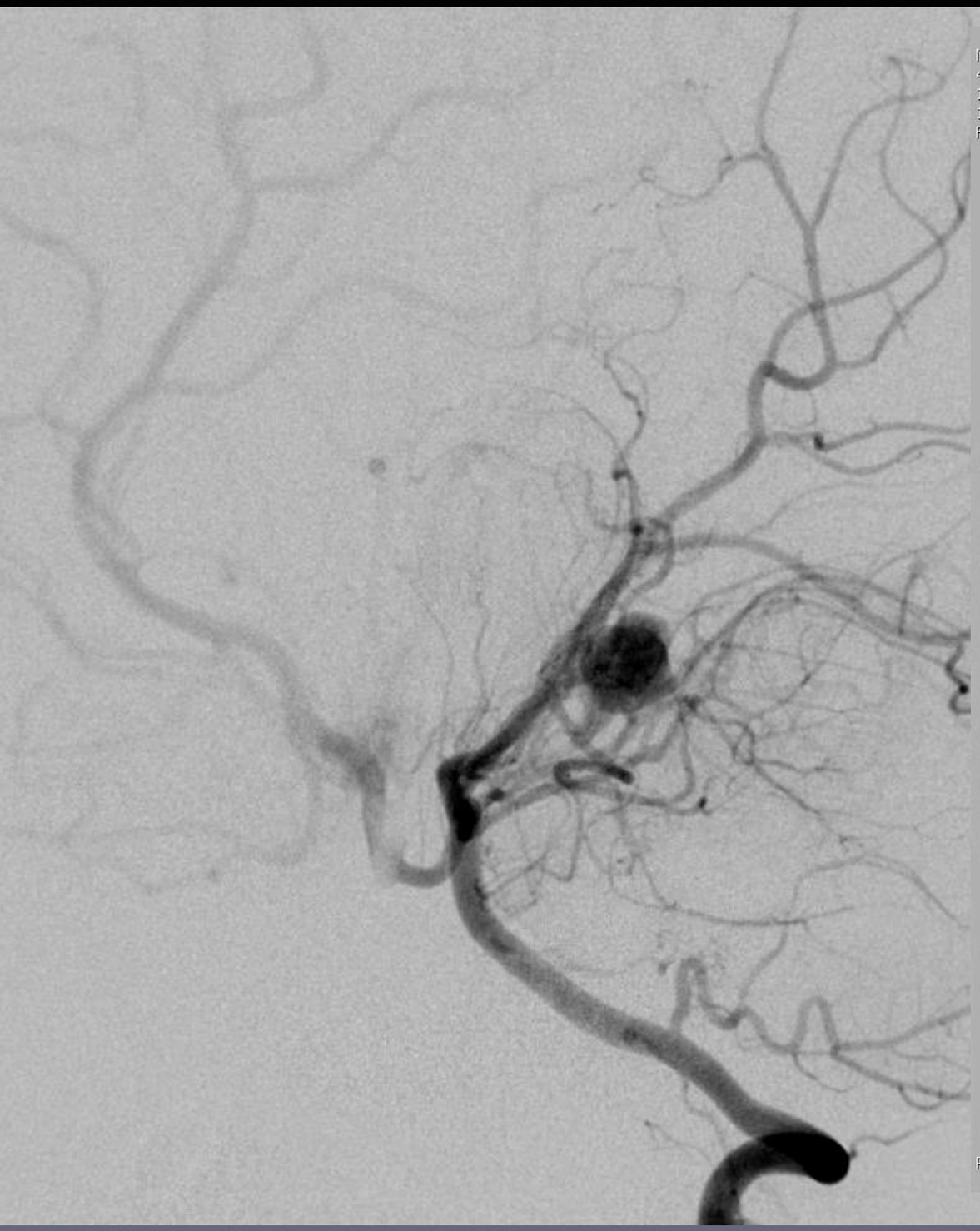
Page: 9 of 15 IM: 9 SE: 181


Page: 6 of 15
15
cm
IM: 6 SE: 181

13 month


H
OUTSIDE MRI IMAGES ON PACS
1/14/2005
15 MONTH
F
PJN
4/21/2006 10:47:35 AM
10150750
LOC: 0
THK: 1.40 SP: 1.40
HFS
RA
LP
EC: 1
GR
FA: 20
TR: 36
TE: 6.90
Z: 1
C: 300
W: 897
Page: 6 of 16
F
IM: 6 SE: 257


Age:15 months
F
02 May 2006
13:58:55
CT Circle o
R
kVP:140
mA:200
msec:730
mAs:9
Thk:1.25 mm
LightSpeed VCT
Page: 1 of 4
Axial 14.72mm MIP S
P

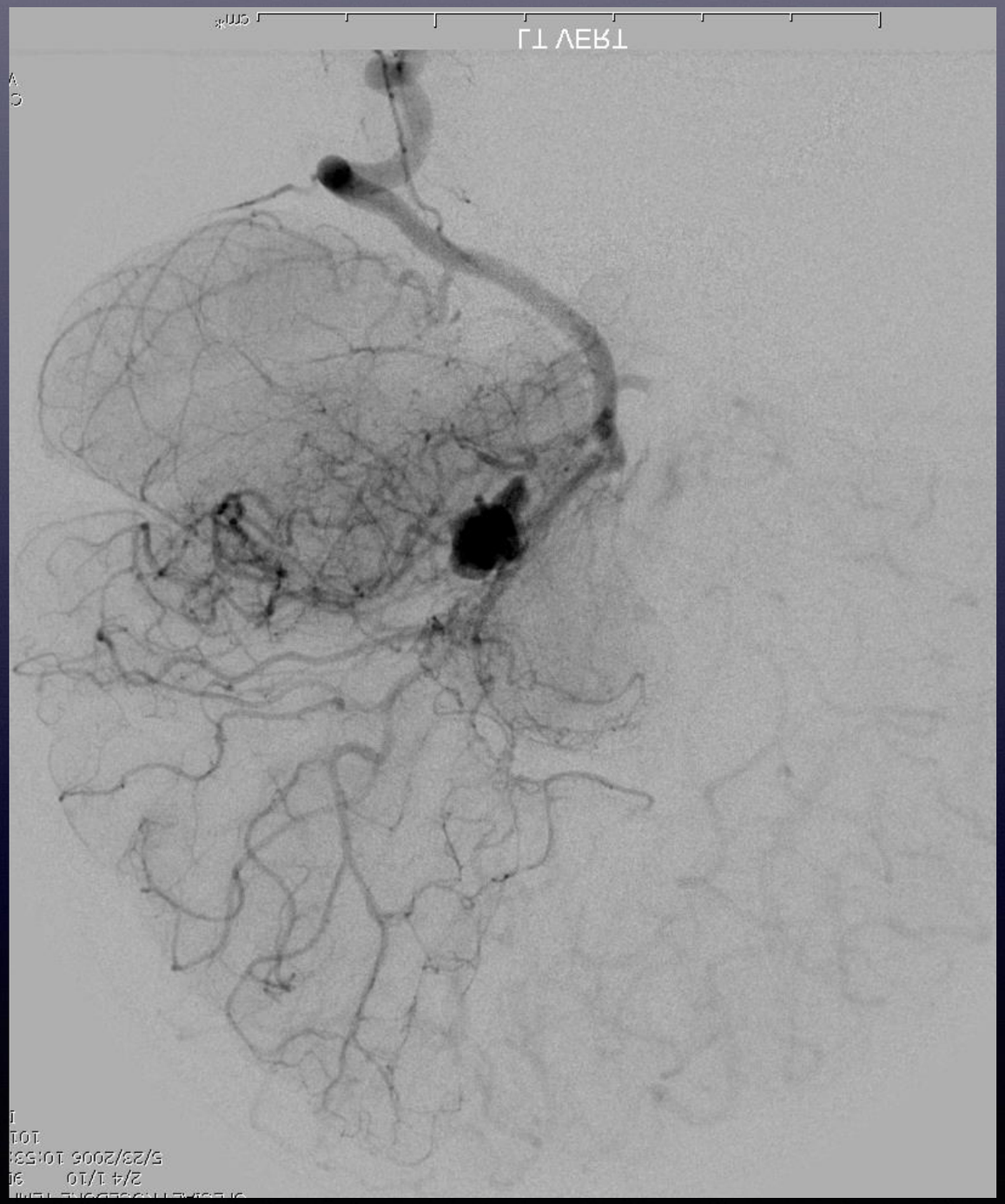



Normandeau, Emma
4057596
1/14/2005
16 MONTH
F
CHILDREN'S HOSPITAL BOSTON
SPECIAL PROCEDURE TEMP CODE
RICA_1
5/23/2006 11:16:57 AM
10158616
IODINE
HFS
RICA
Z: 1
C: 1898
W: 819
IM: 7
cm*

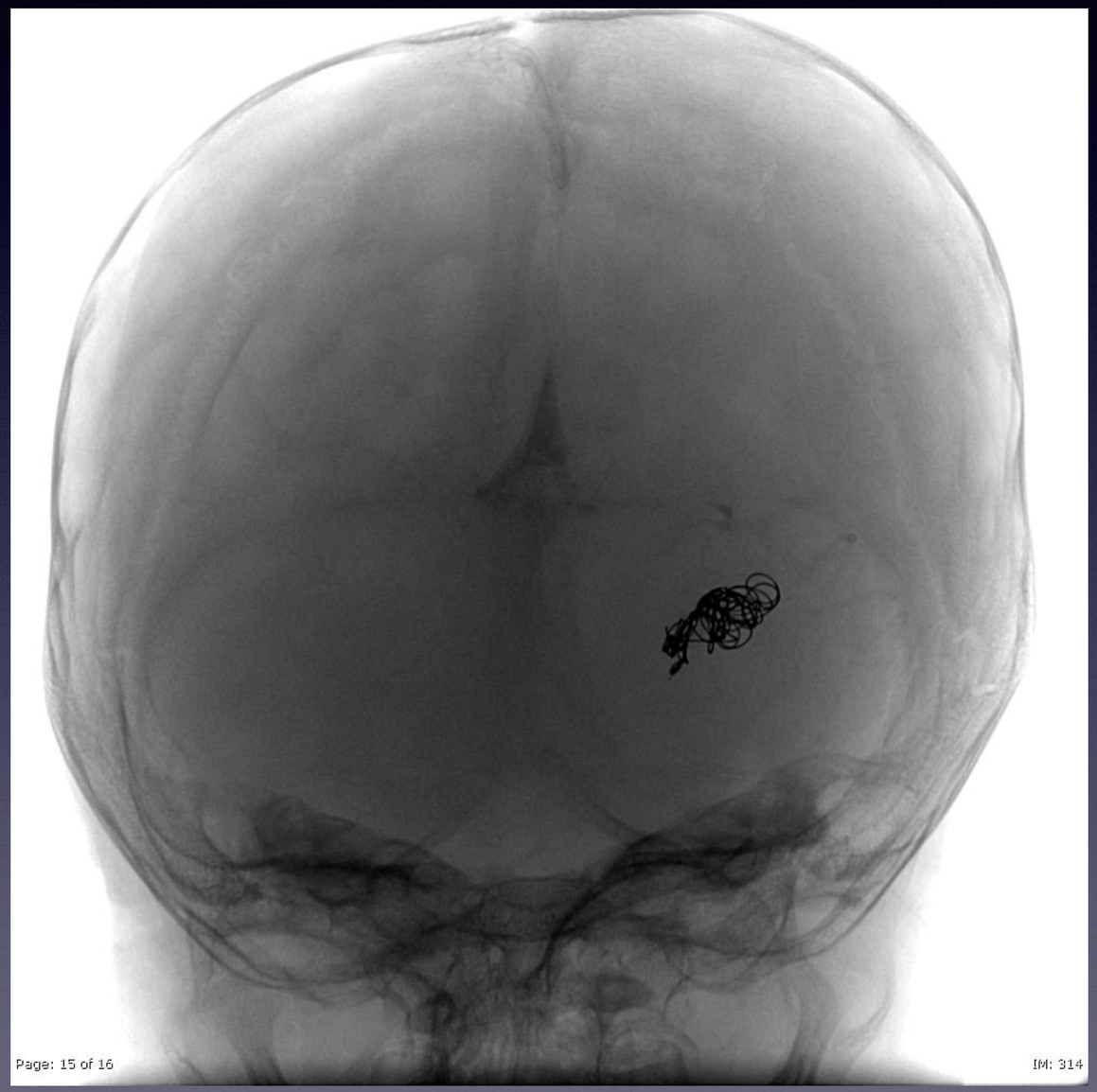

2/4 1/10
5/23/2006 10:
1
LT VERT
cm


LT VERT
cm


Page: 9 of 14
6 IMI

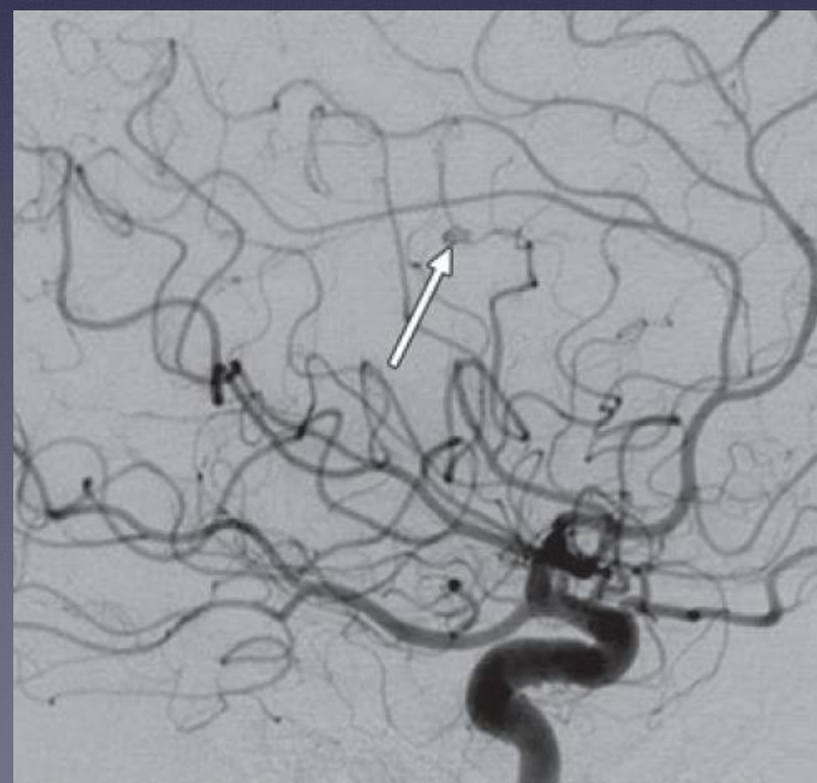

LT VERT

Post coiling

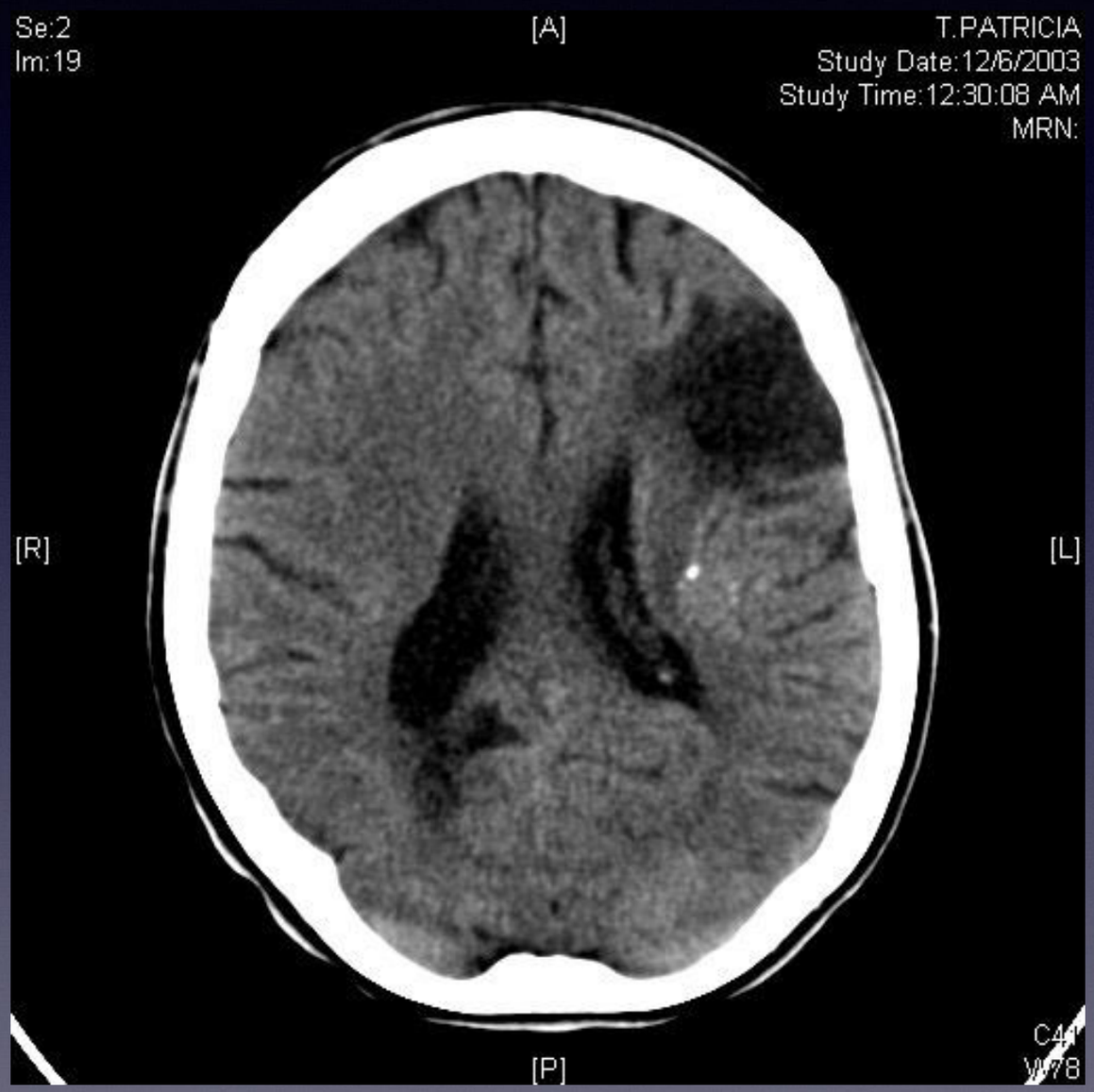


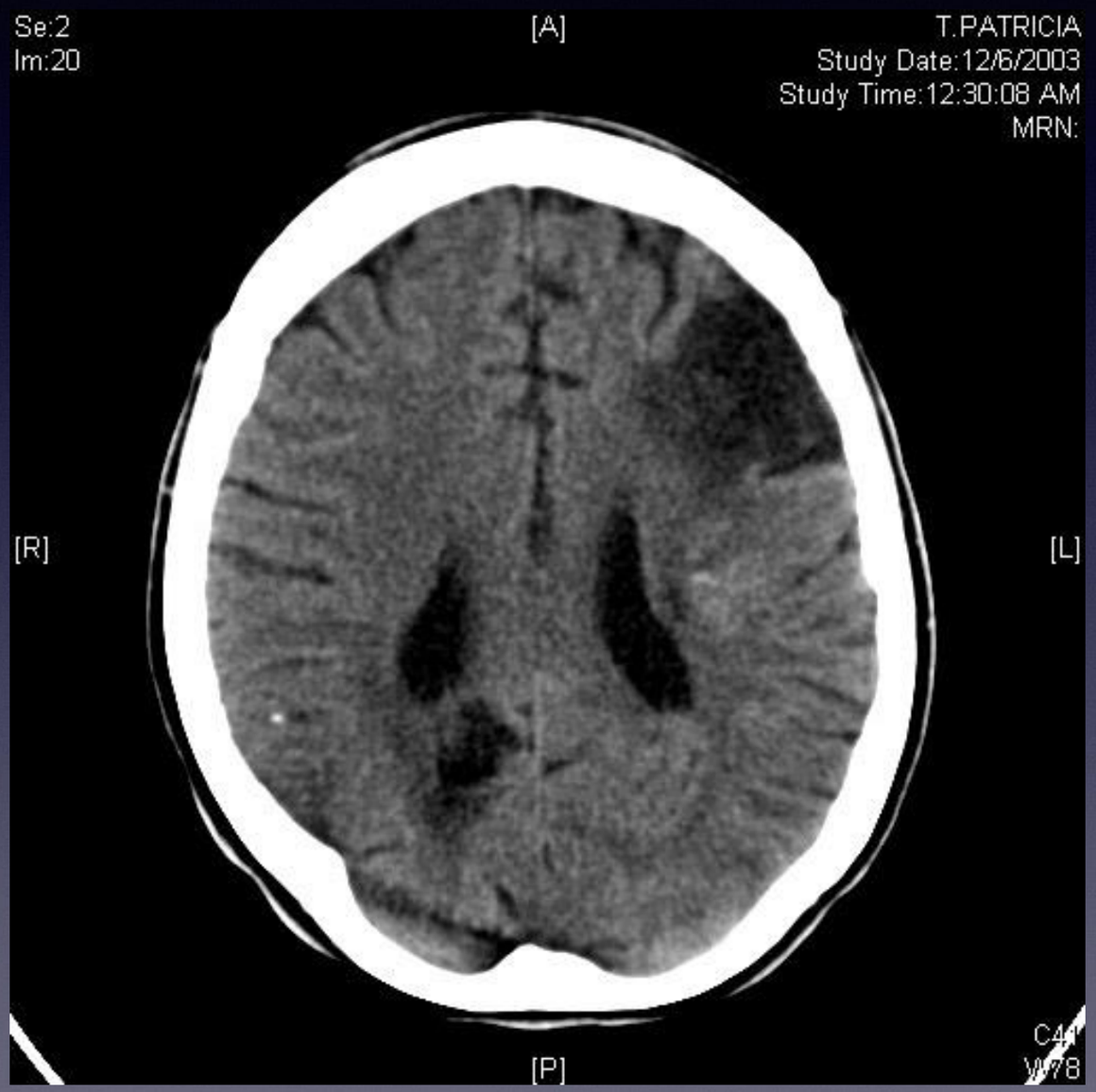
Septic(Mycotic) aneurysm

- 2% των ανευρυσμάτων
- Ενδοκαρδίτιδα(5%)
- Μηνιγγίτιδα
- Κυτταρίτιδα οφθαλμικού κόγχου
- Λοίμωξη σηραγγώδους κόλπου



Endocarditis

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MRN:
[R]
[L]
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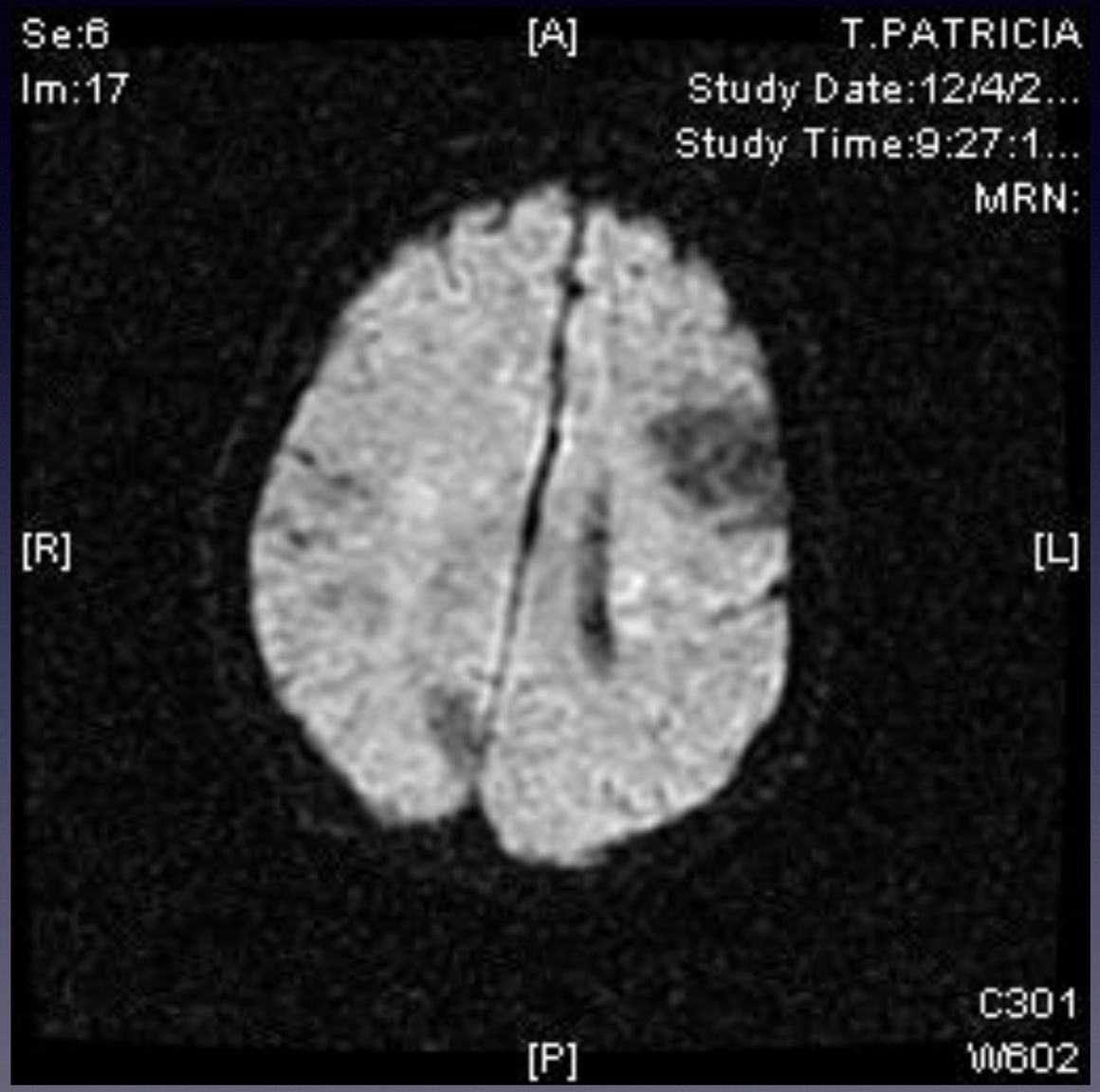
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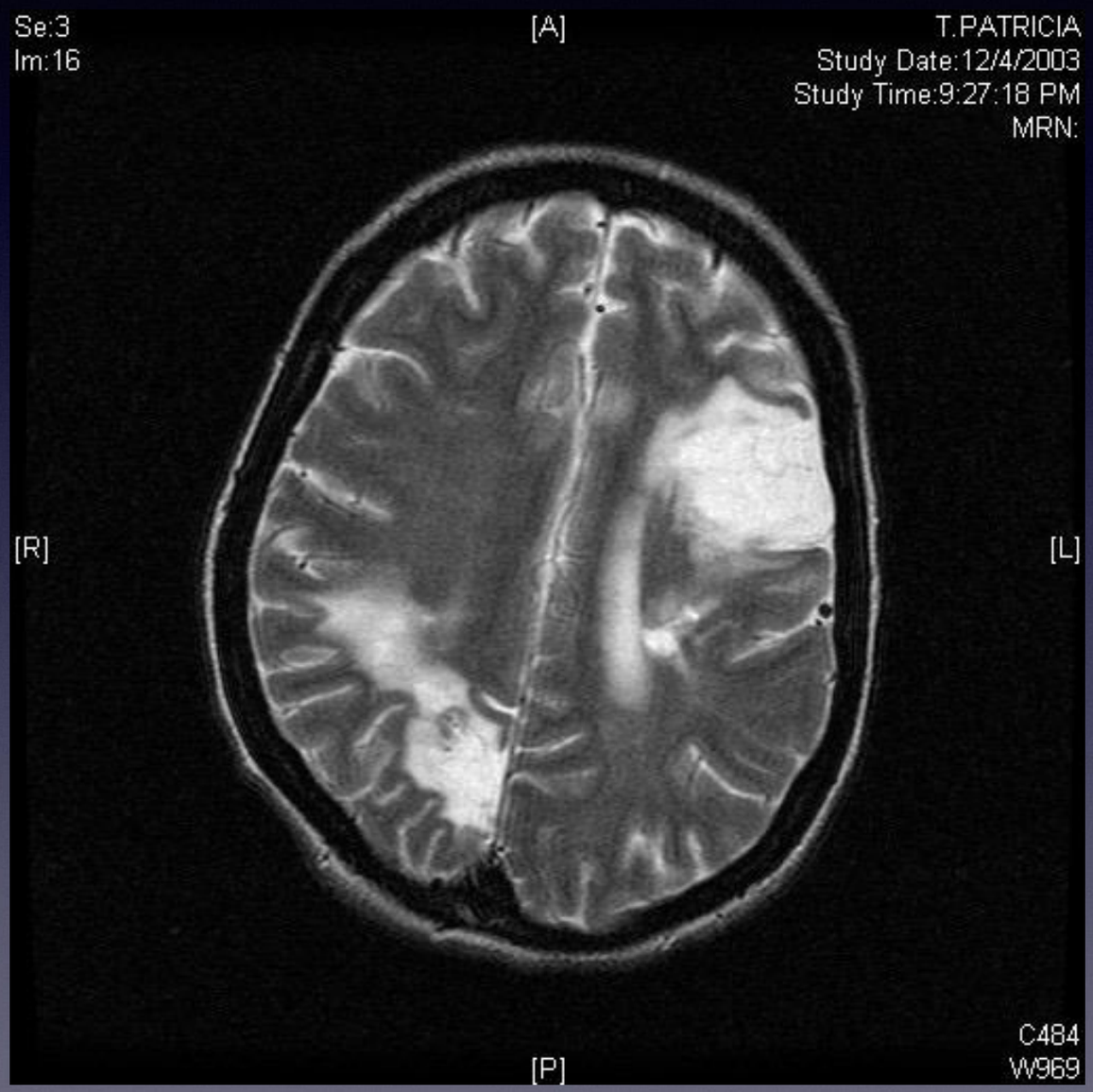
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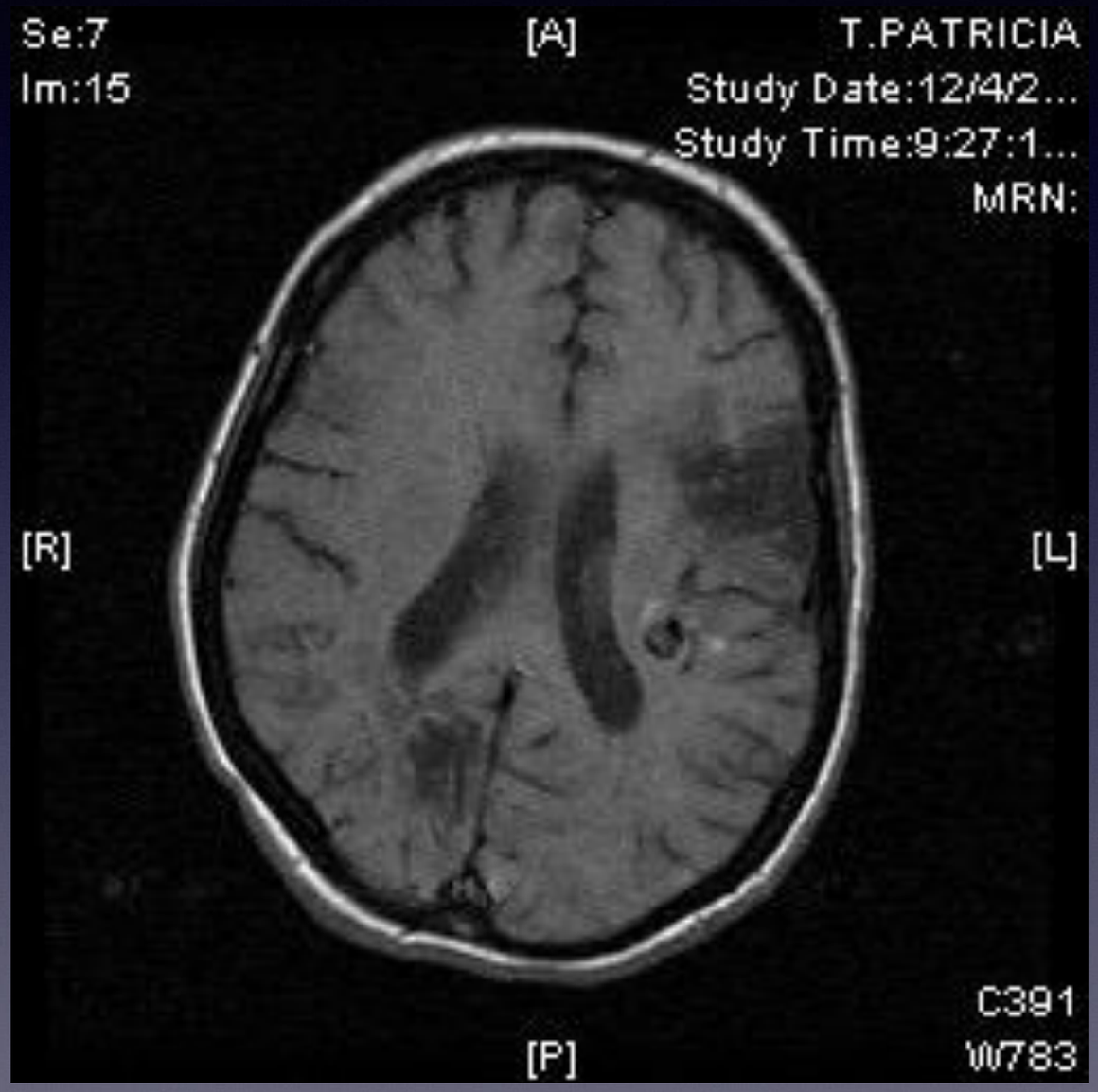
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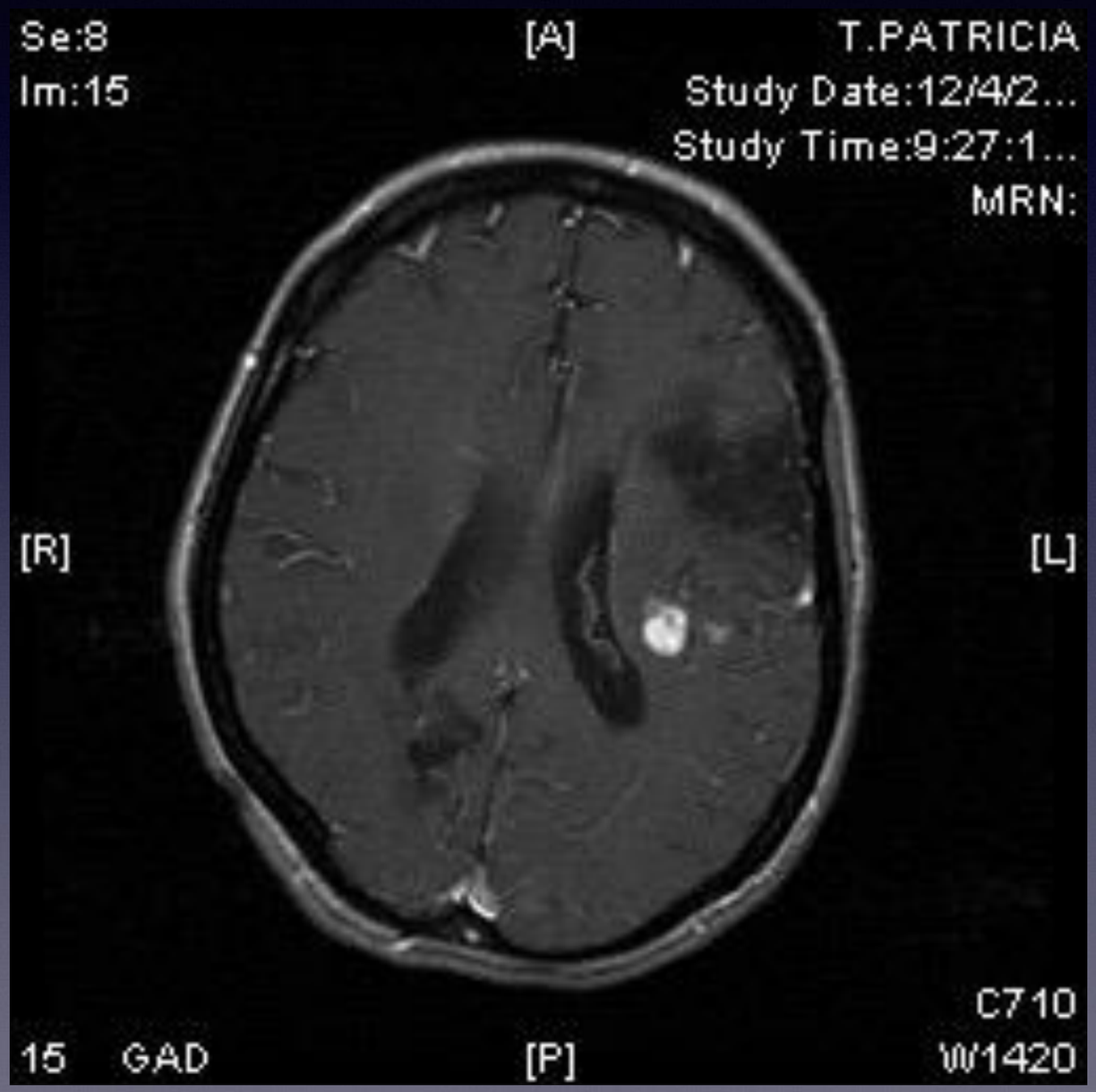
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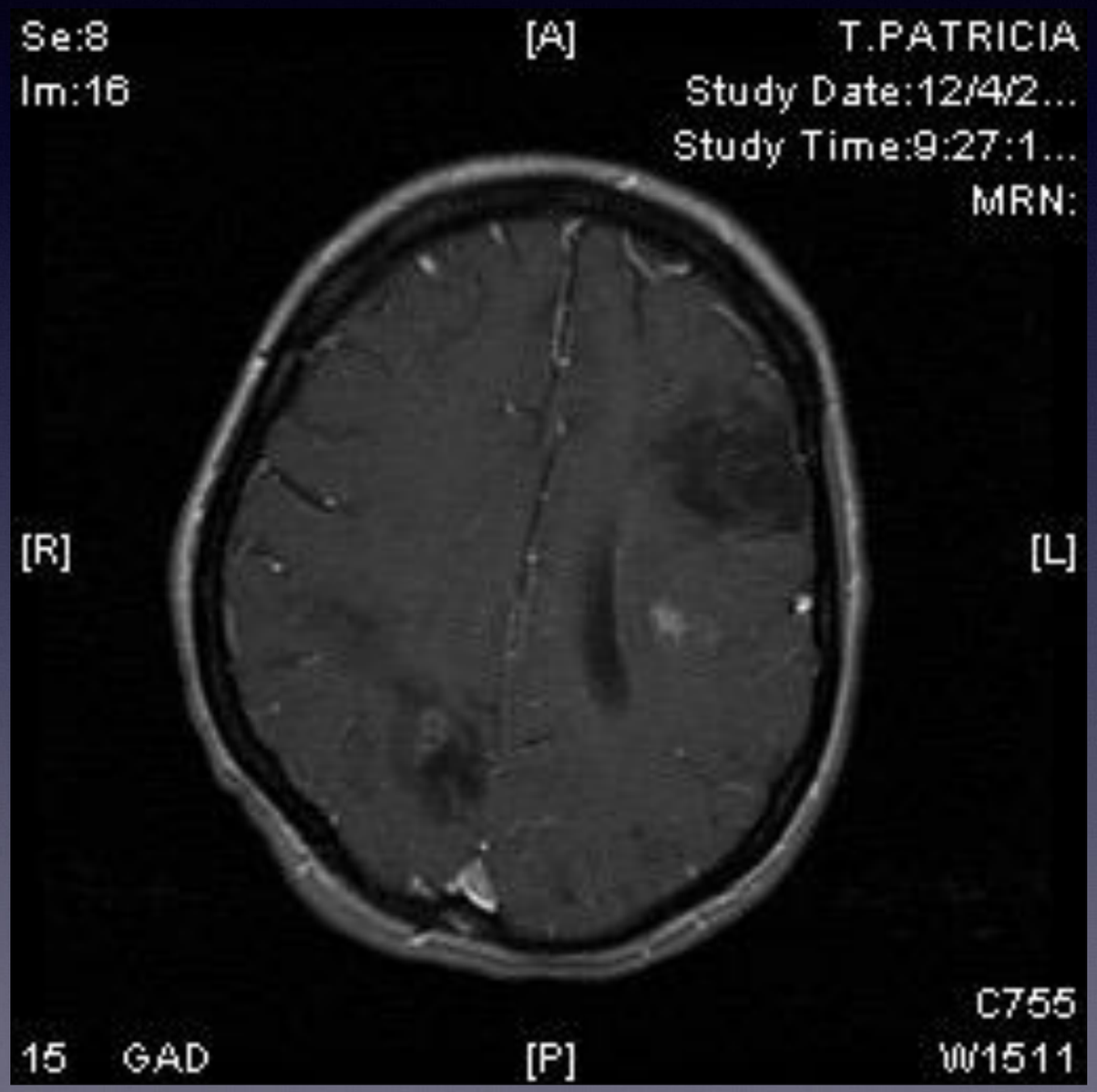
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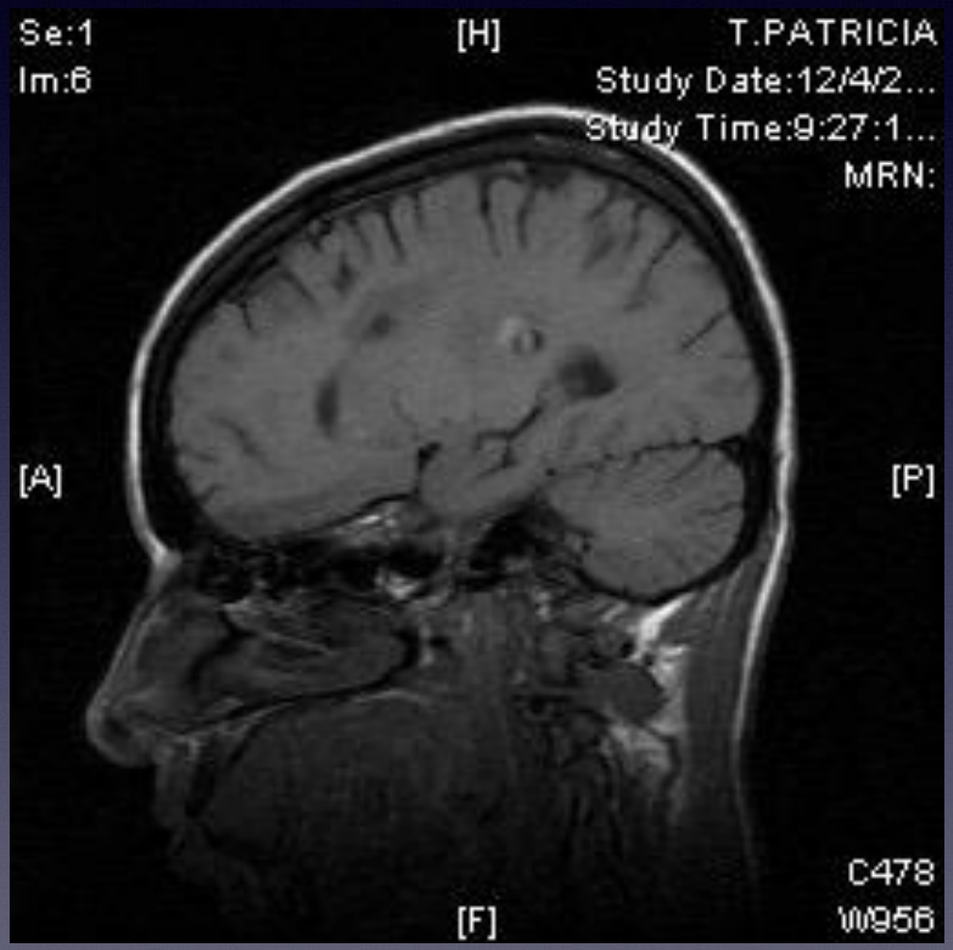
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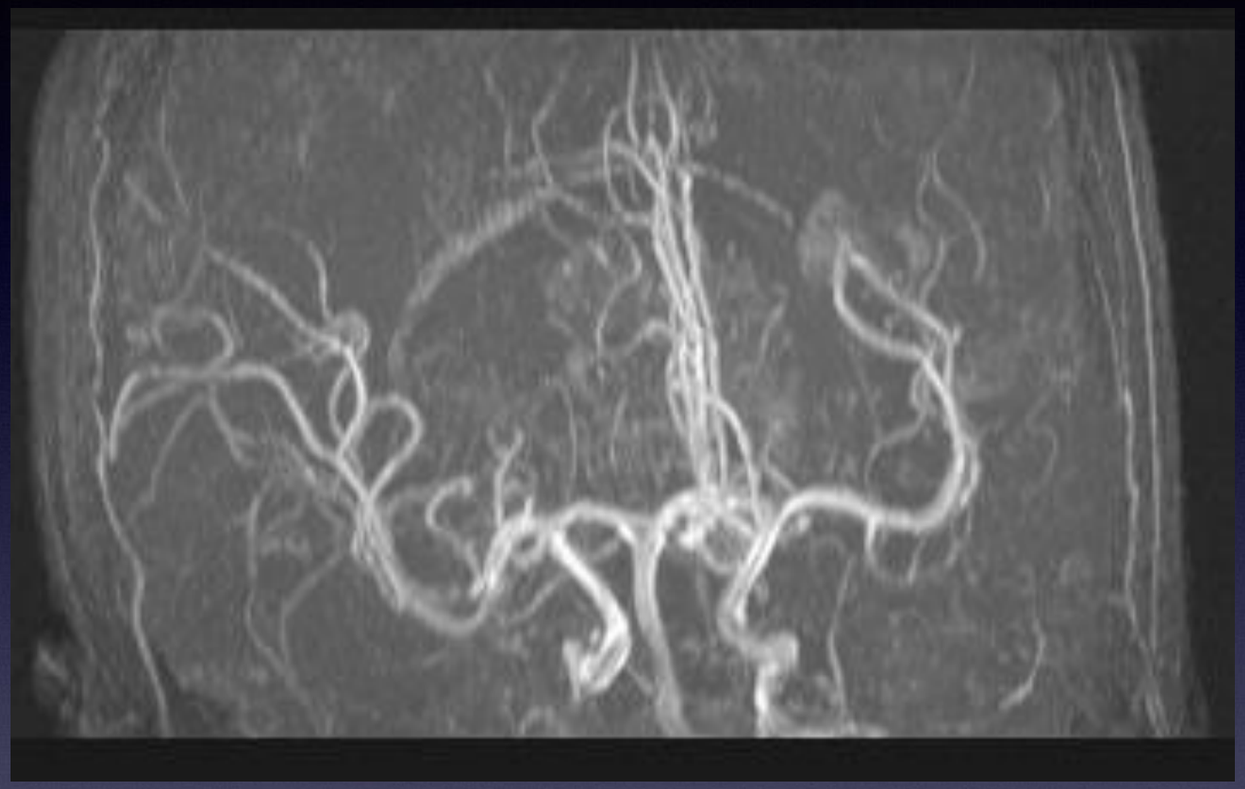

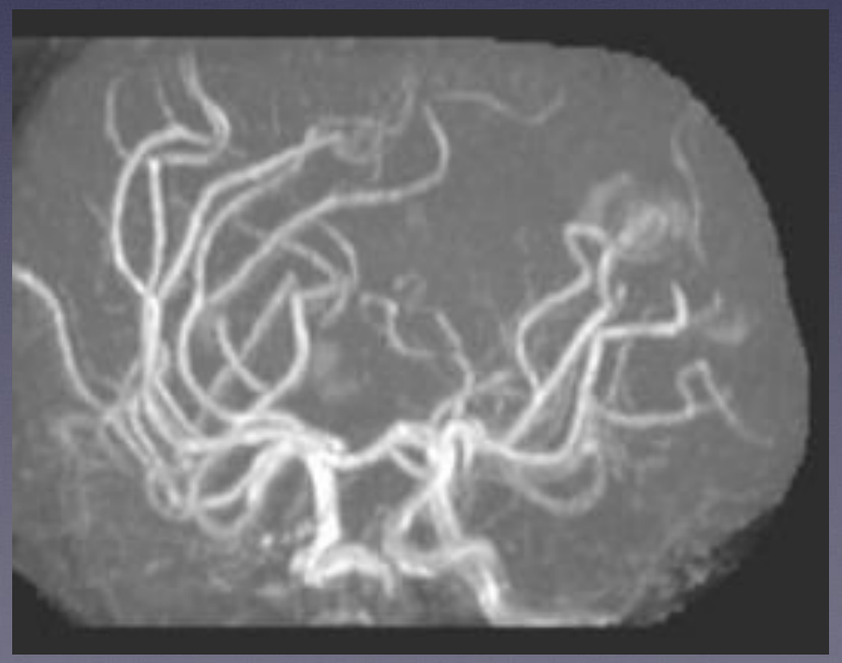

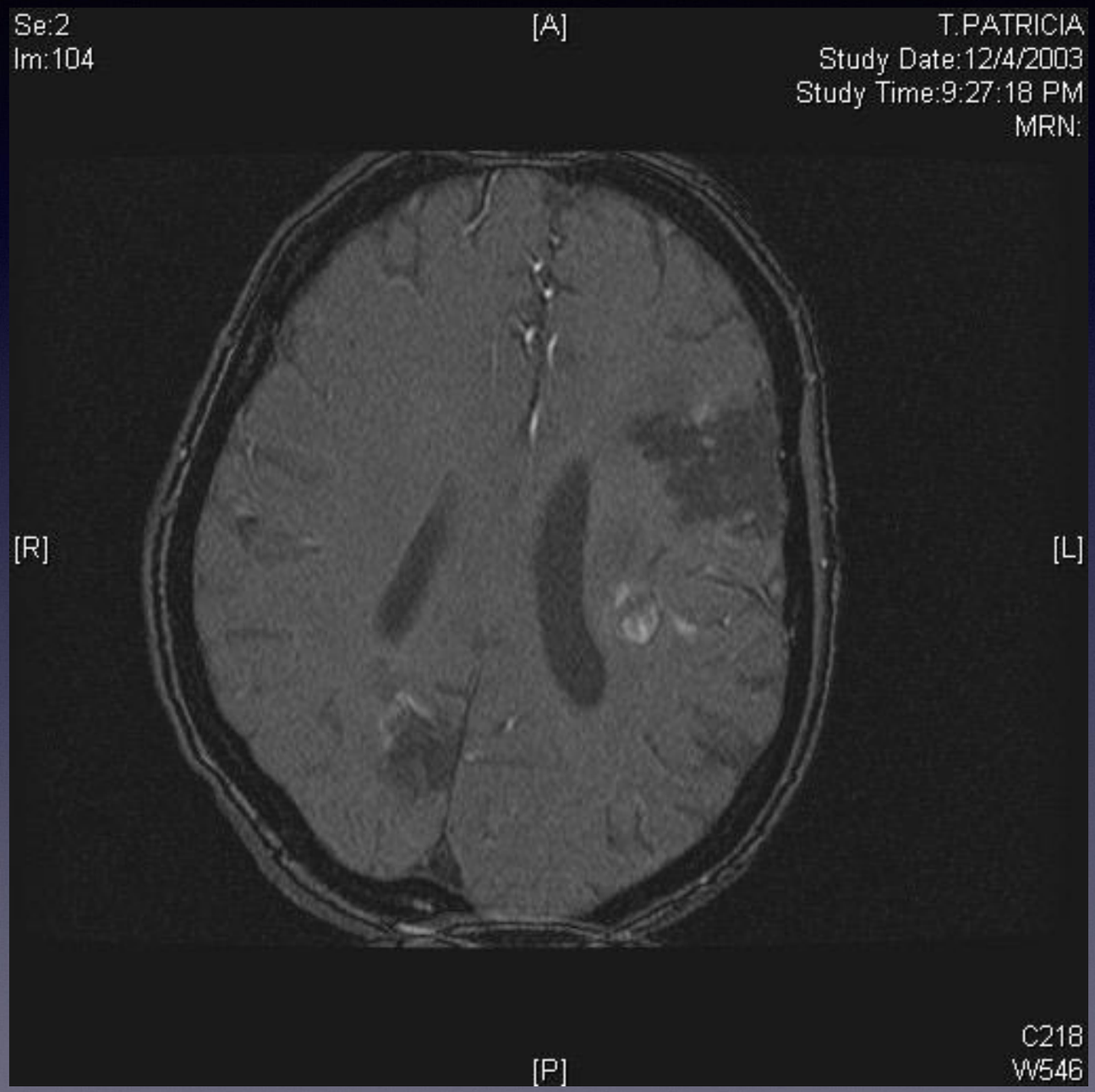
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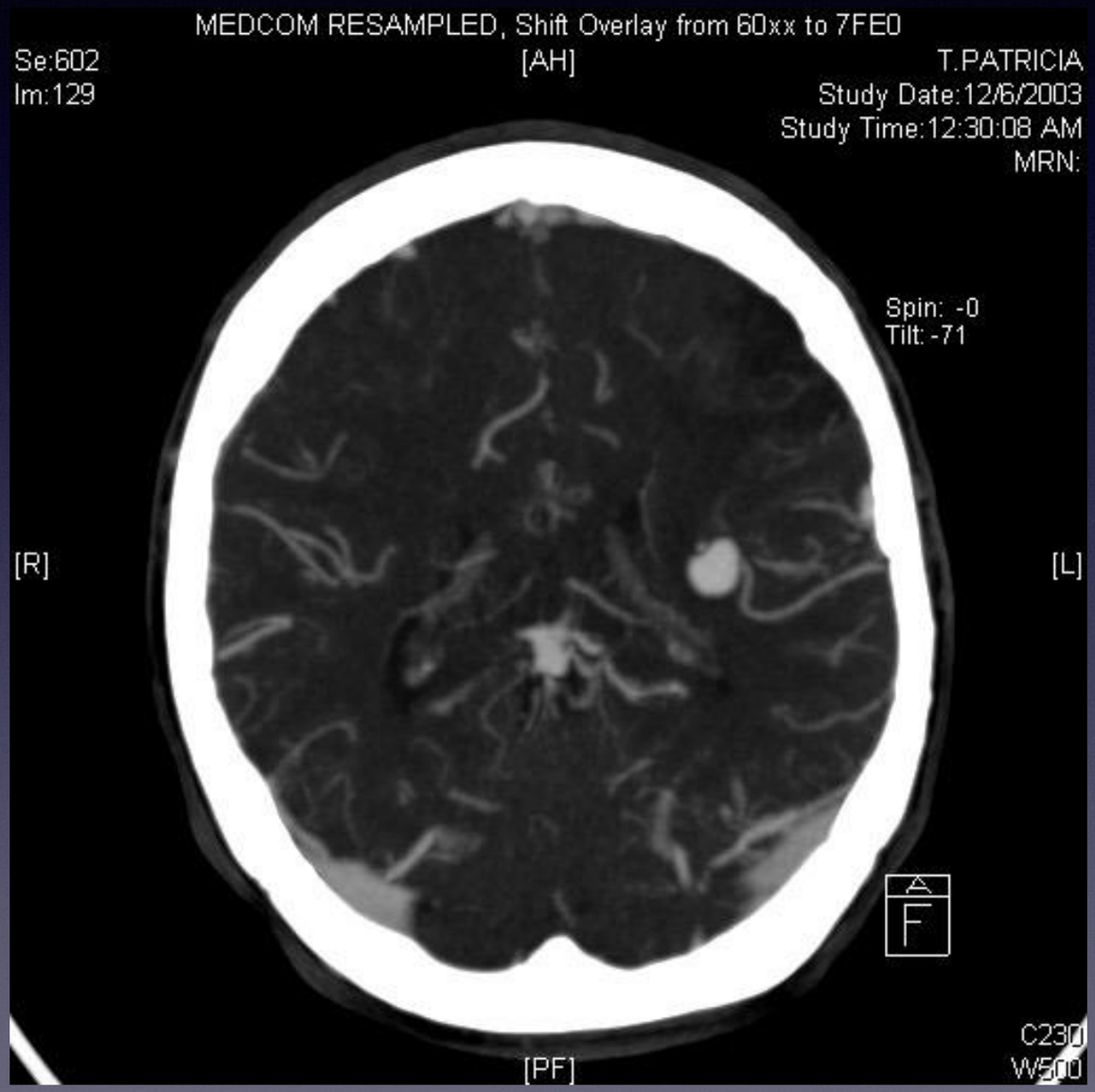
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Im:129
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F
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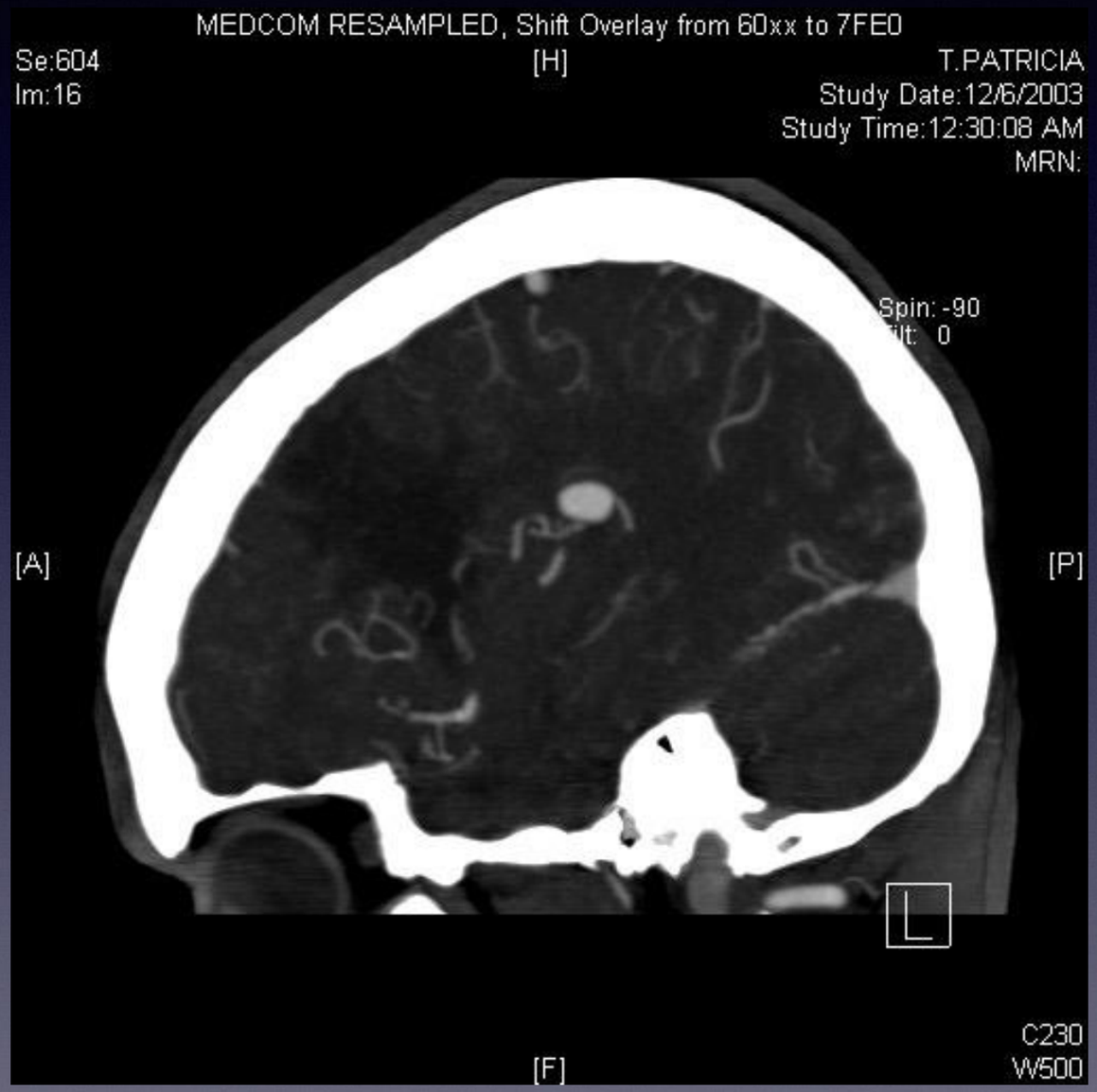
C230
W500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[P]
L
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C230
W500

Μαγνητική τομογραφία

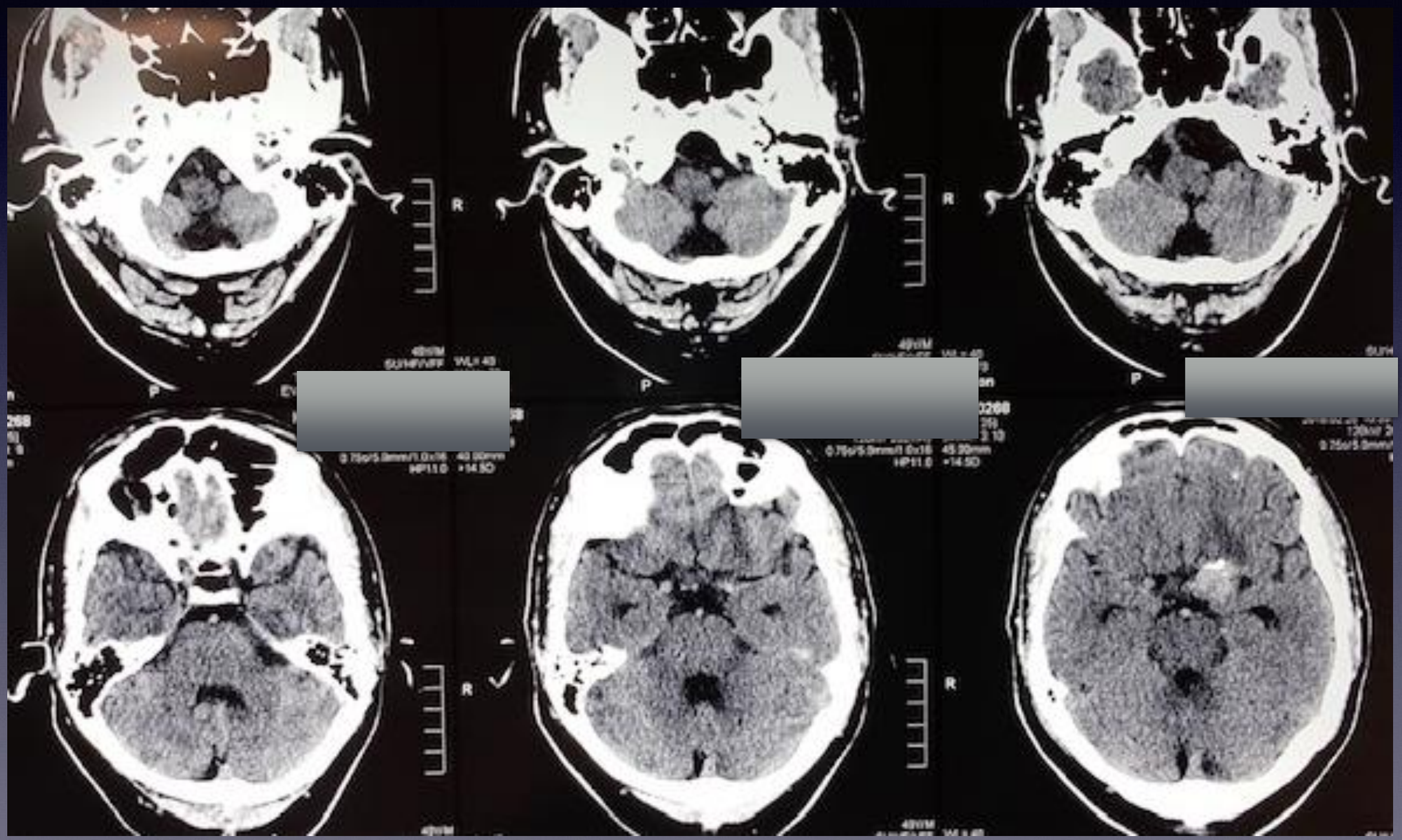
- Αρνητική ψηφιακή αγγειογραφία > Ανίχνευση θρομβωμένου ανεύρυσματος, άλλης αιτίας αιμορραγίας

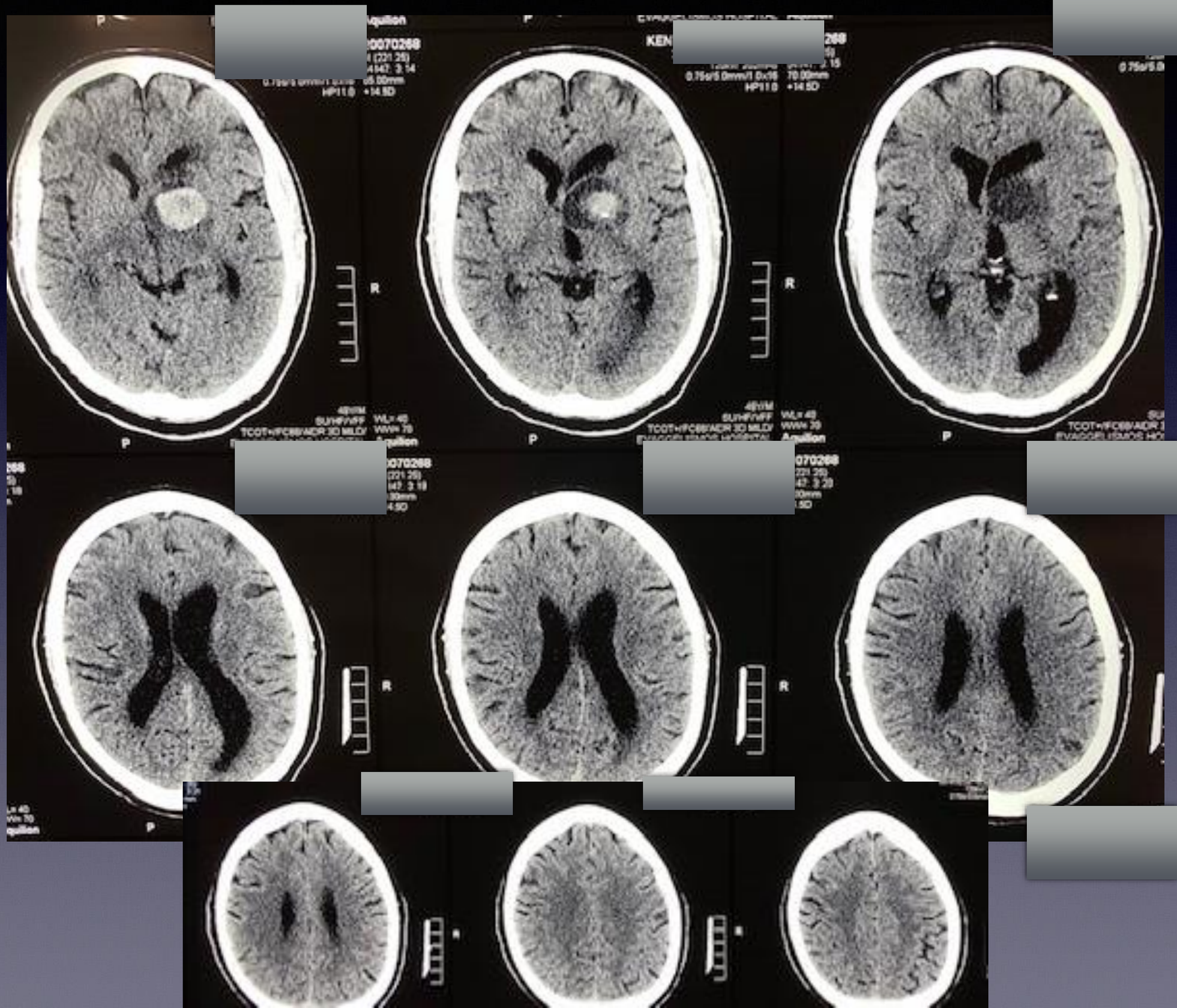
- Αυχενική μοίρα ΣΣ > όγκος, ΑΦΔ


Neuro
Ex: 28012005174021
Se: 1/8
Im: 12/158
BETH ISRAEL DEACONESS H
BENNETT
F
Acc:
200
Stdy Tm: 17:4
W:255 L:127

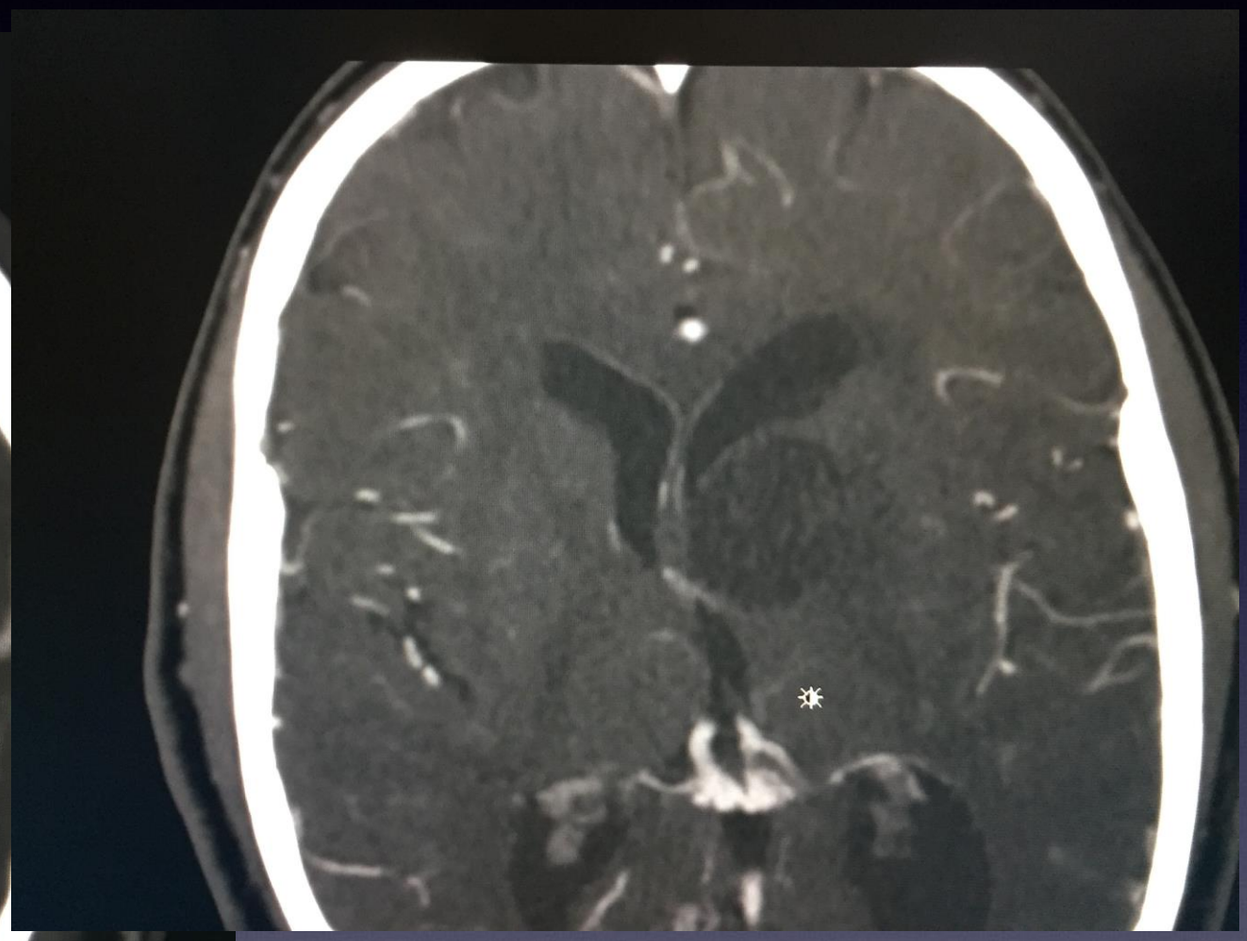

1.5T mr
Ex: 1
ROUTINE_HEAD/T1W_SAG
Se: 2/16
Im: 14/18
Sag: R1.6(C0.0)
512 x 192
BIDMC #
BENNETT^EILEEN
047Y F
Acc:
2005 Jan 29
A
P
I
ET: 1
TR:
TE: 14.0
CP Head
WW:1488 L:496
DFOV: 25.0 x 25.0cm

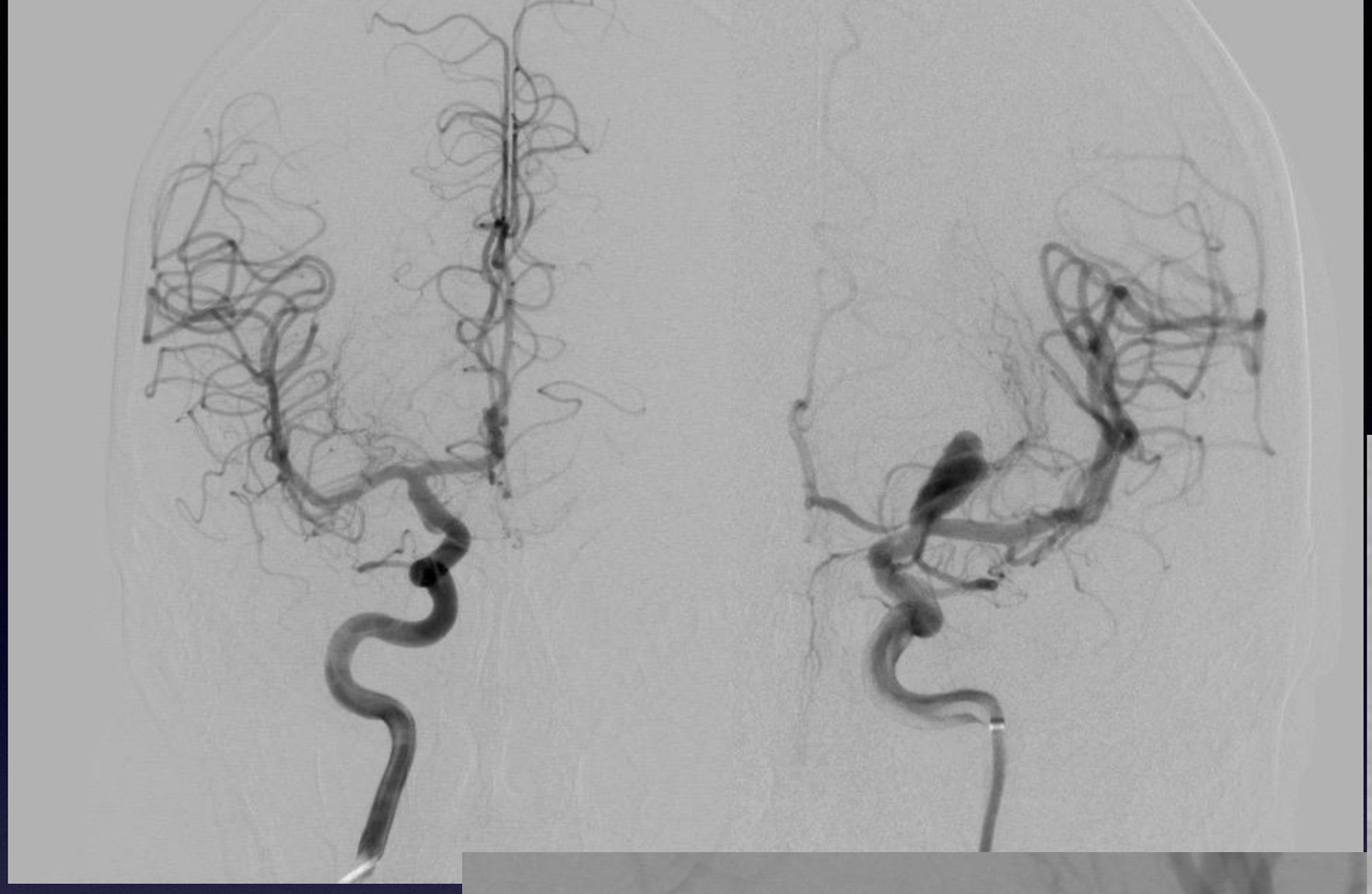
48 year old man with headaches and acute onset of right sided numbness and right facial nerve palsy



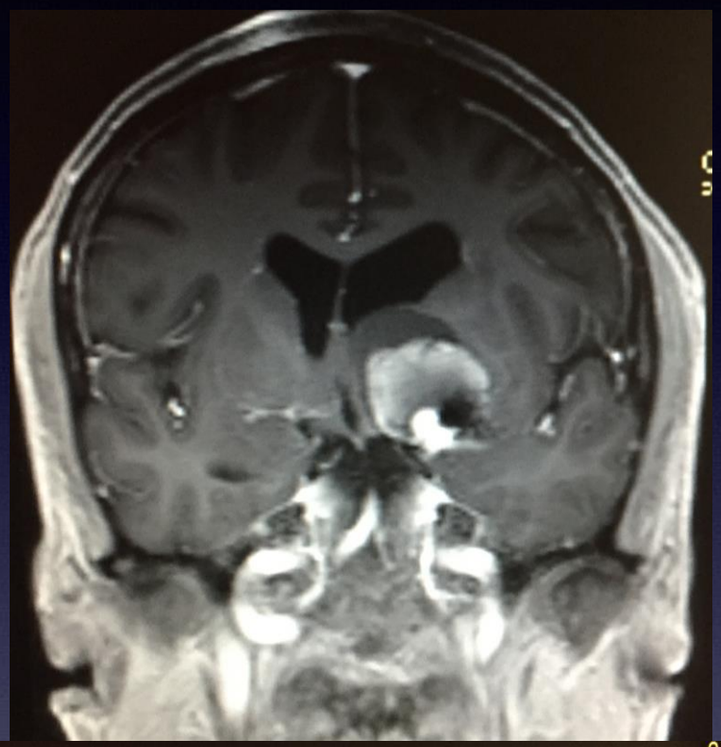


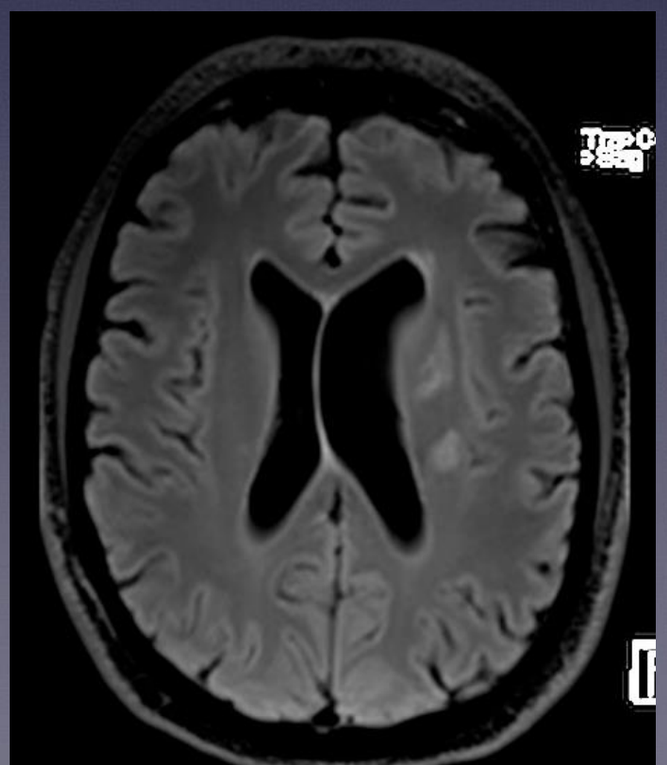
48 year old man with headaches and acute onset of right sided weakness

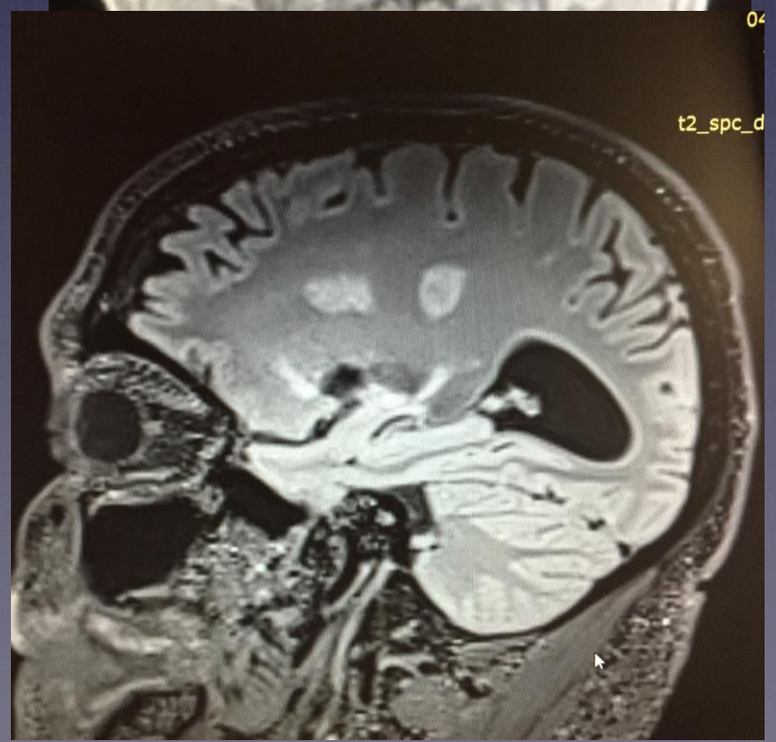


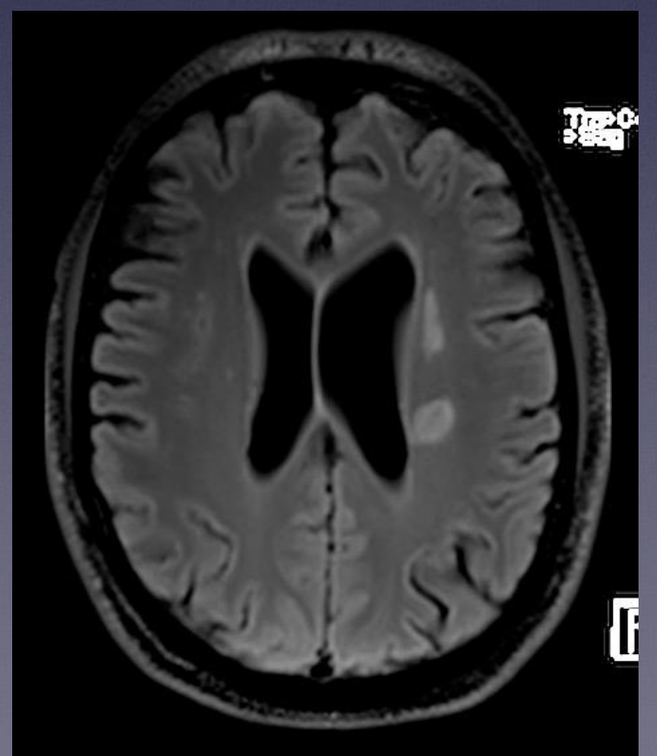


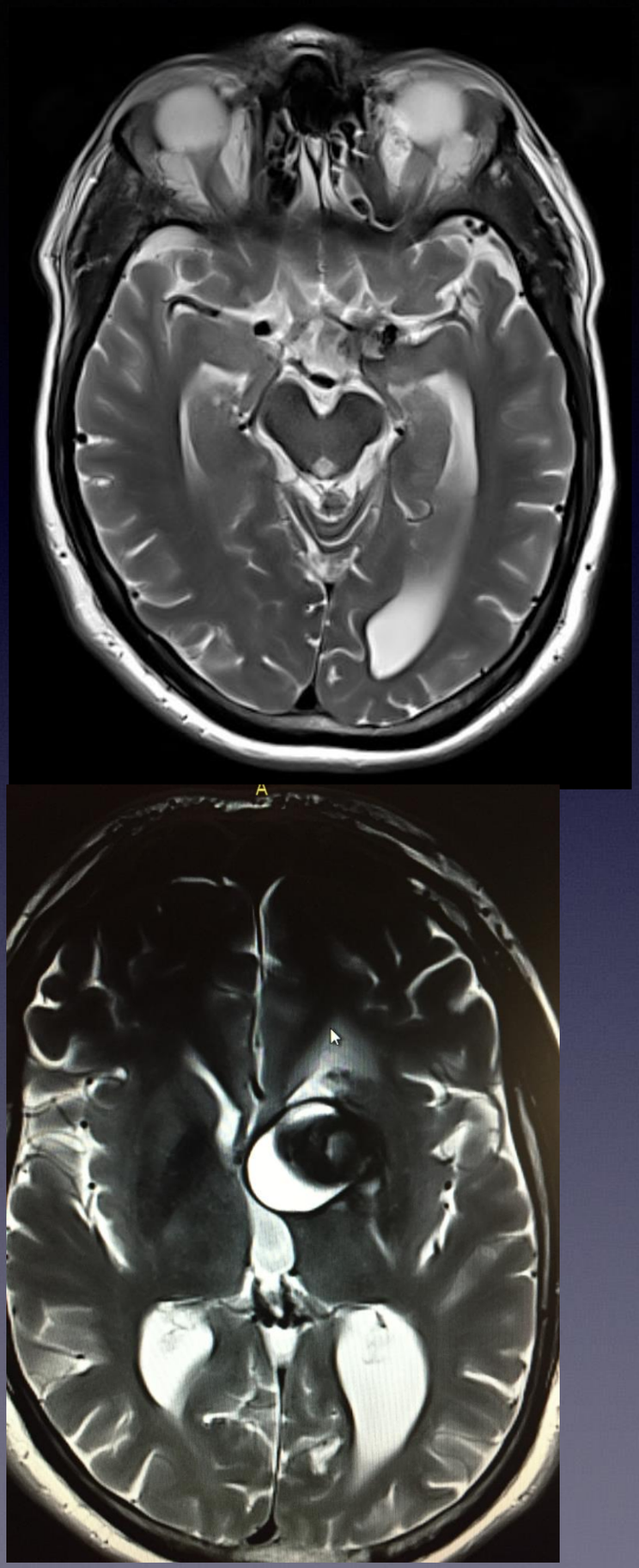
MRI 6 weeks after presentation and coiling







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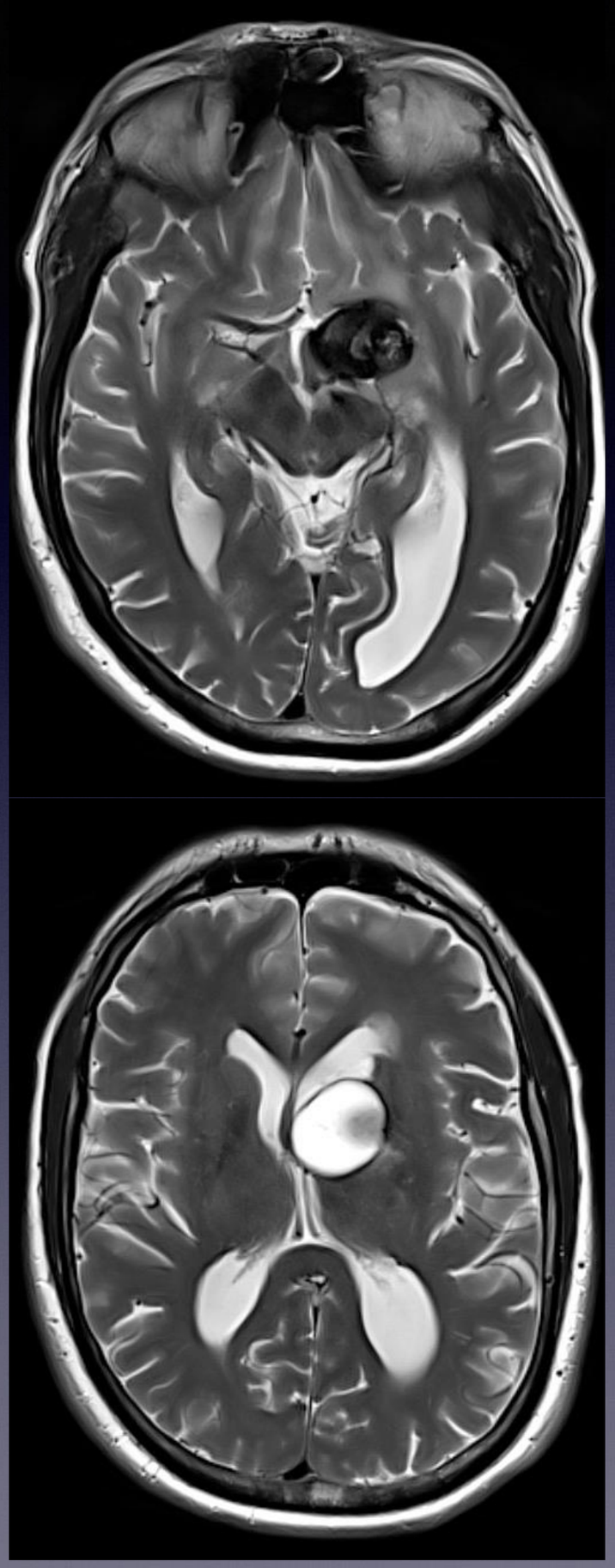
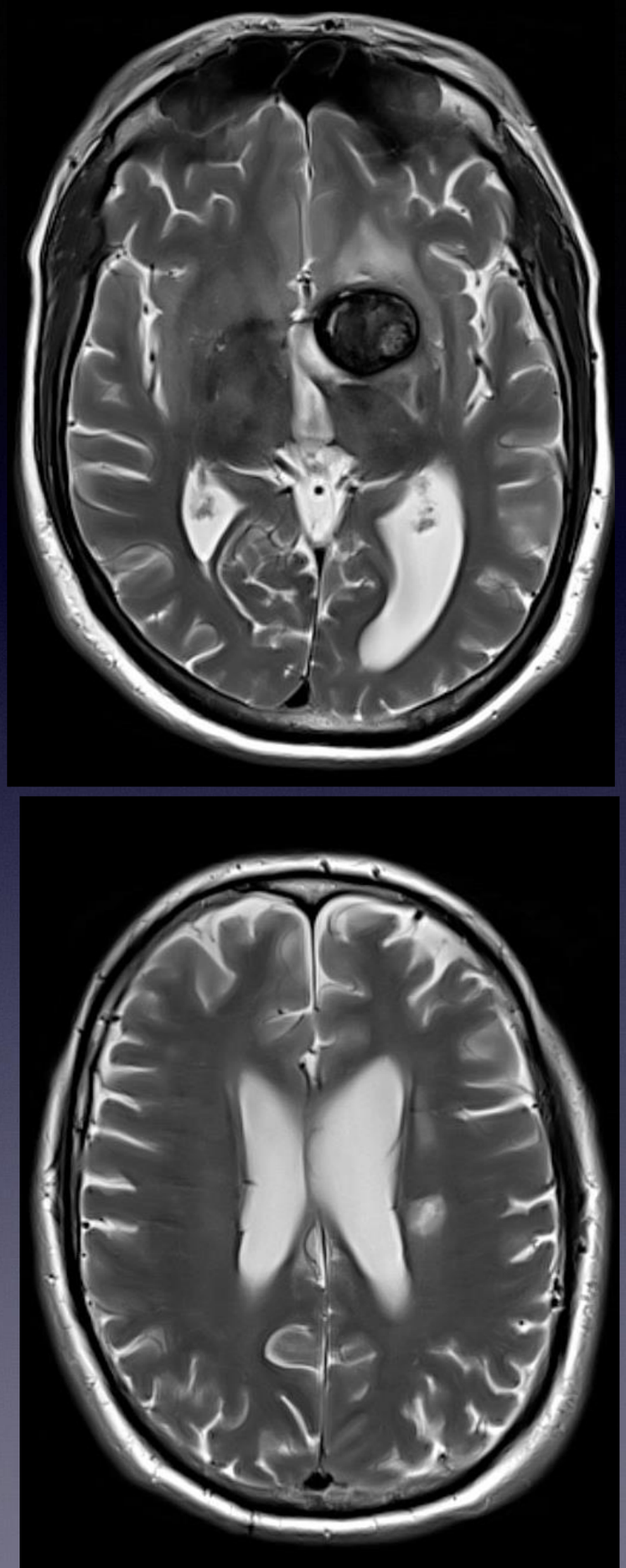
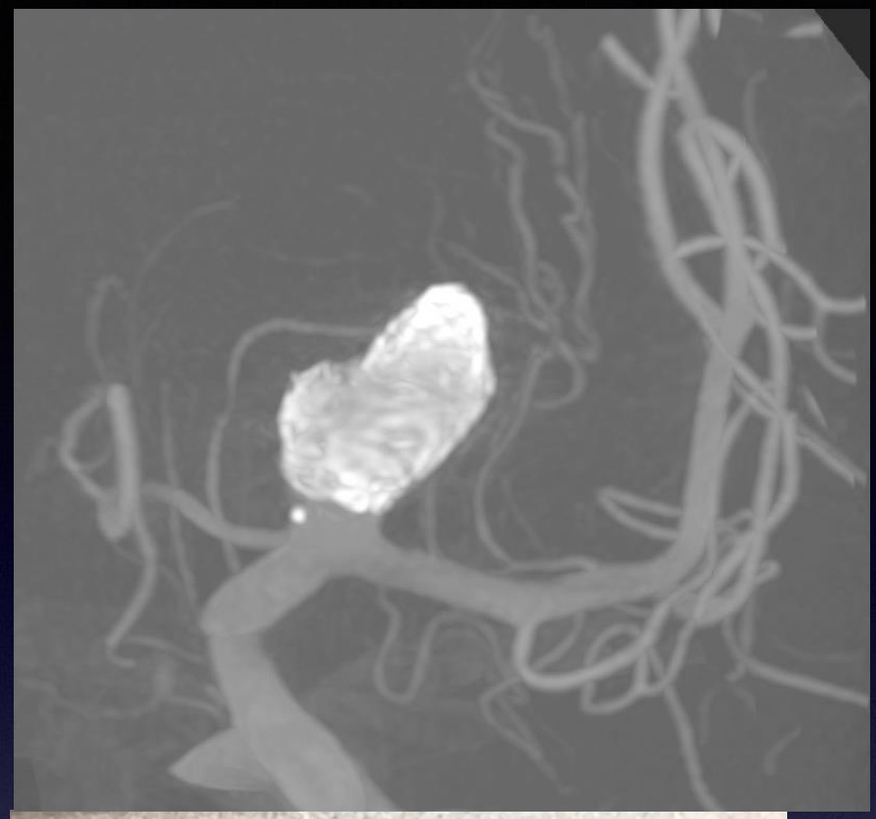
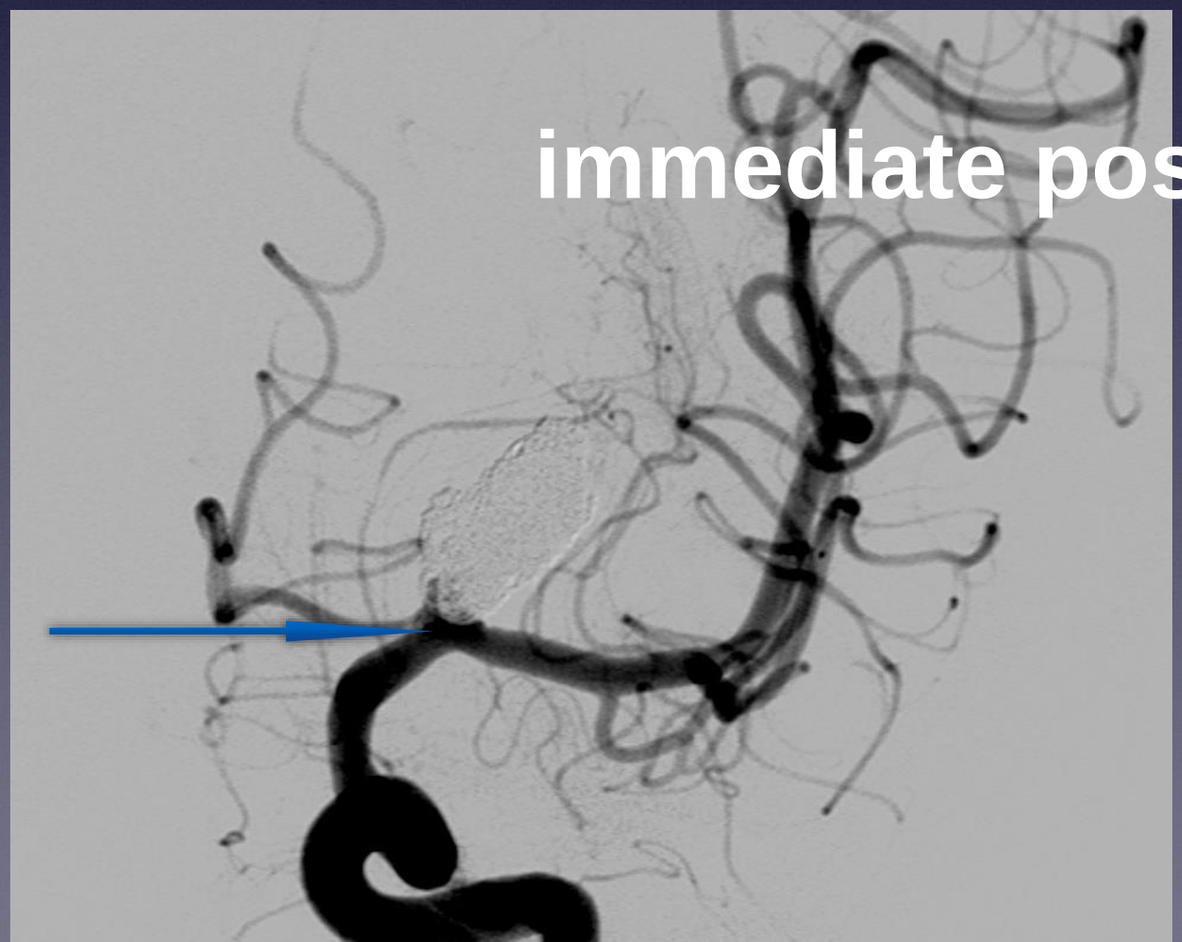
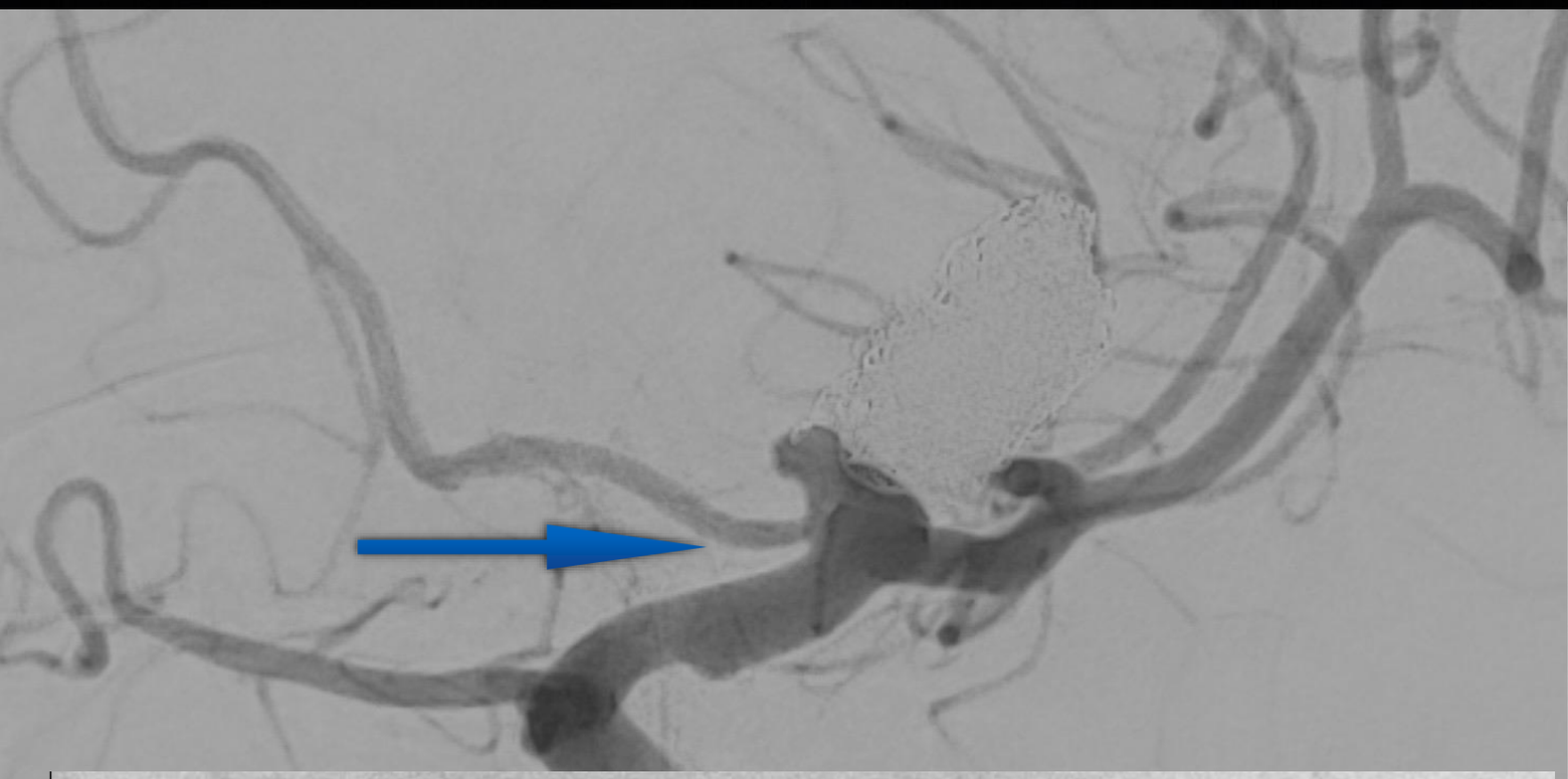



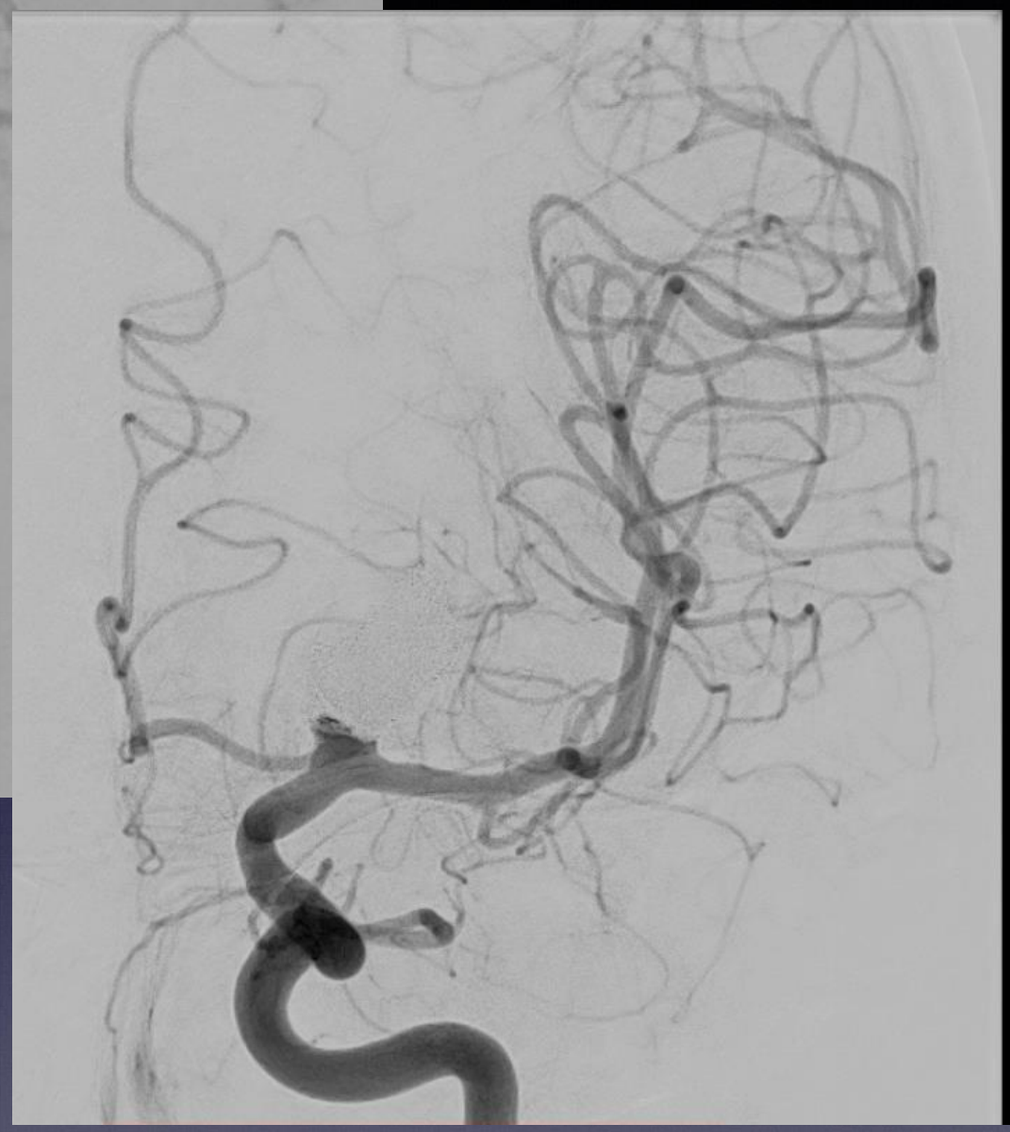
FOLLOW UP

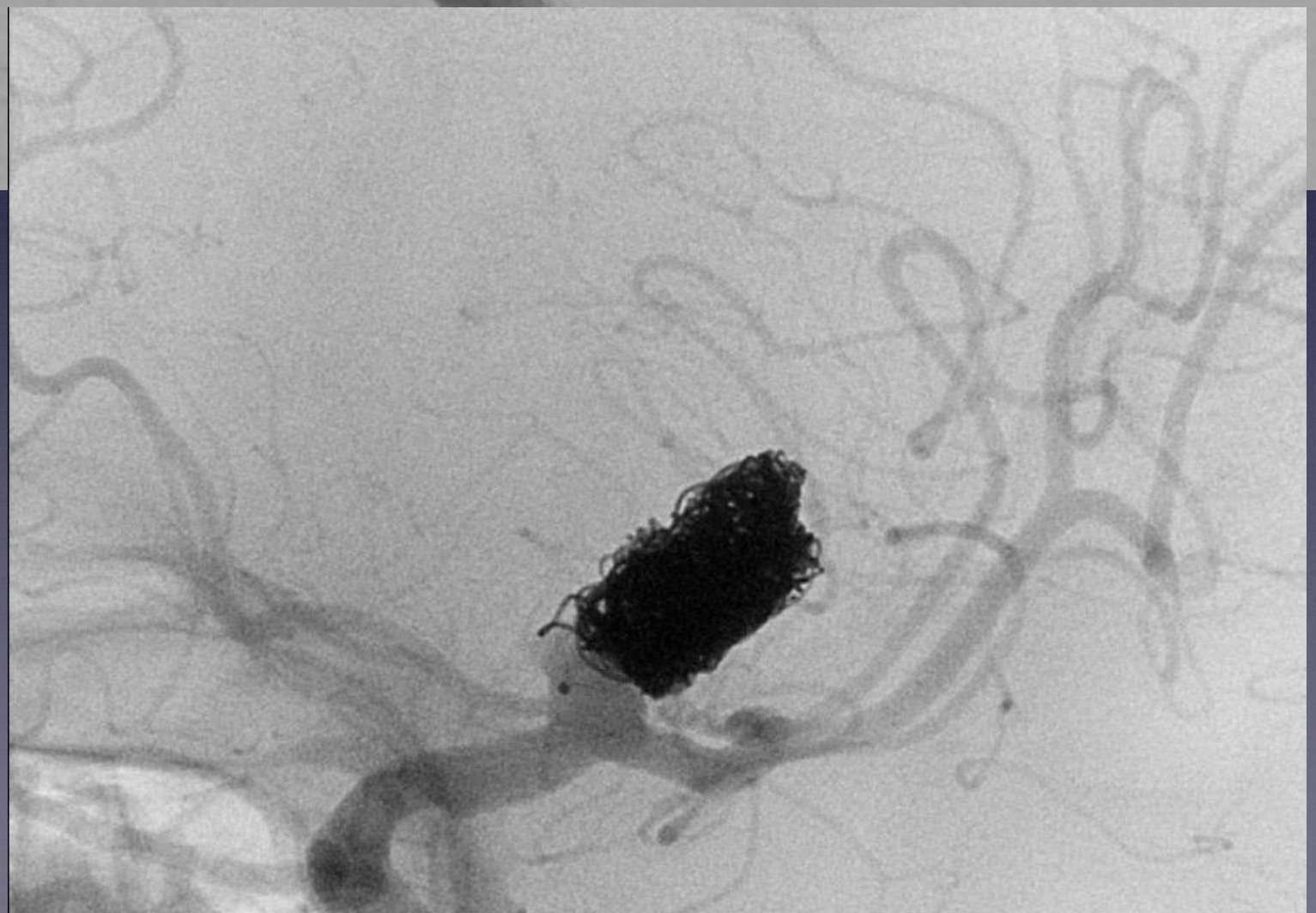


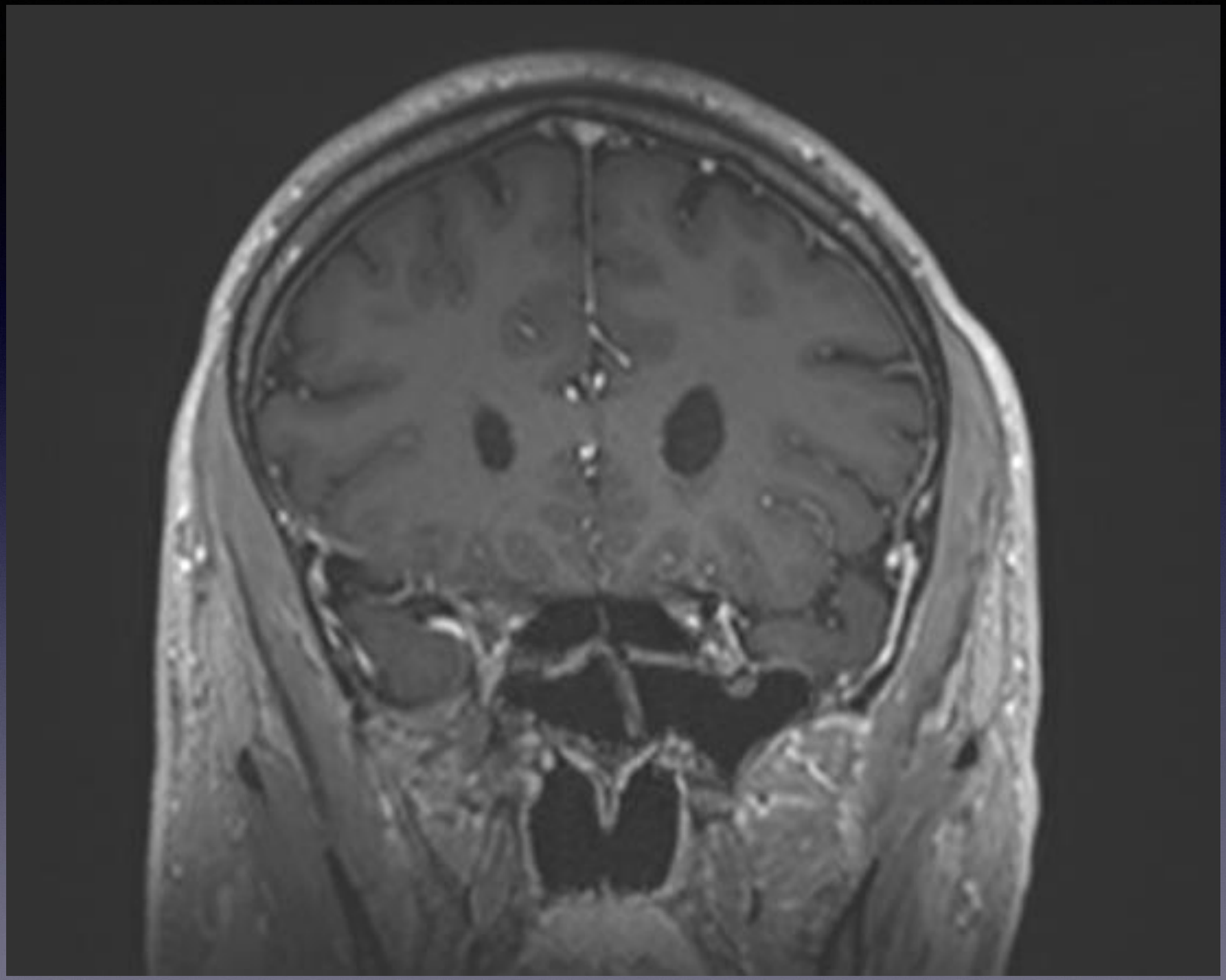


immediate post embo images

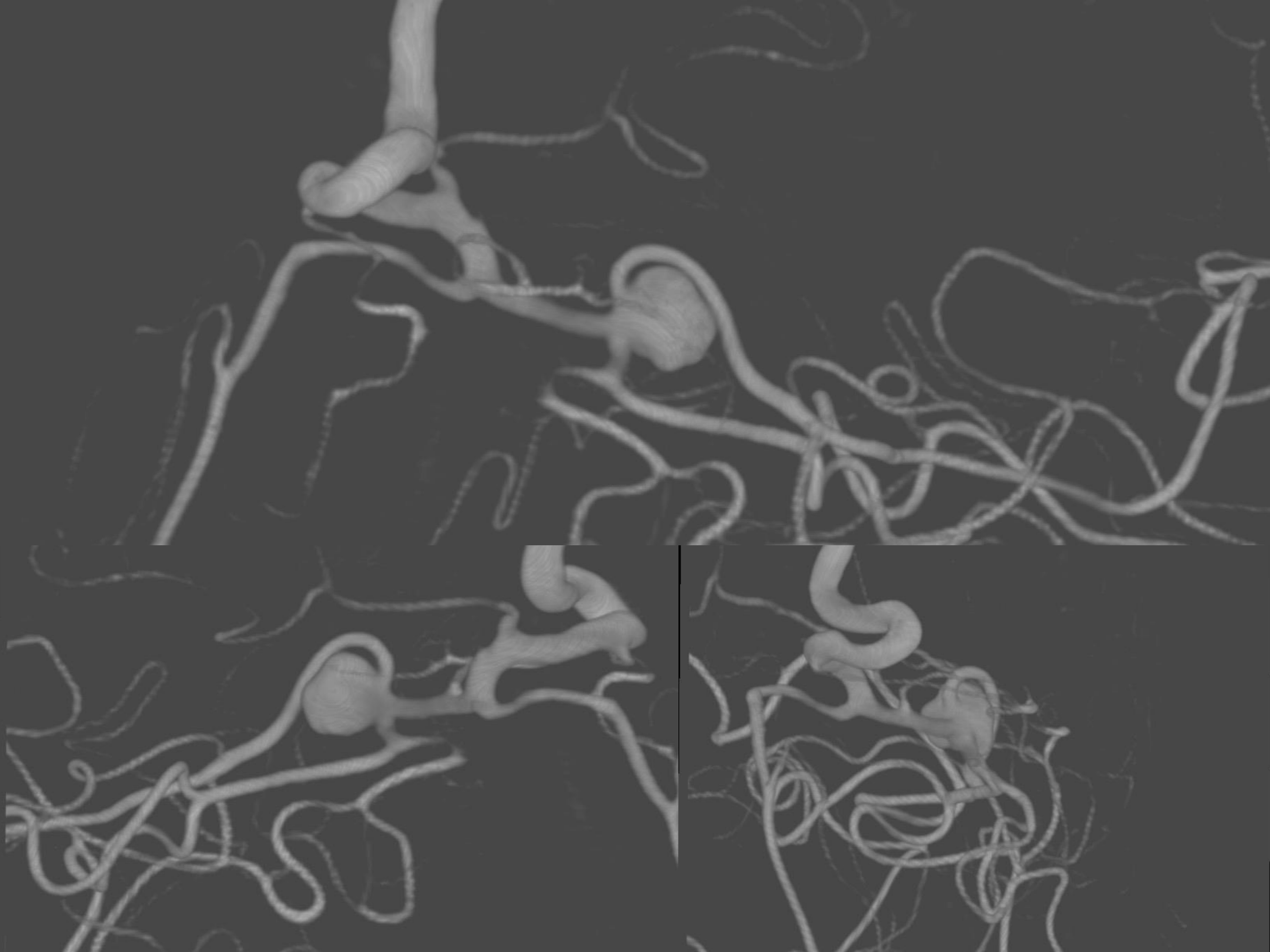


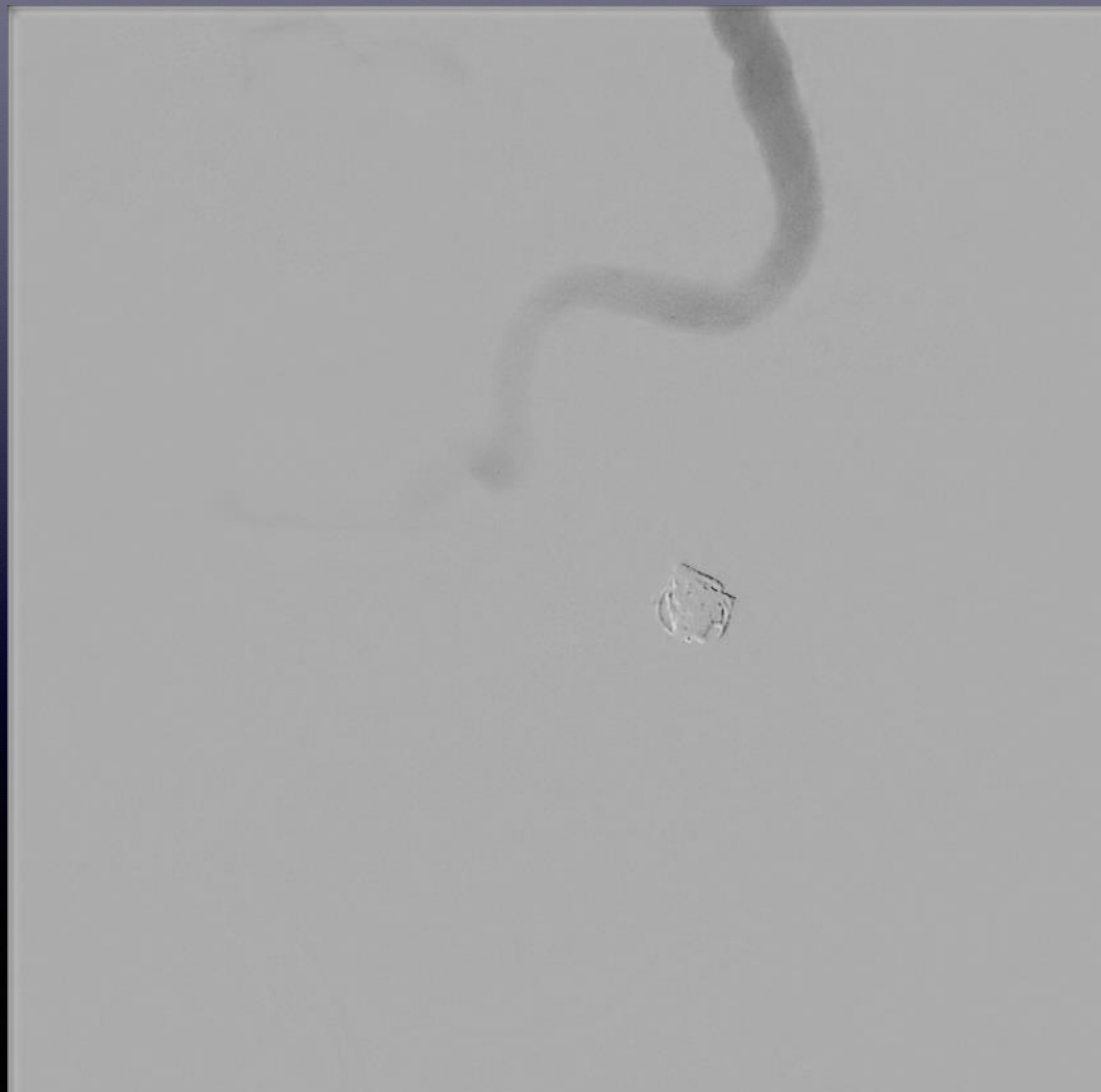


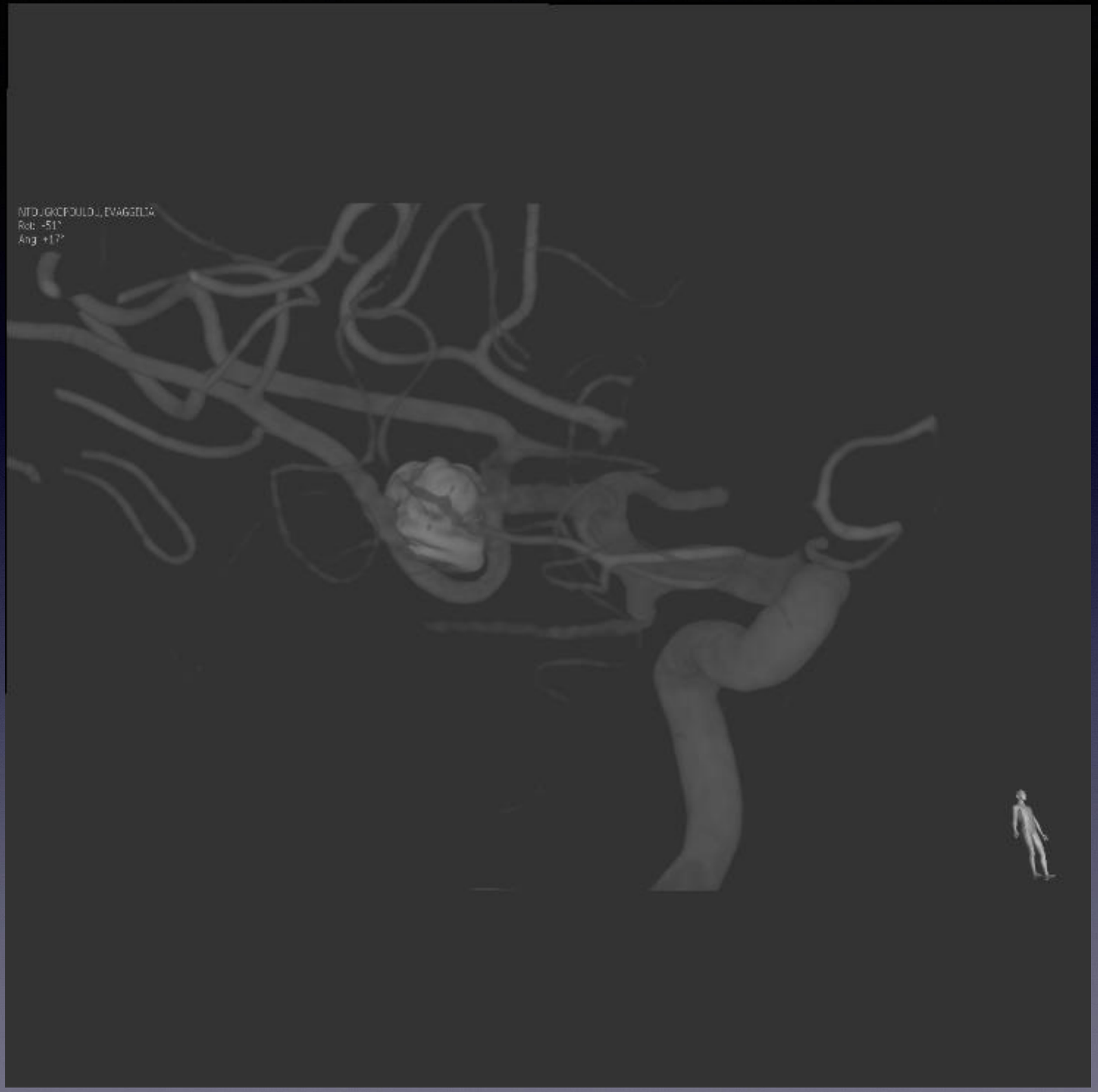




56 year old female patient with new onset of headaches






NTD_GKCPOULOS_EVAGGELIA
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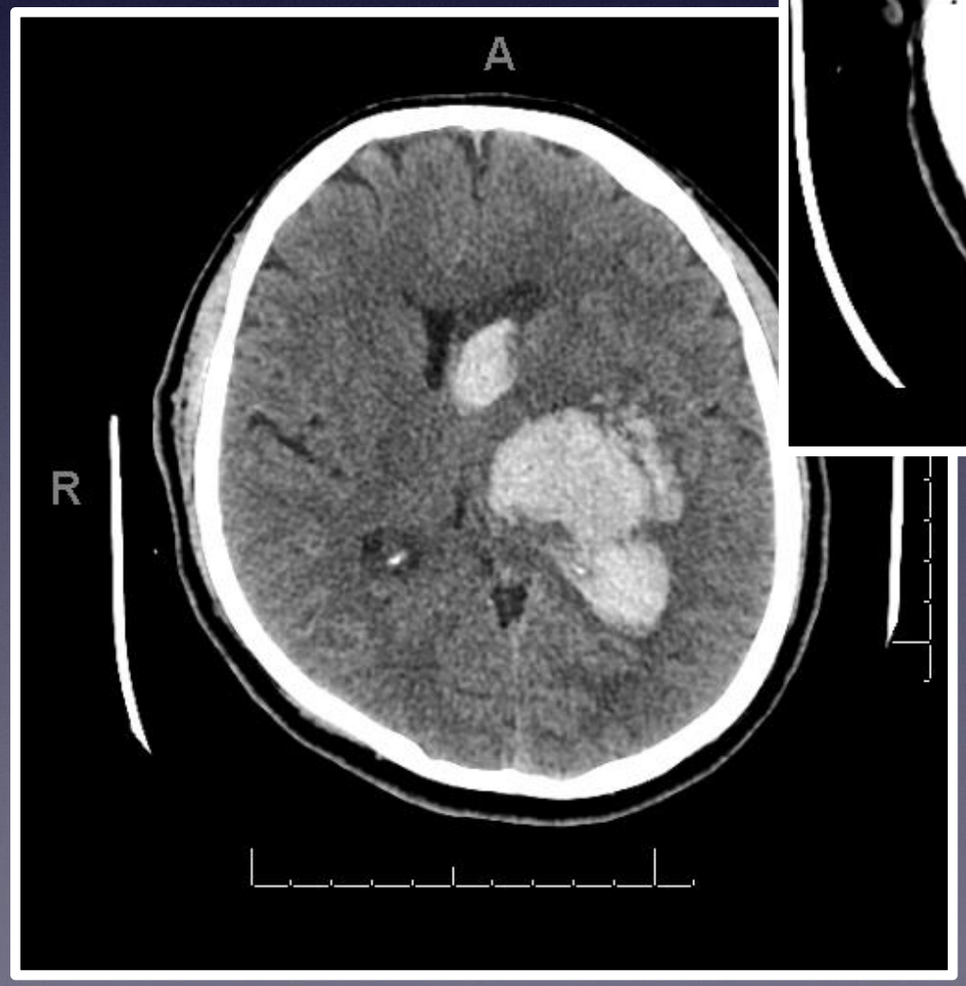
Ang: +17°

Hemorrhagic Stroke



70 yo man presenting with left hemiplegia and altered mental status

Striato-capsular Hemorrhage

- Etiology: HTN
- 40% ICH, 10-15% of all strokes
- Location: BG, thalamus, pons and cerebellar nuclei
- CTA has prognostic value
- Dot sign -> active hemorrhage, enlarging hematoma (25-40% of pts)
- *Lipohyalinosis* and *fibrinoid necrosis* => *Charcot-Bouchard* aneurysms

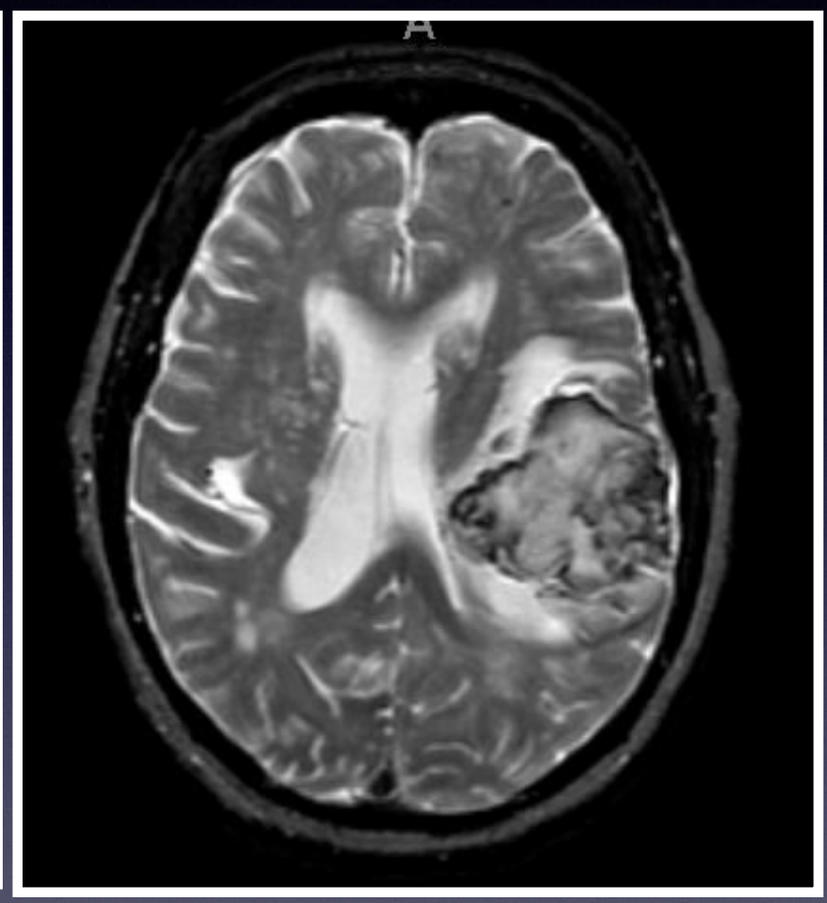
Differential Diagnosis

- Underlying vascular lesion:
  - Vascular malfomation
  - Neoplasm (hypervascular)

- Vasculopathy:
  - HTN, Amyloid, Moyamoya, Cocaine

Differential Diagnosis

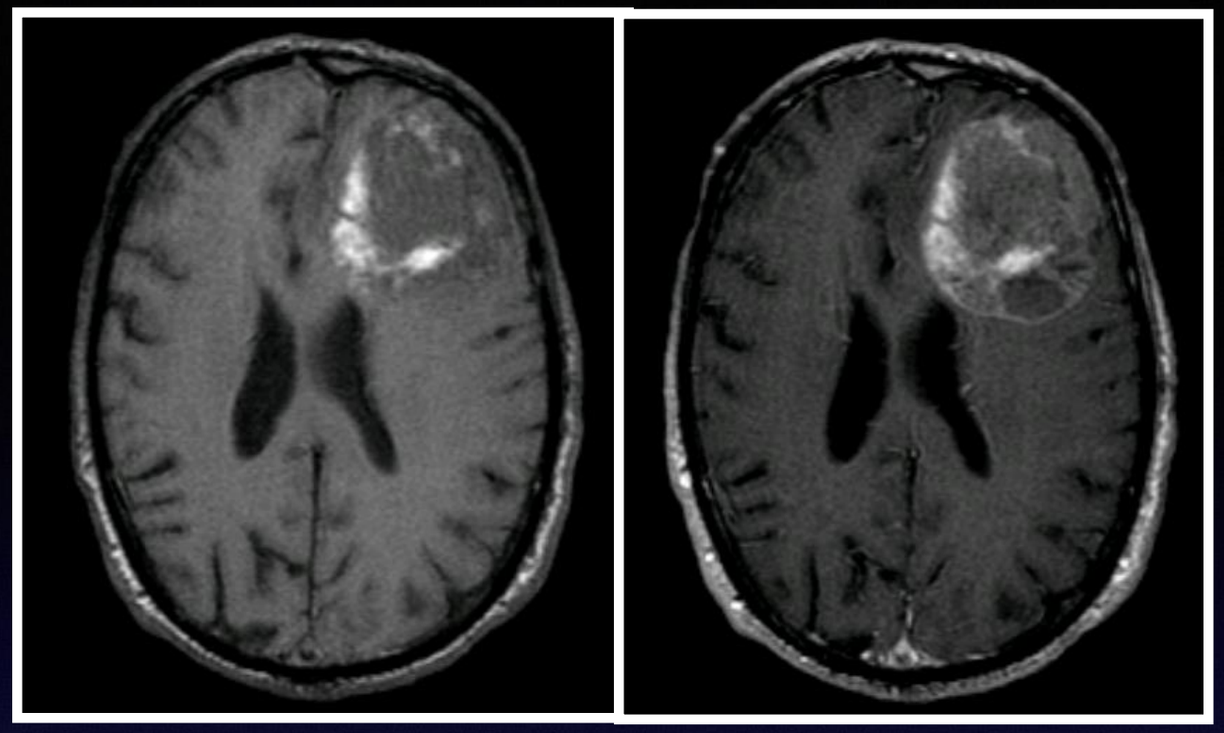
Ruptured AVM



Amyloid angiopathy

Moyamoya disease

LOBAR HEMORRHAGE

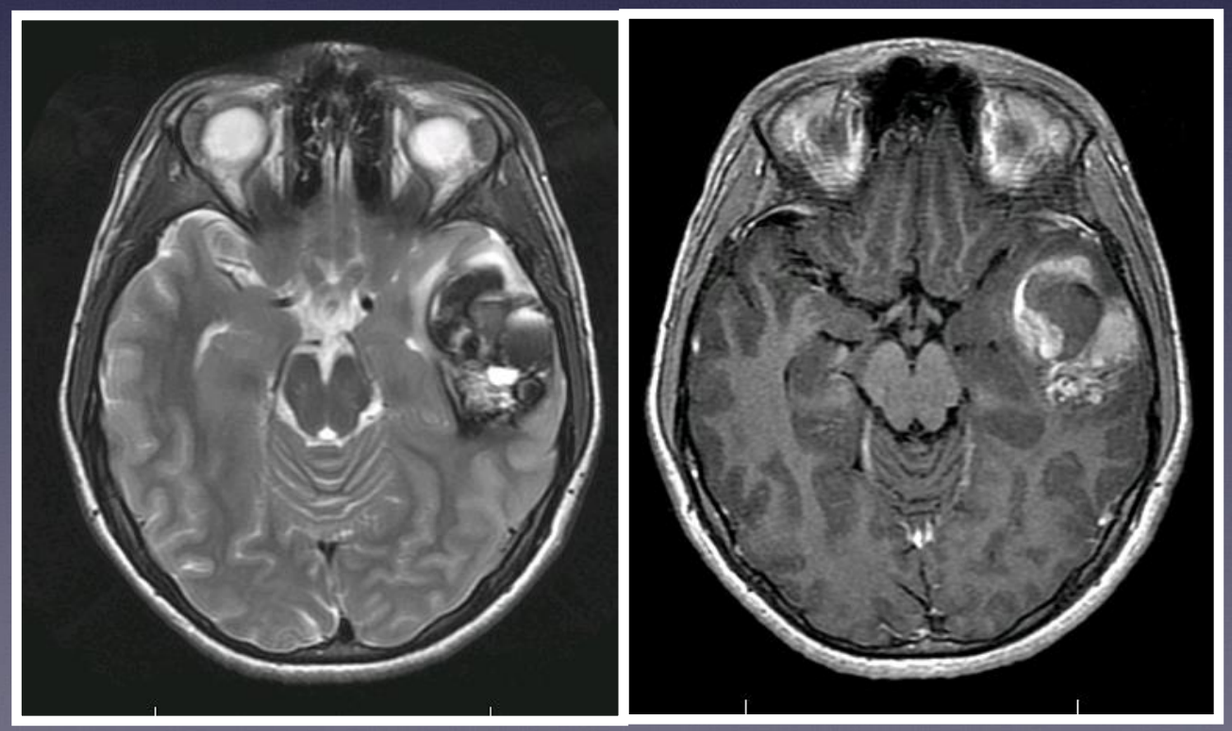


Frontal hemorrhagic metastasis – lung ca

LOBAR HEMORRHAGE

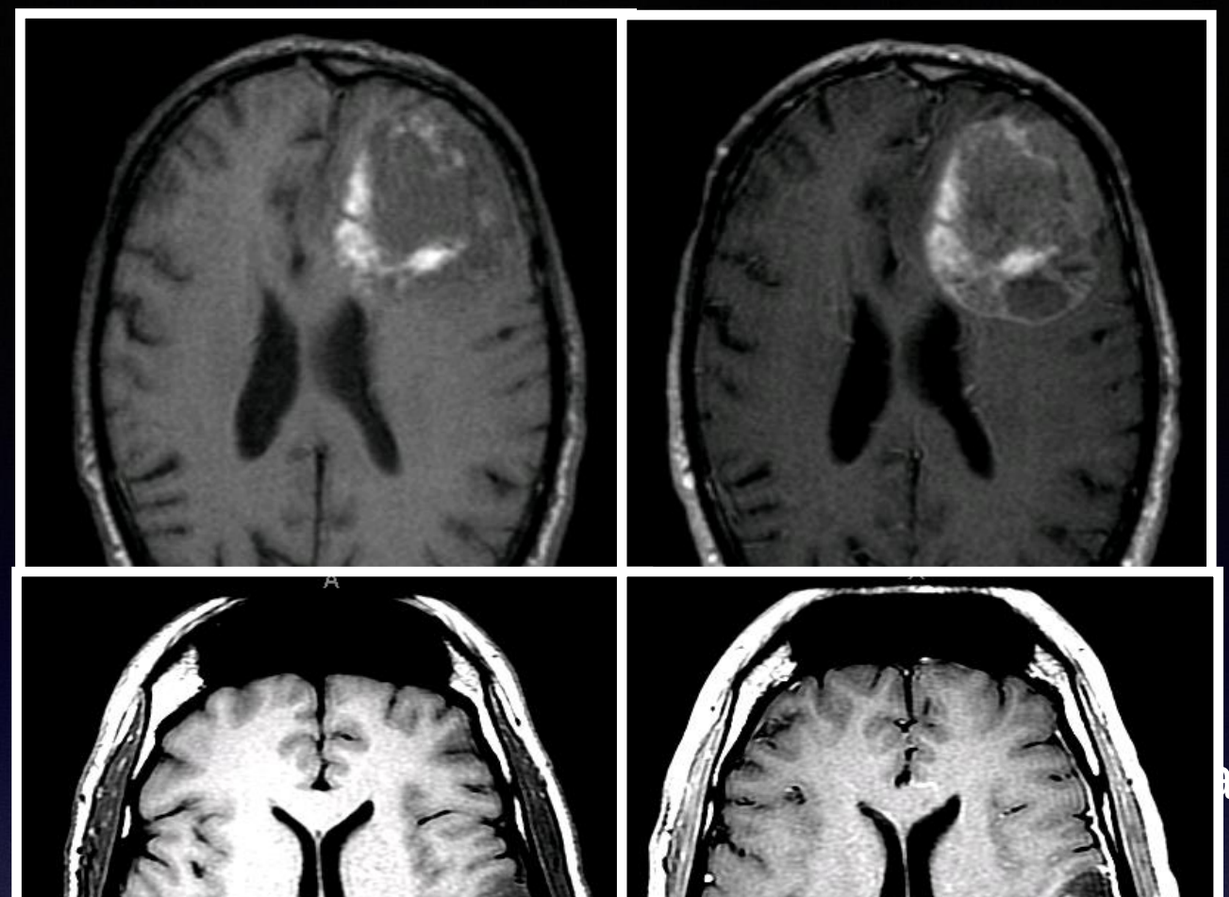
Frontal hemorrhagic mass – GBM

LOBAR HEMORRHAGE



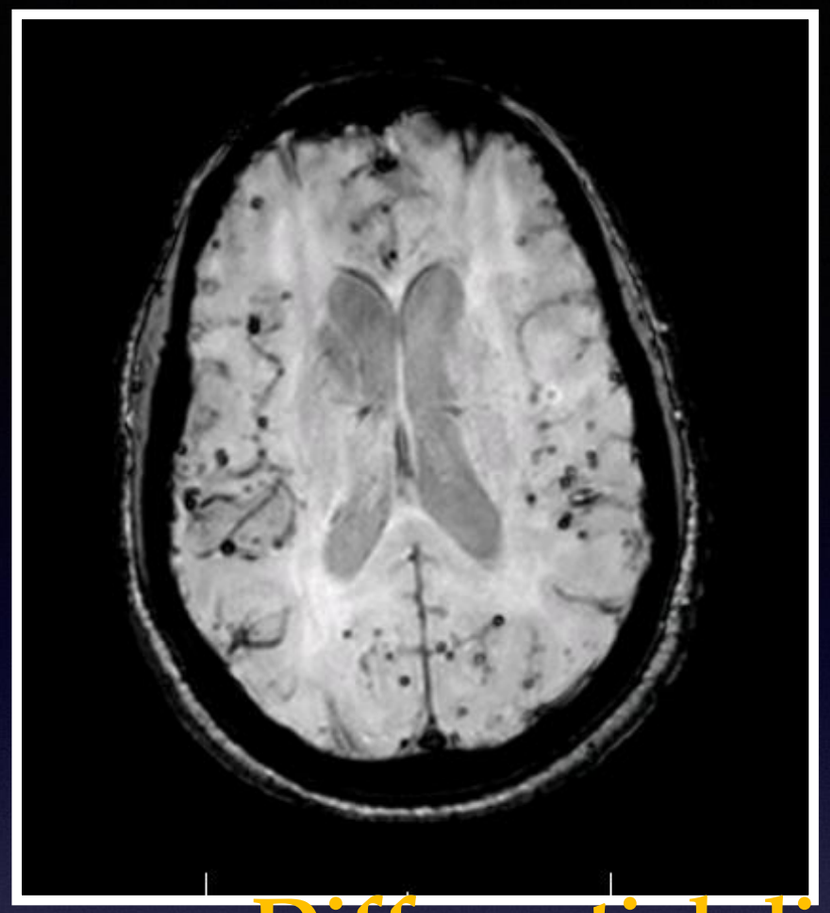
Temporal hemorrhagic mass – Cavernous mal.

LOBAR HEMORRHAGE



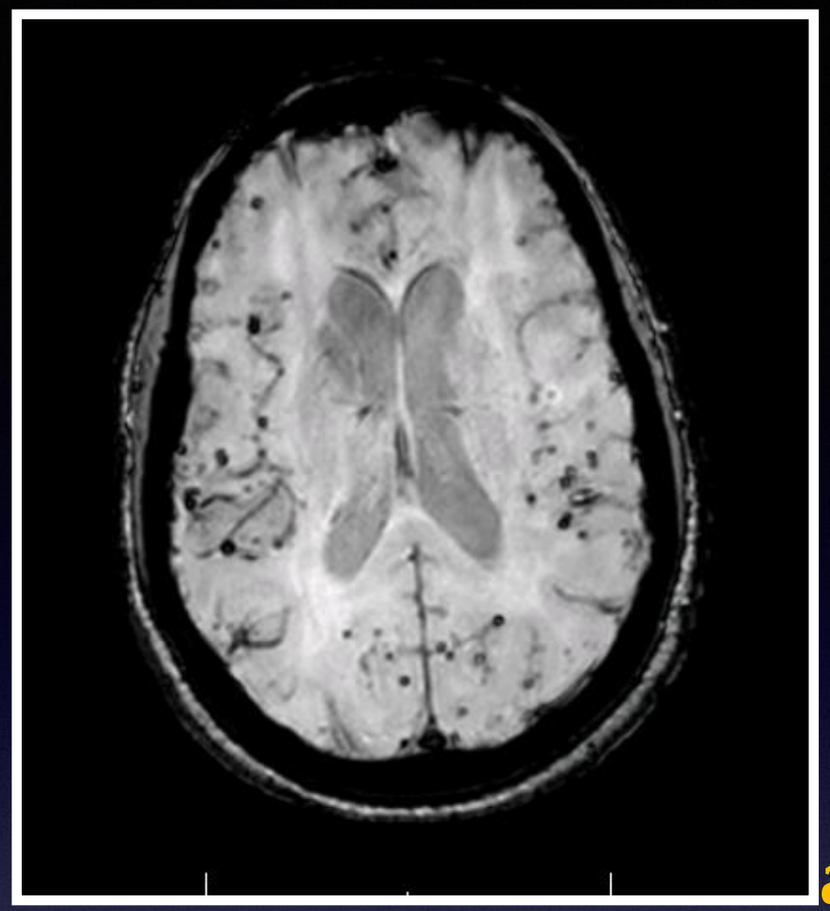
Temporal hemorrhagic mass – Cavernous mal.

Microbleeds



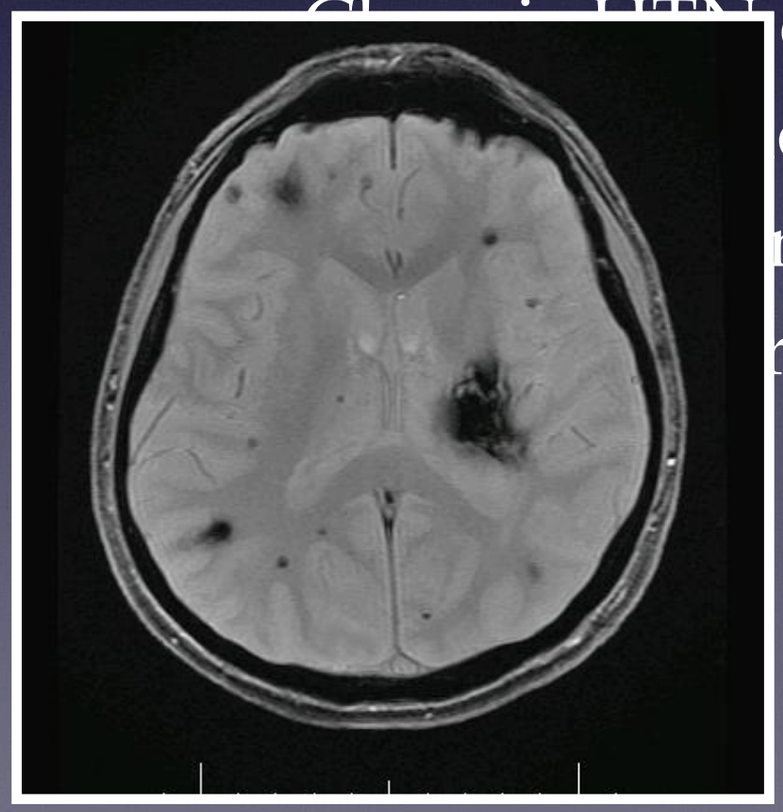
- **Differential diagnosis:**
  - Chronic HTN encephalopathy
  - Cerebral amyloid angiopathy
  - Hemorrhagic metastasis

Microbleeds



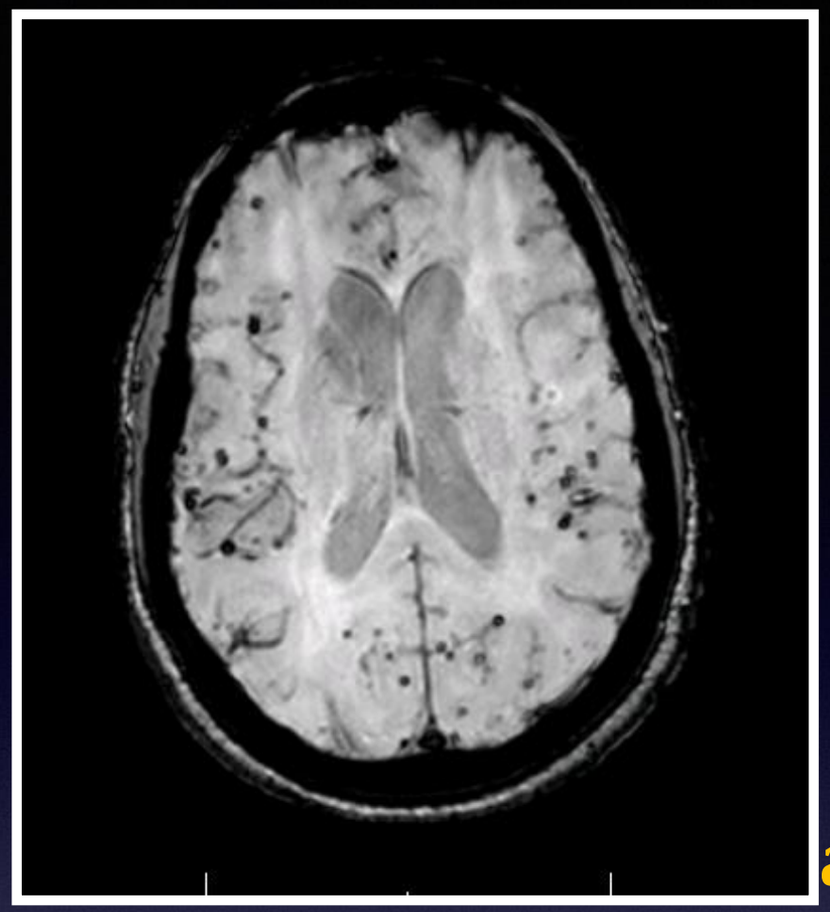
agnosis:

- Chronic HTN encephalopathy
- oid angiopathy
- metastasis
- rnous malformations



Familial cav. mal.

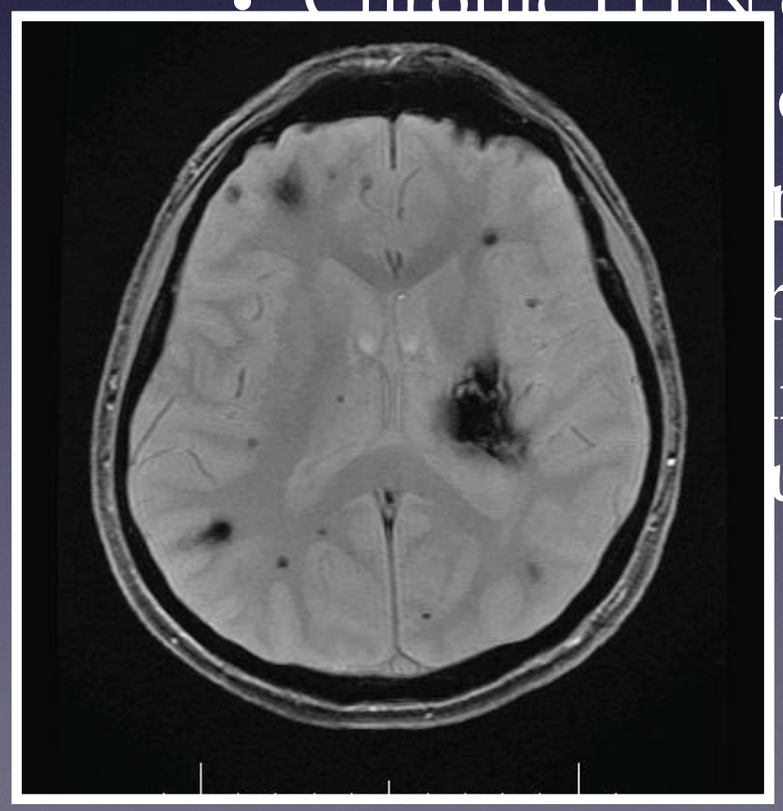
Microbleeds



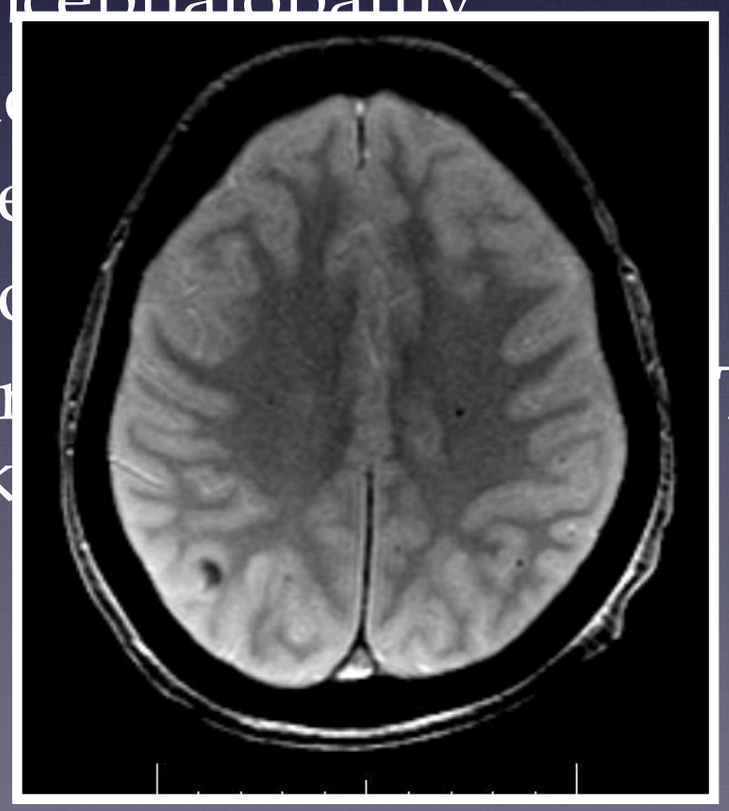
agnosis:

- Chronic HTN encephalopathy
- oi
- me
- rn
- lic
- uk

TTP/HUS,

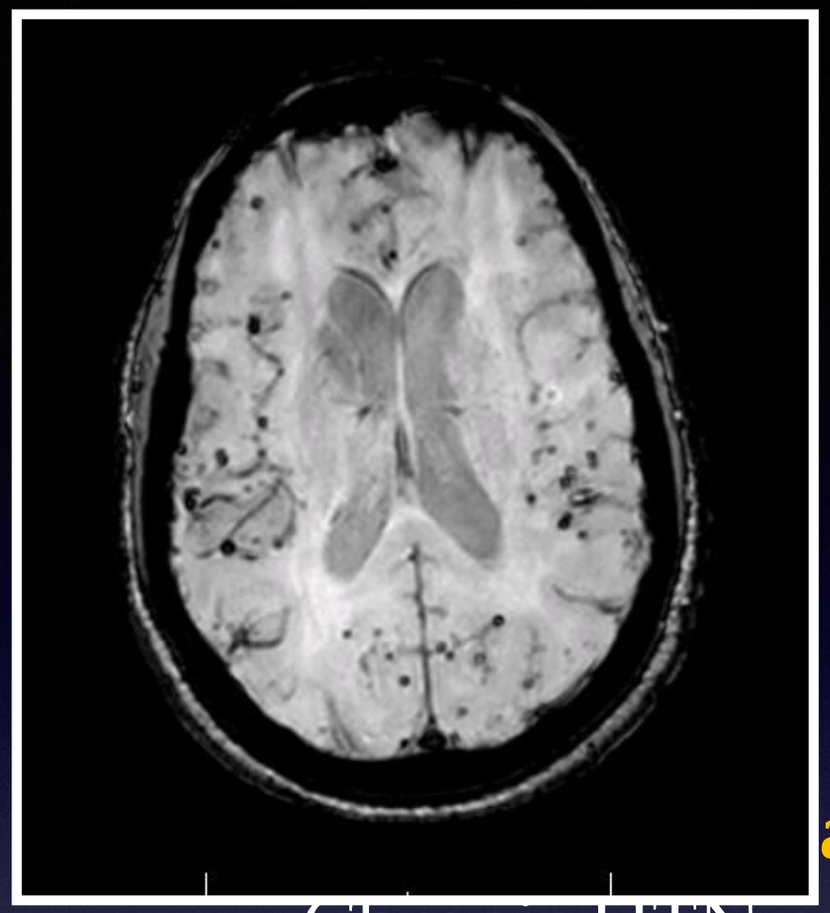


Familial cav. mal.



E.Coli sepsis

Microbleeds

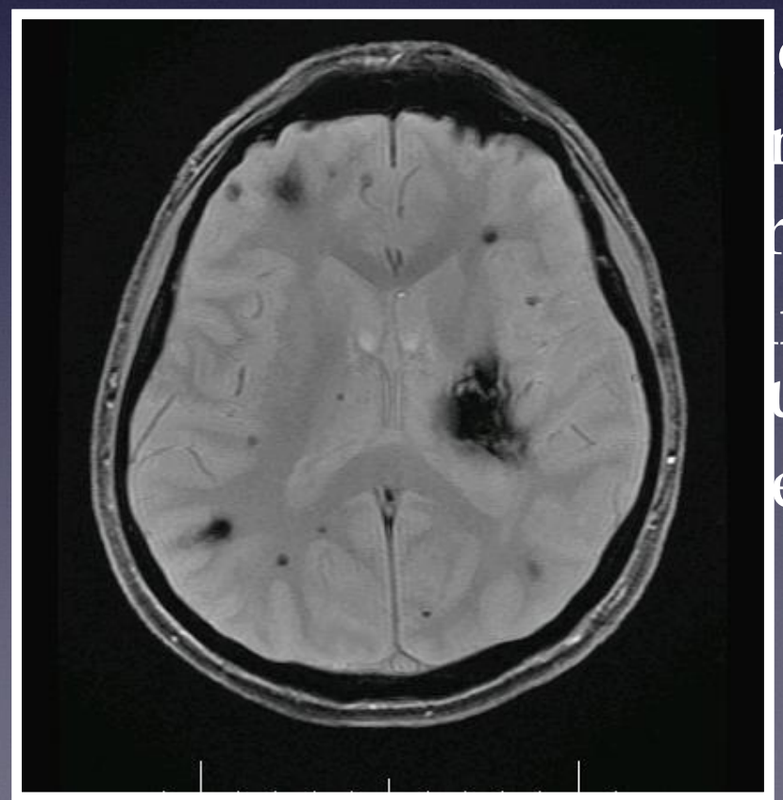


agnosis:

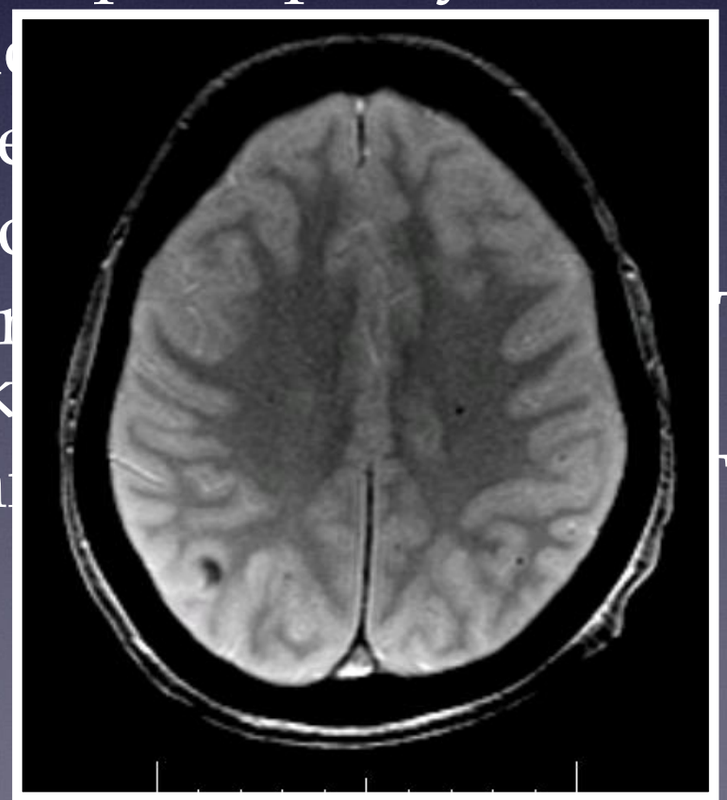
- Chronic HTN encephalopathy
- oi
- me
- rn
- ici
- uk
- ea

TT

S)



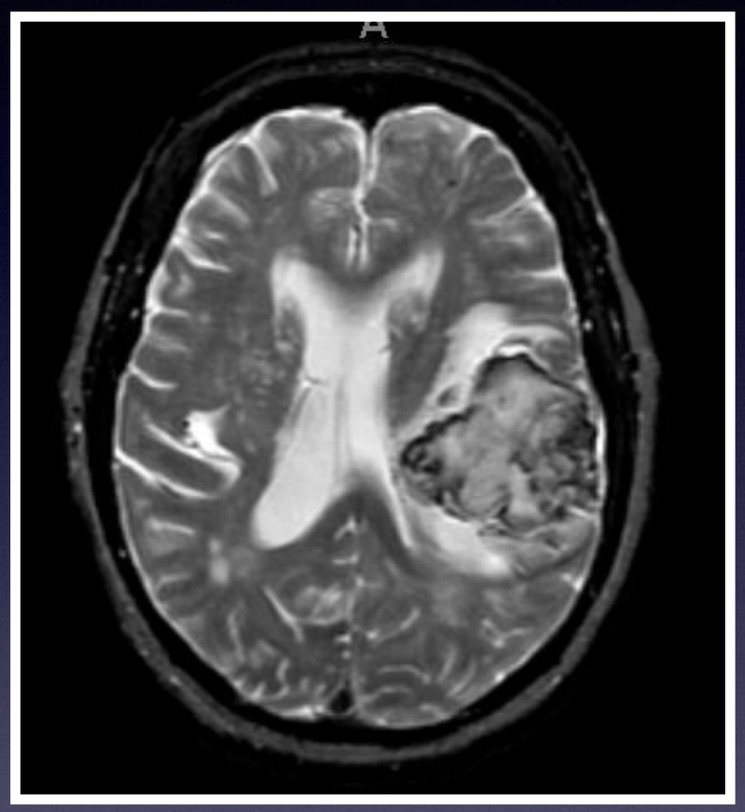
Familial cav. mal.

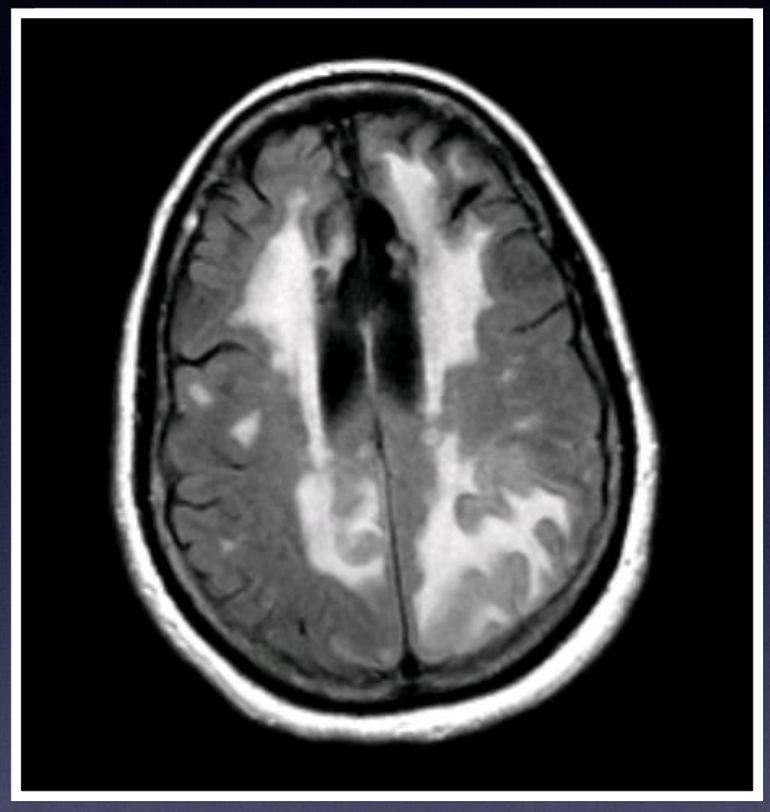


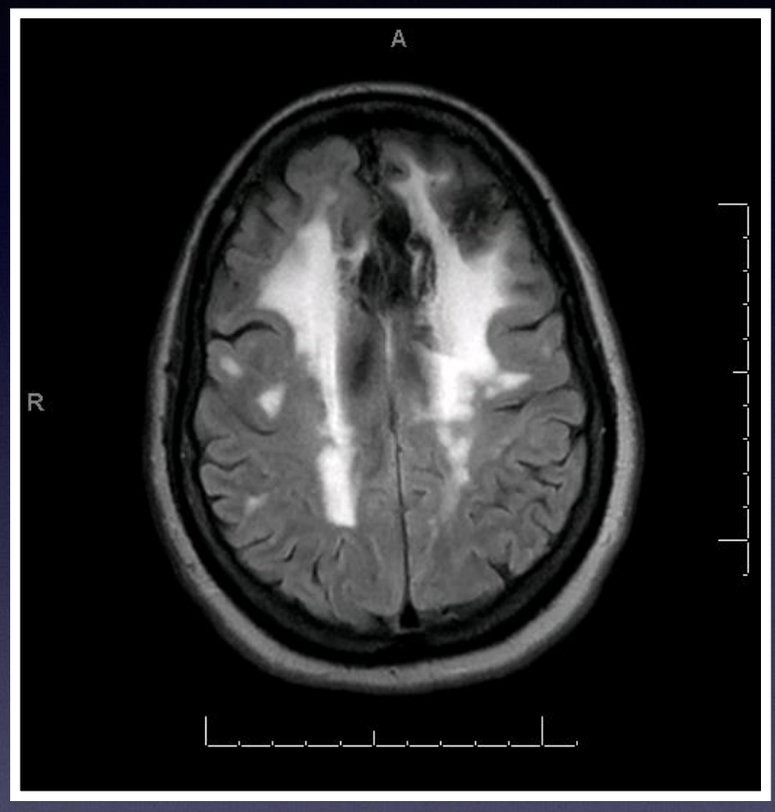
E.Coli sepsis

Ataxia-telangiectasia syndrome

Amyloid angiopathy







Cerebral amyloid disease

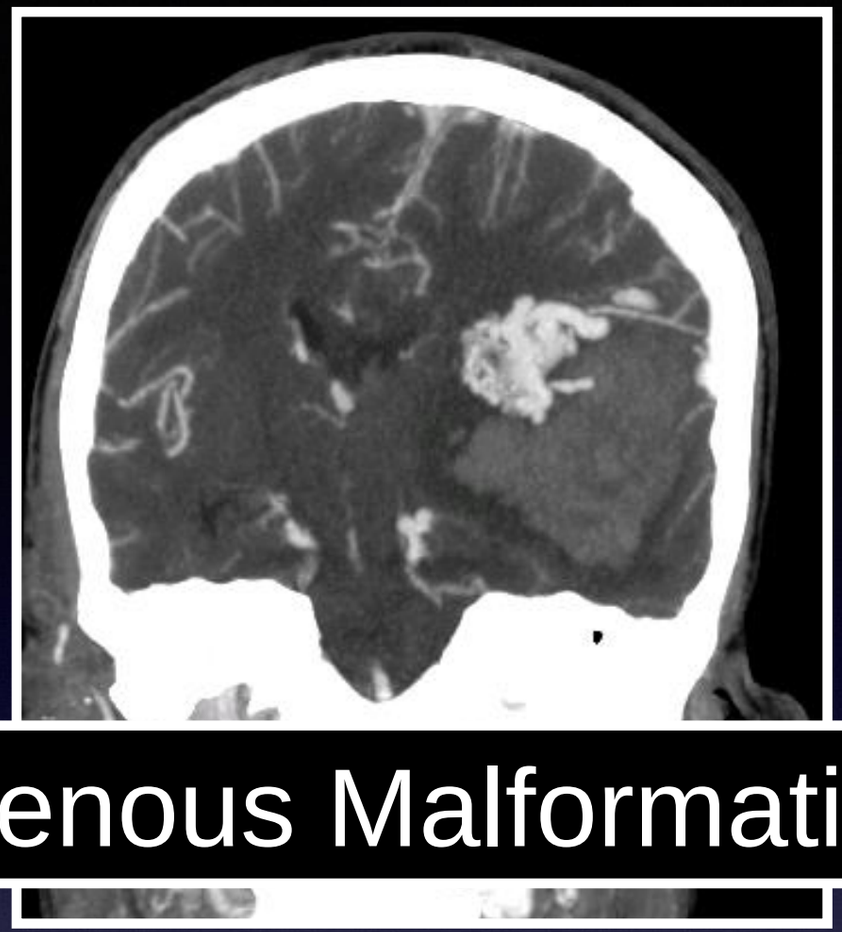
- Arterial wall deposition Aβ fibrils
  - Major lobar hemorrhages
  - Cortical petechial hemorrhages
- Small cerebral infarcts, microbleeds
  - White matter ischemic lesions

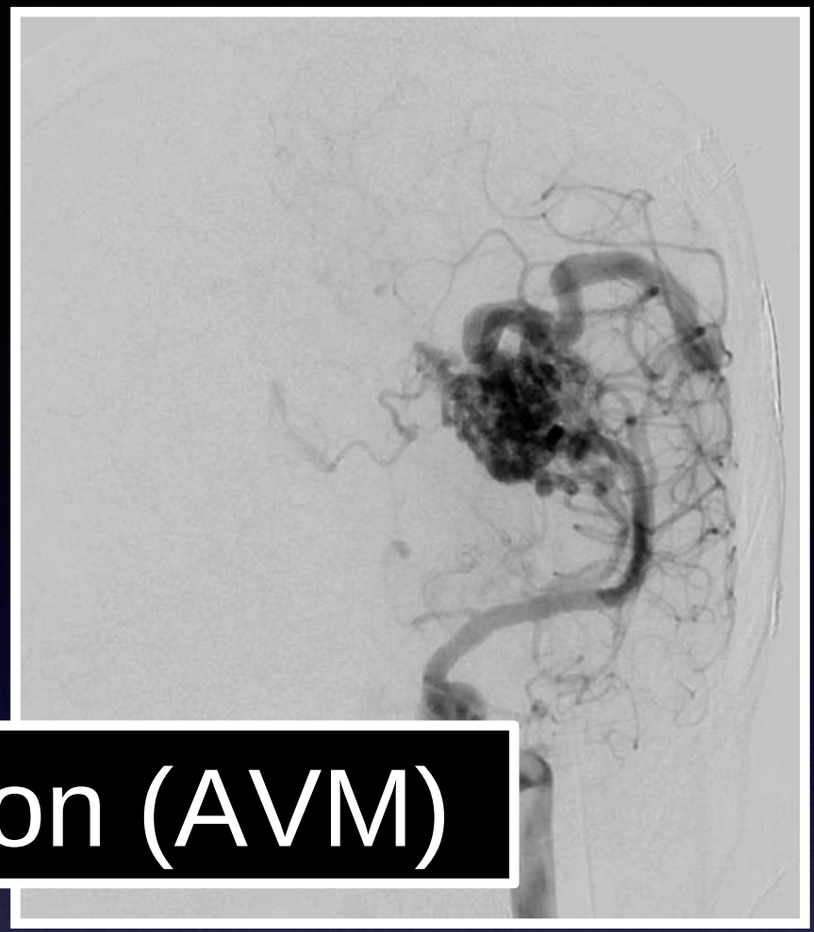
Amyloid β-related angiitis (ABRA)

- White matter lesions predominate
  - Inflammatory component
  - Responds to steroids

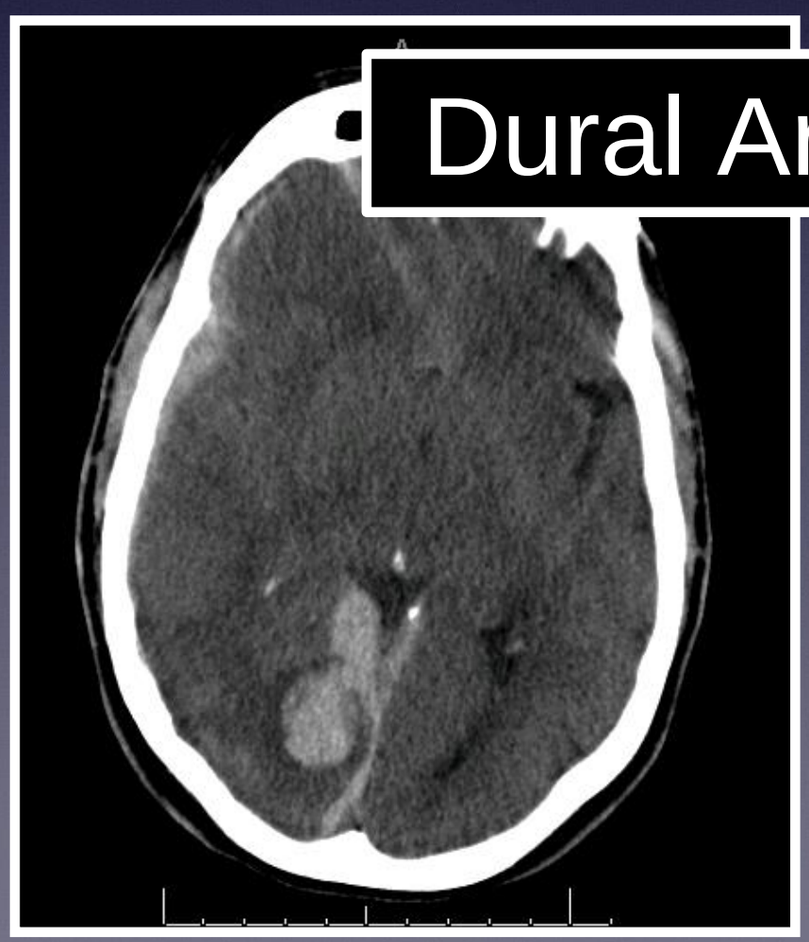
Cerebrovascular malformations

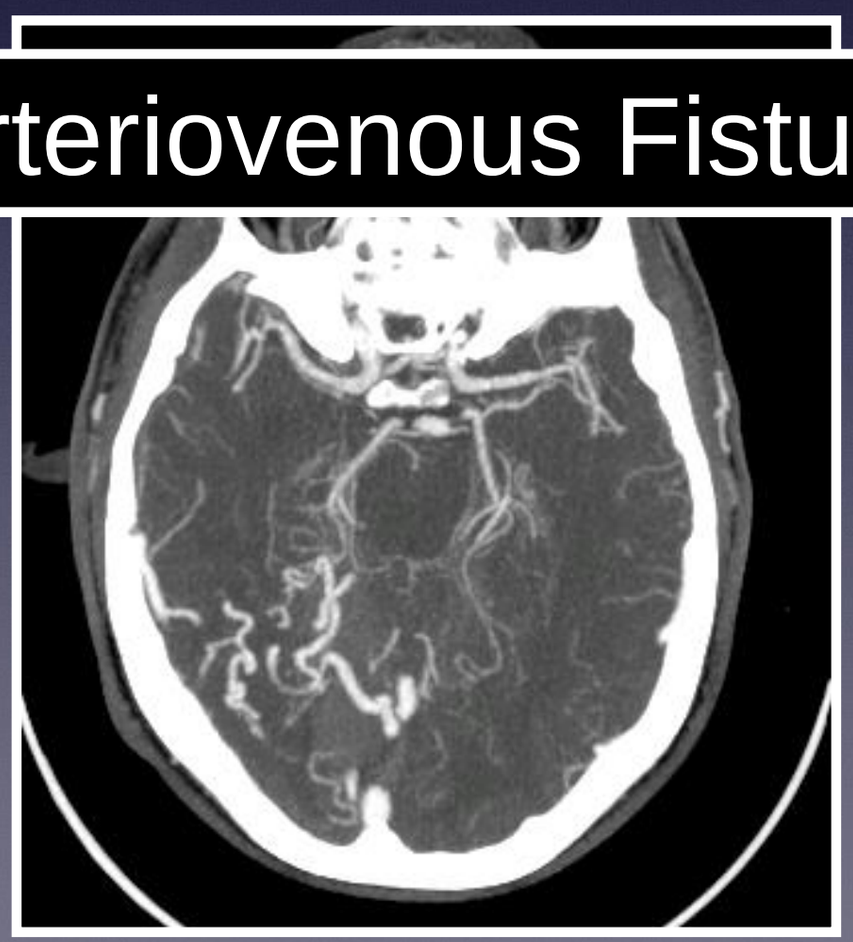
- With AV Shunts
  - AVM
  - Dural AV fistula
  - Vein of Galen malformation
- Without AV shunt
  - Cavernous malformations
  - Developmental venous anomaly
  - Sinus pericranii
  - Capillary teleangiectasia

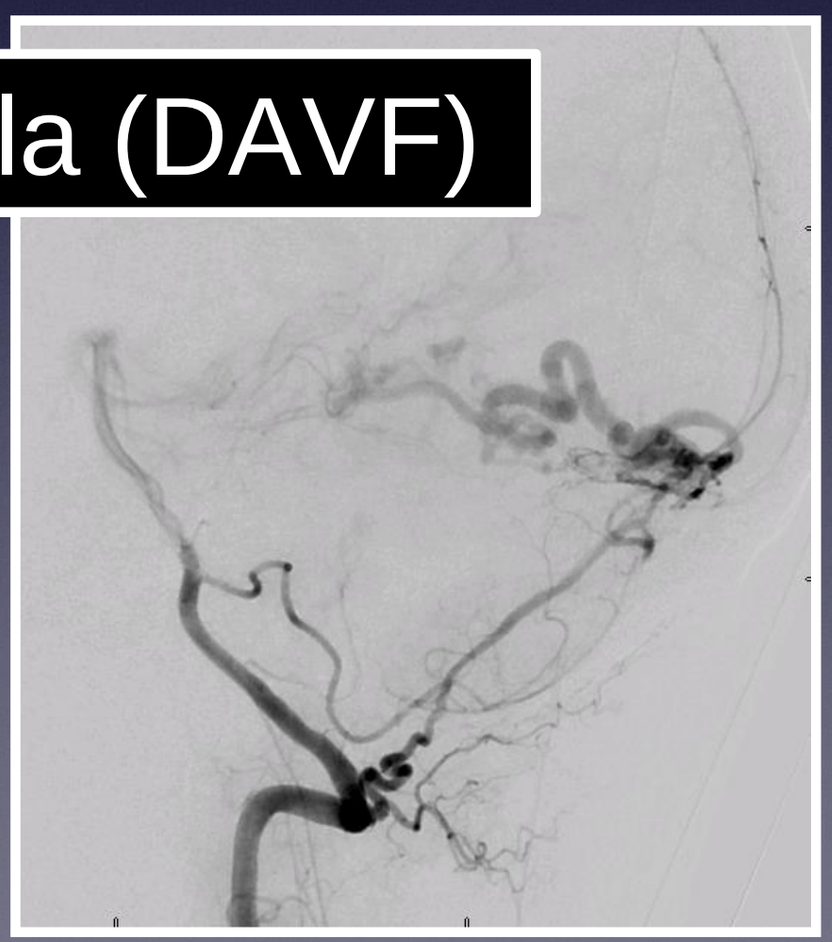




Arteriovenous Malformation (AVM)

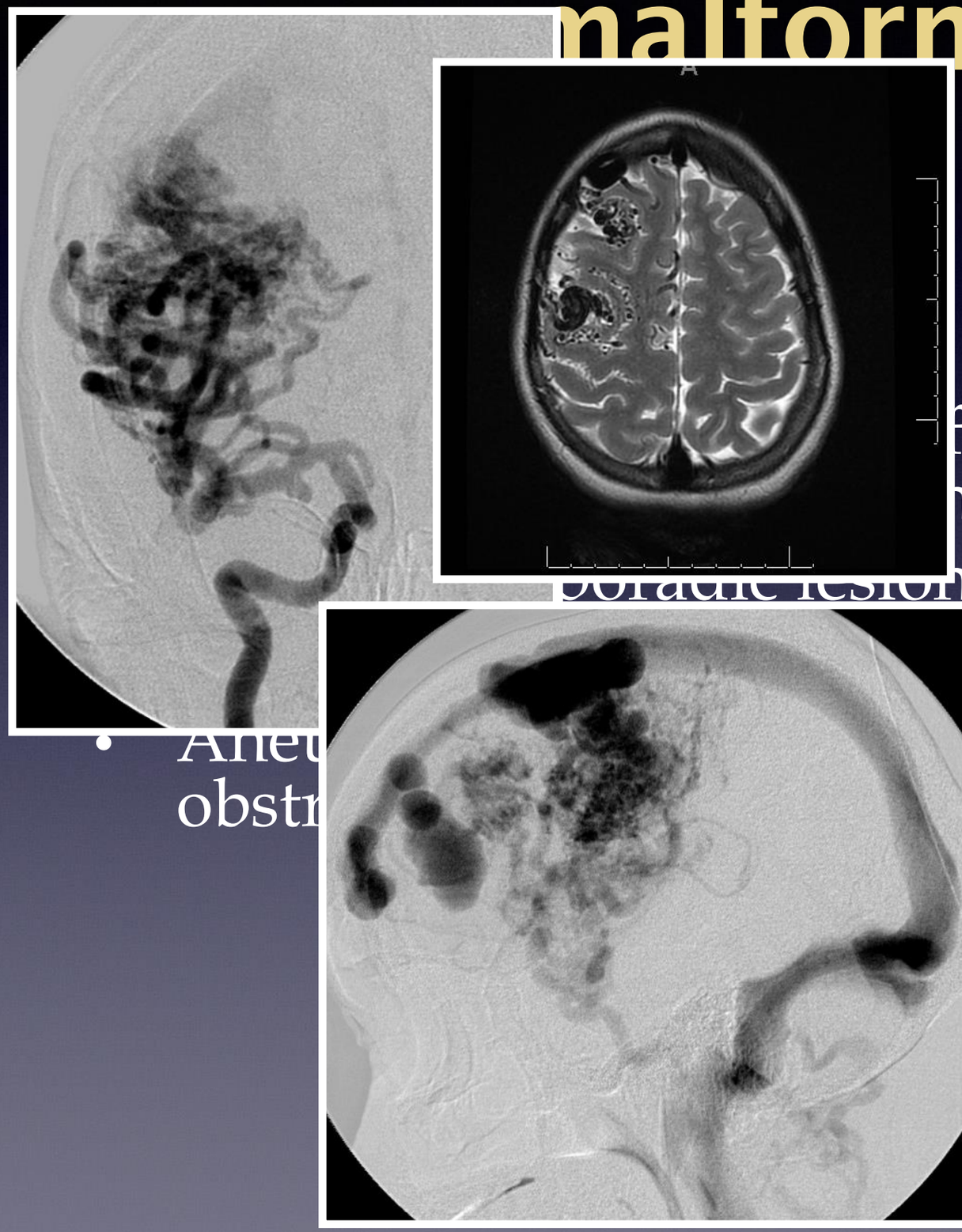






Dural Arteriovenous Fistula (DAVF)

Arterio-venous malformations



- f thin-walled vessels with
  hunting
- oforadic lesions
- year
- Aneu venous outflow
  obstr for ICH

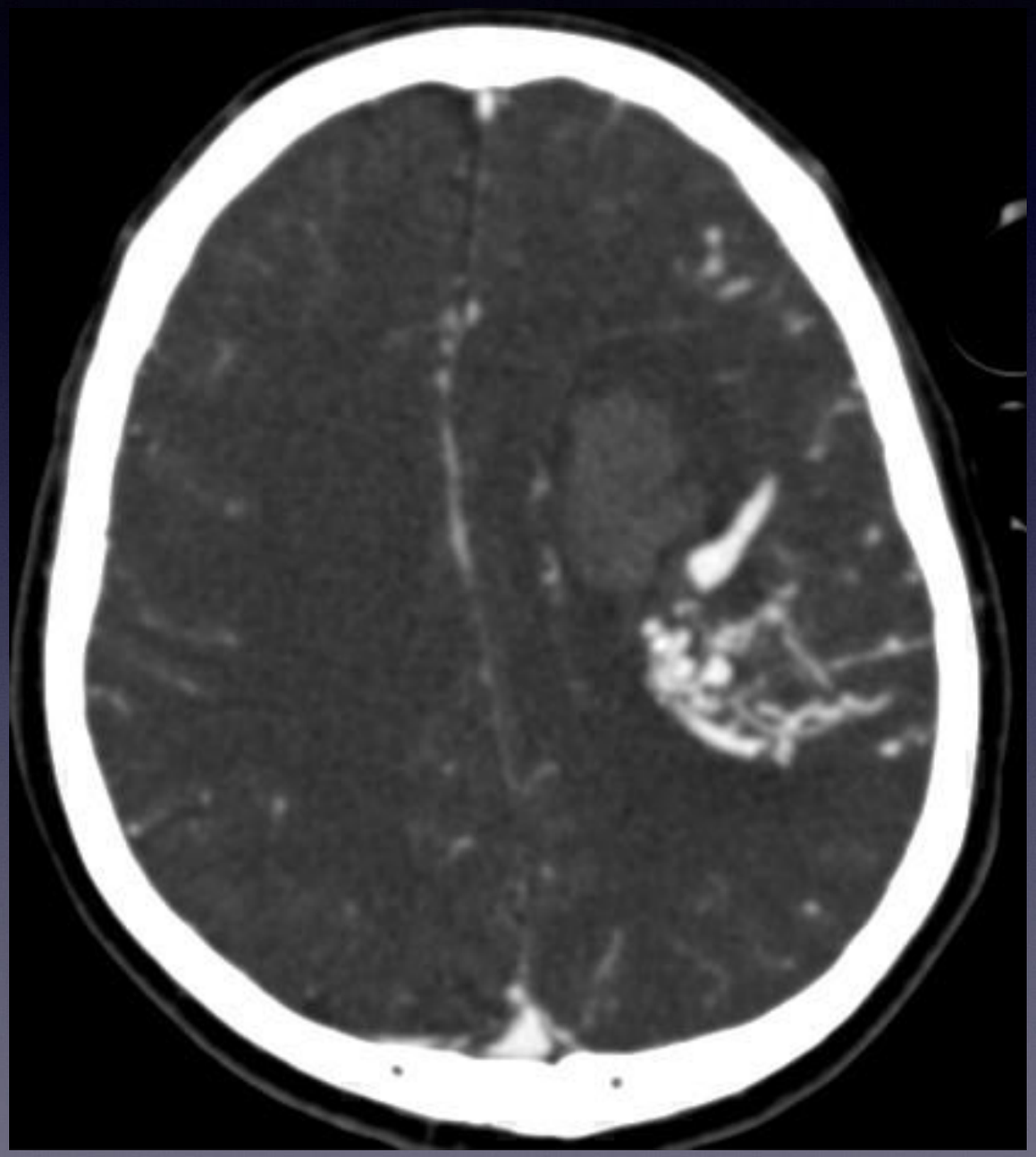
AVM-Hemorrhage Location

- 30% SAH
- 16% IVH
- Combined location 31%
- Parenchymal 23%

- Hartmann et al 1998

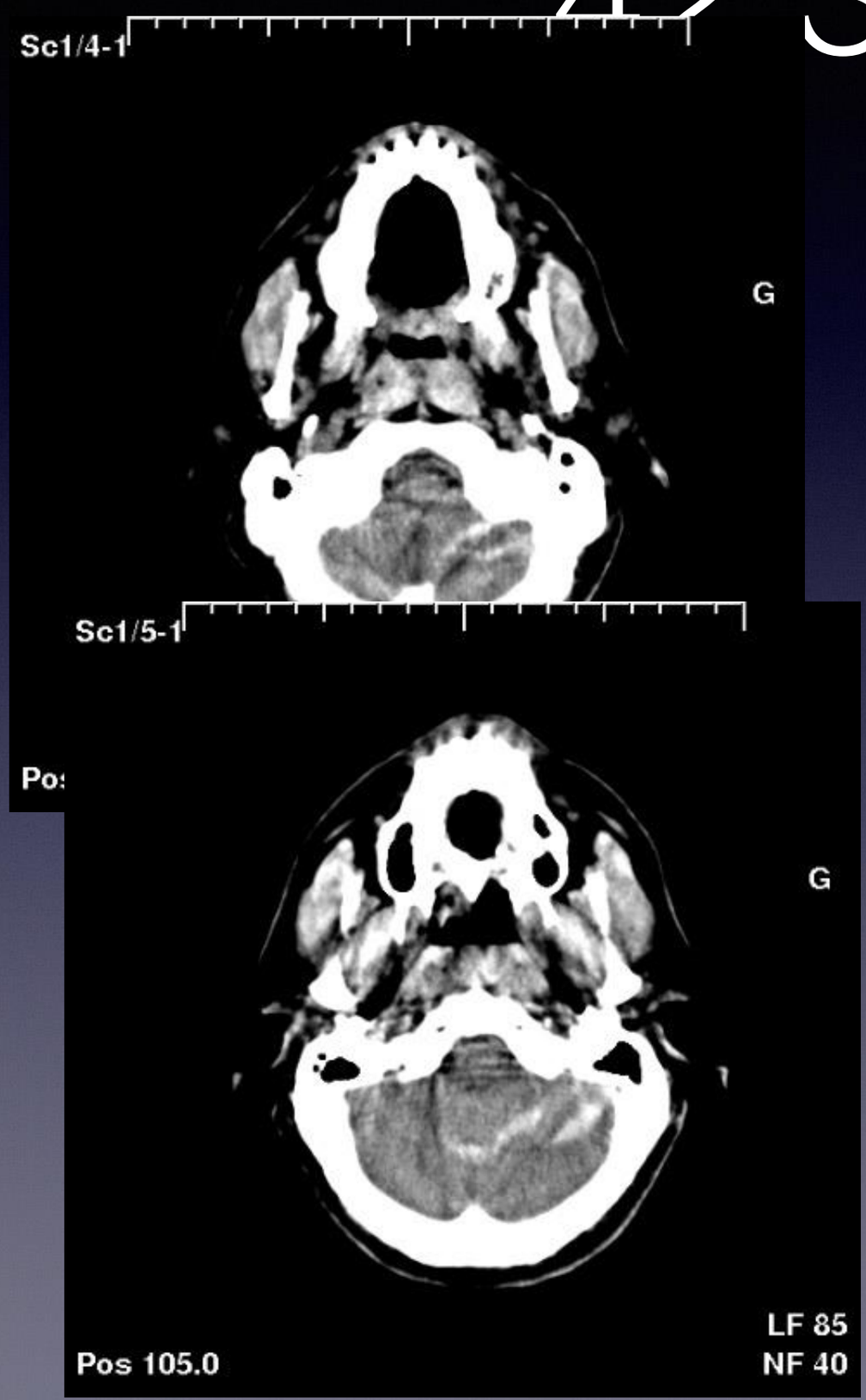
45 YEAR OLD WITH HEADACHE

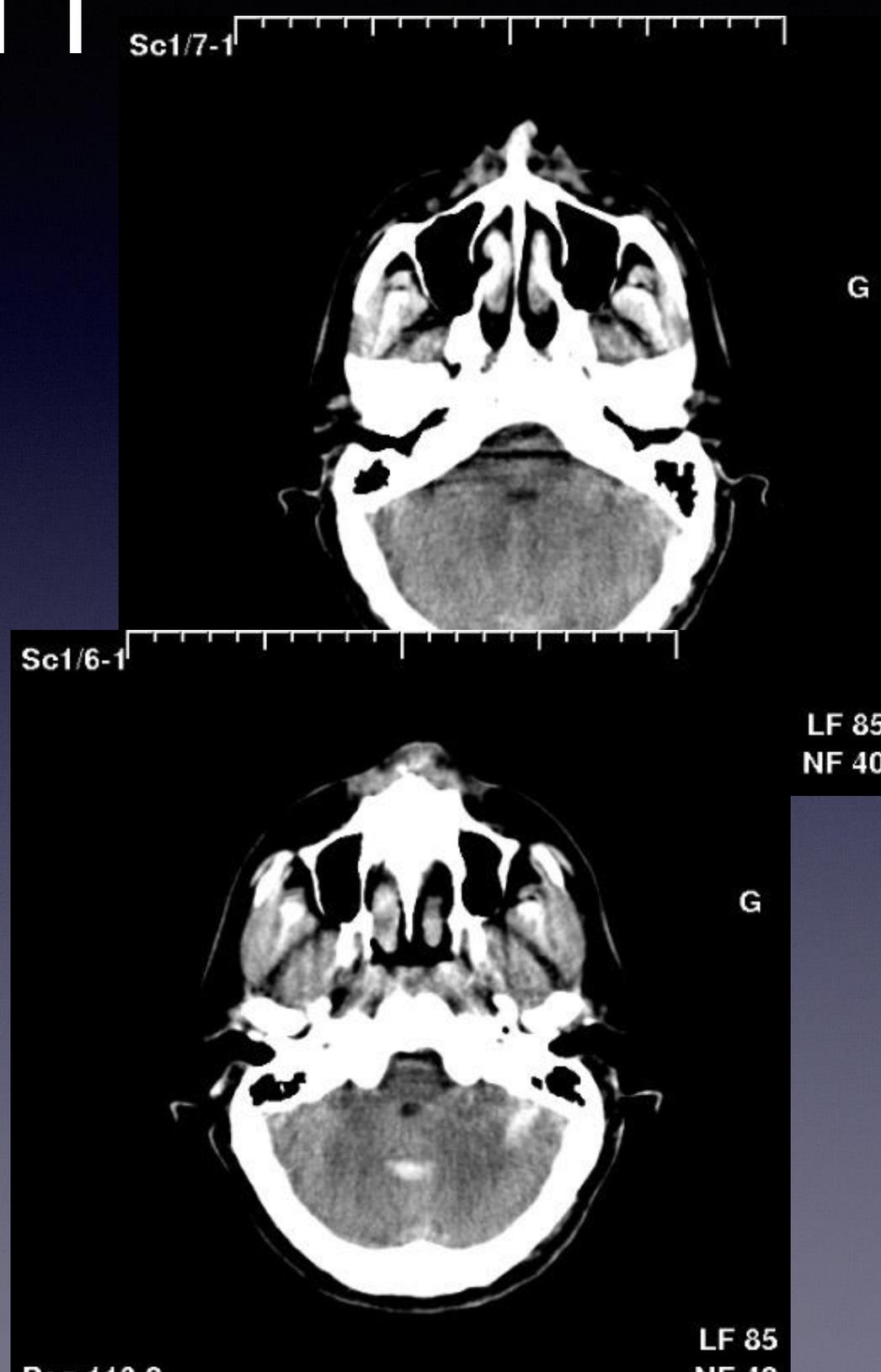
45 YEAR OLD WITH HEADACHE



AVM

42 SAH


Sc1/4-1
G
Sc1/5-1
Pos
G
LF 85
NF 40
Pos 105.0


Sc1/7-1
G
Sc1/6-1
LF 85
NF 40
G
LF 85


Rot.: -90
Inc.: 0
Côté tête
N° séq.: 0008
Date séq.: 2004/12/14
Heure séq.: 15:21:33
Taille portion: 62.54 mm

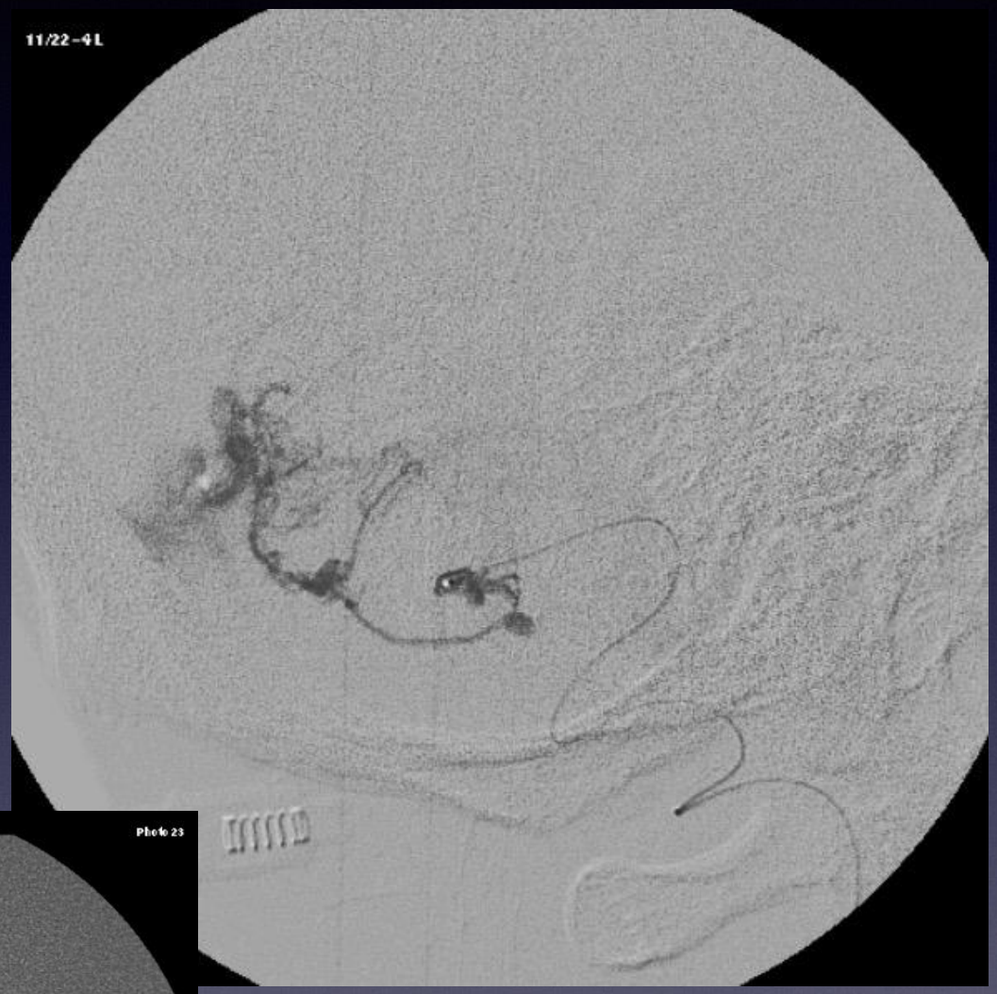
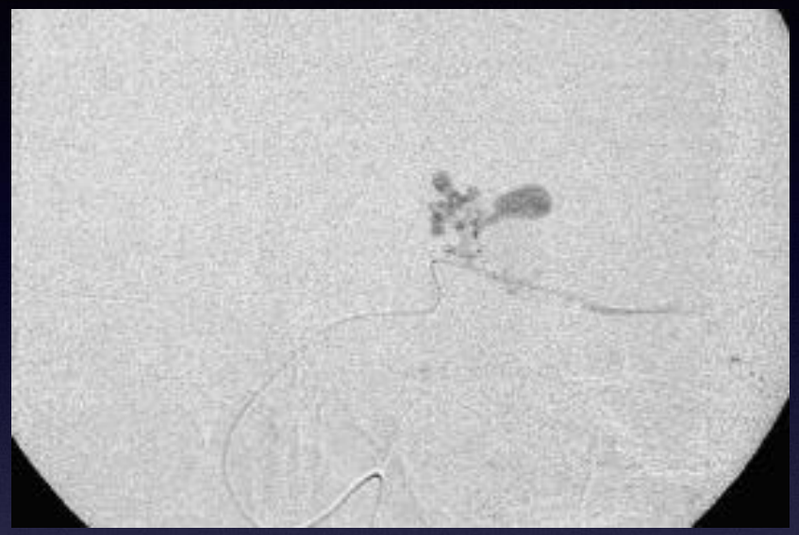

11/22-4L

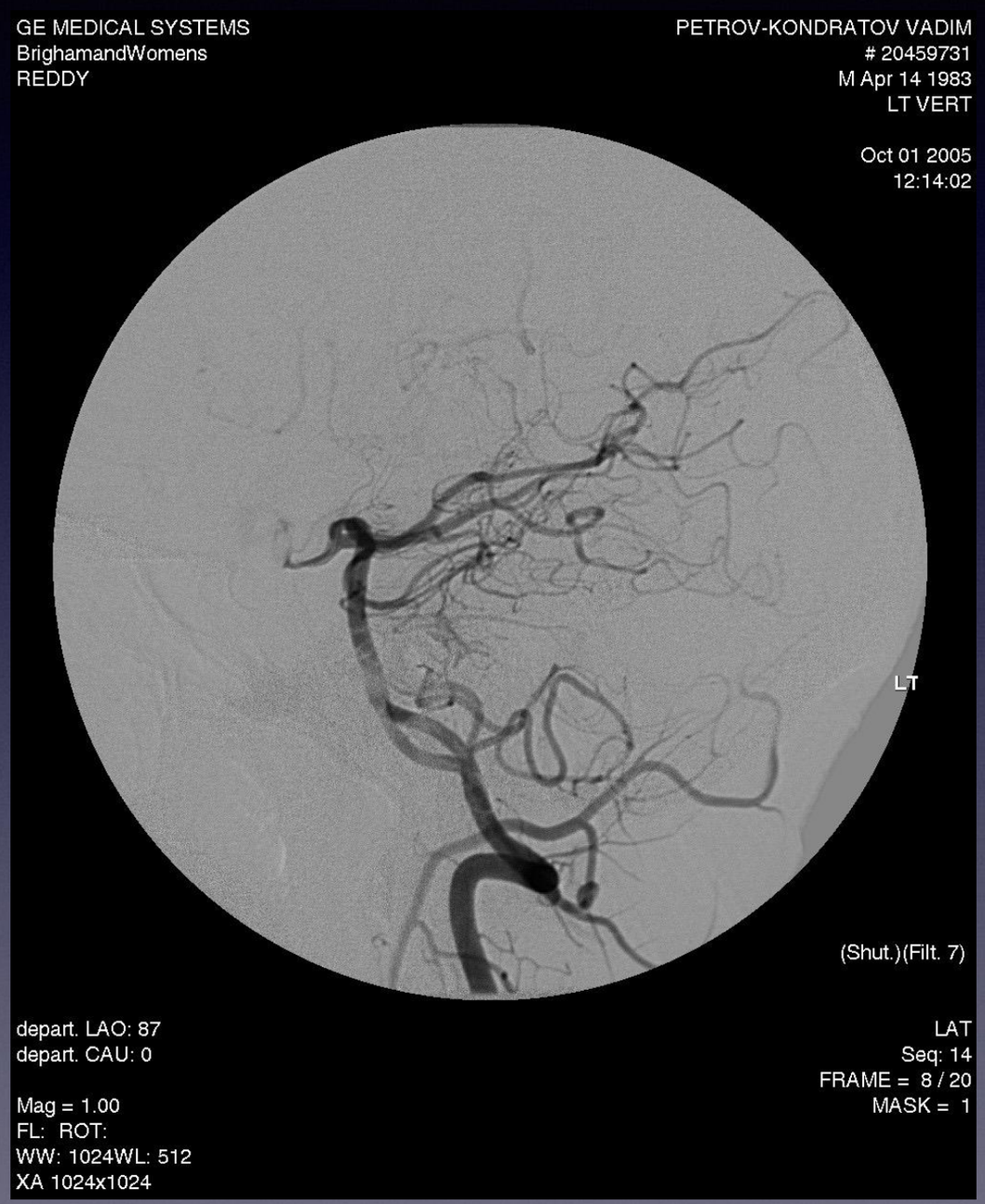

Photo 23

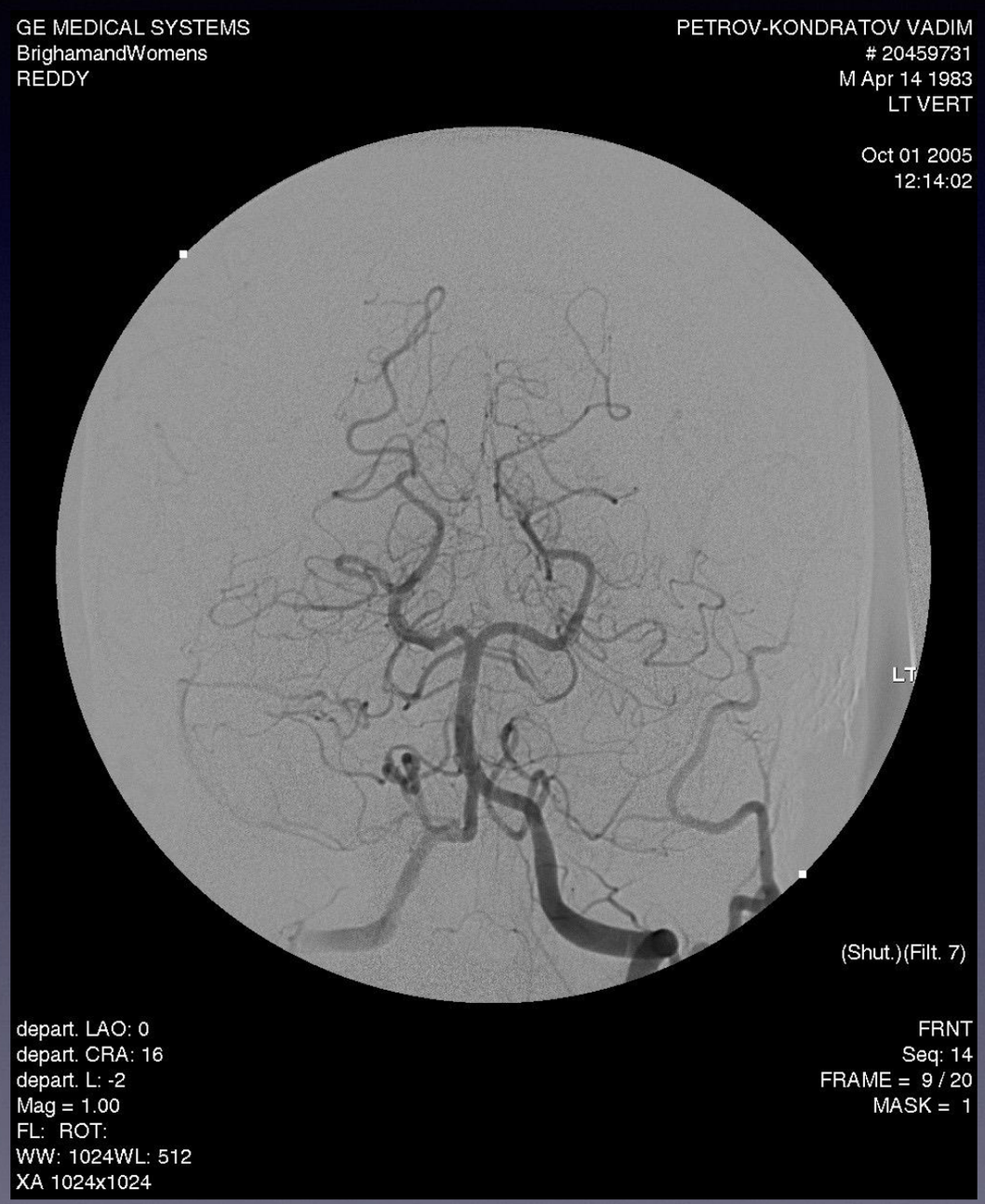
IVH, Small AVM

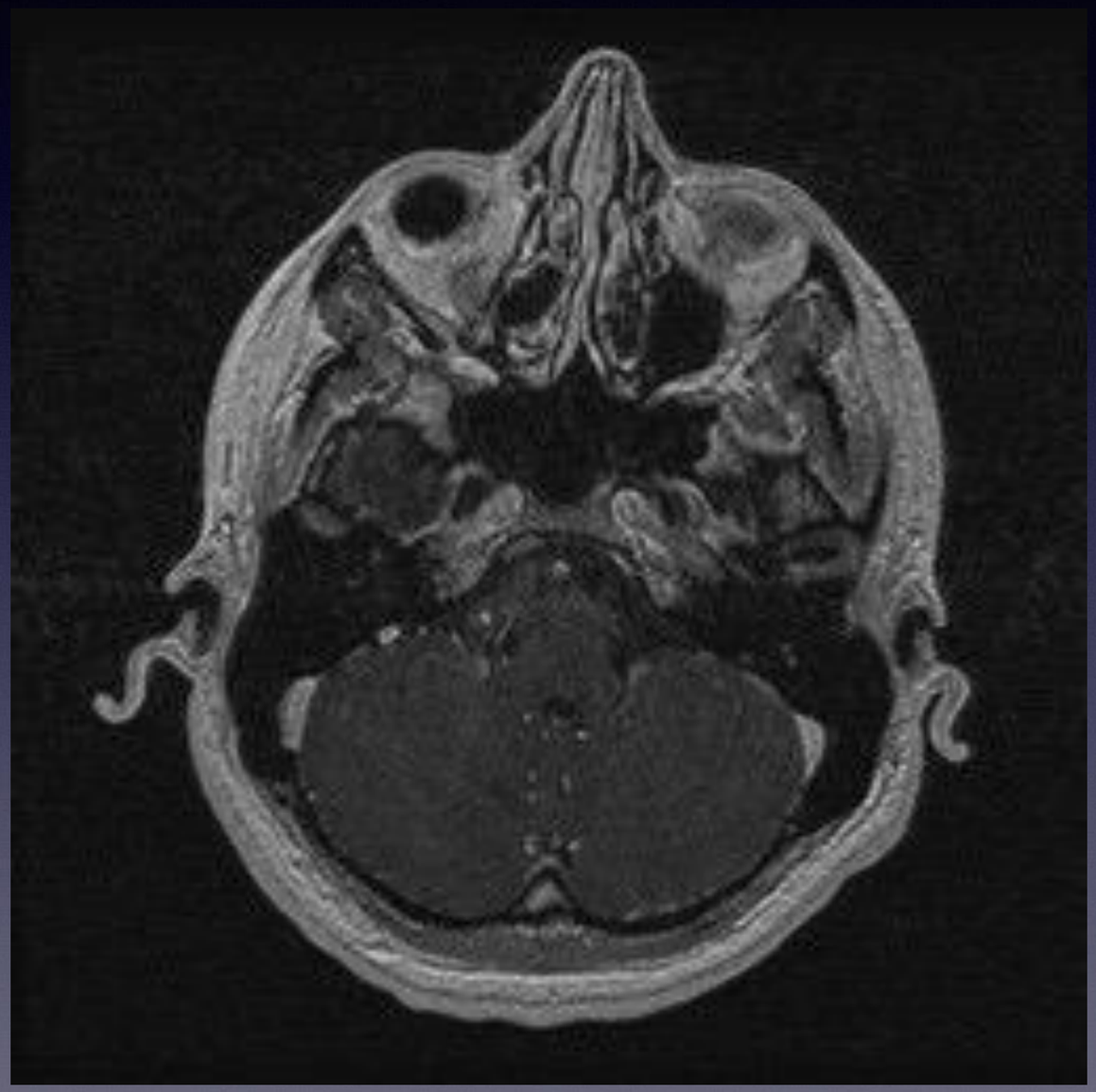


SAH HH Gr 3 22 yo male

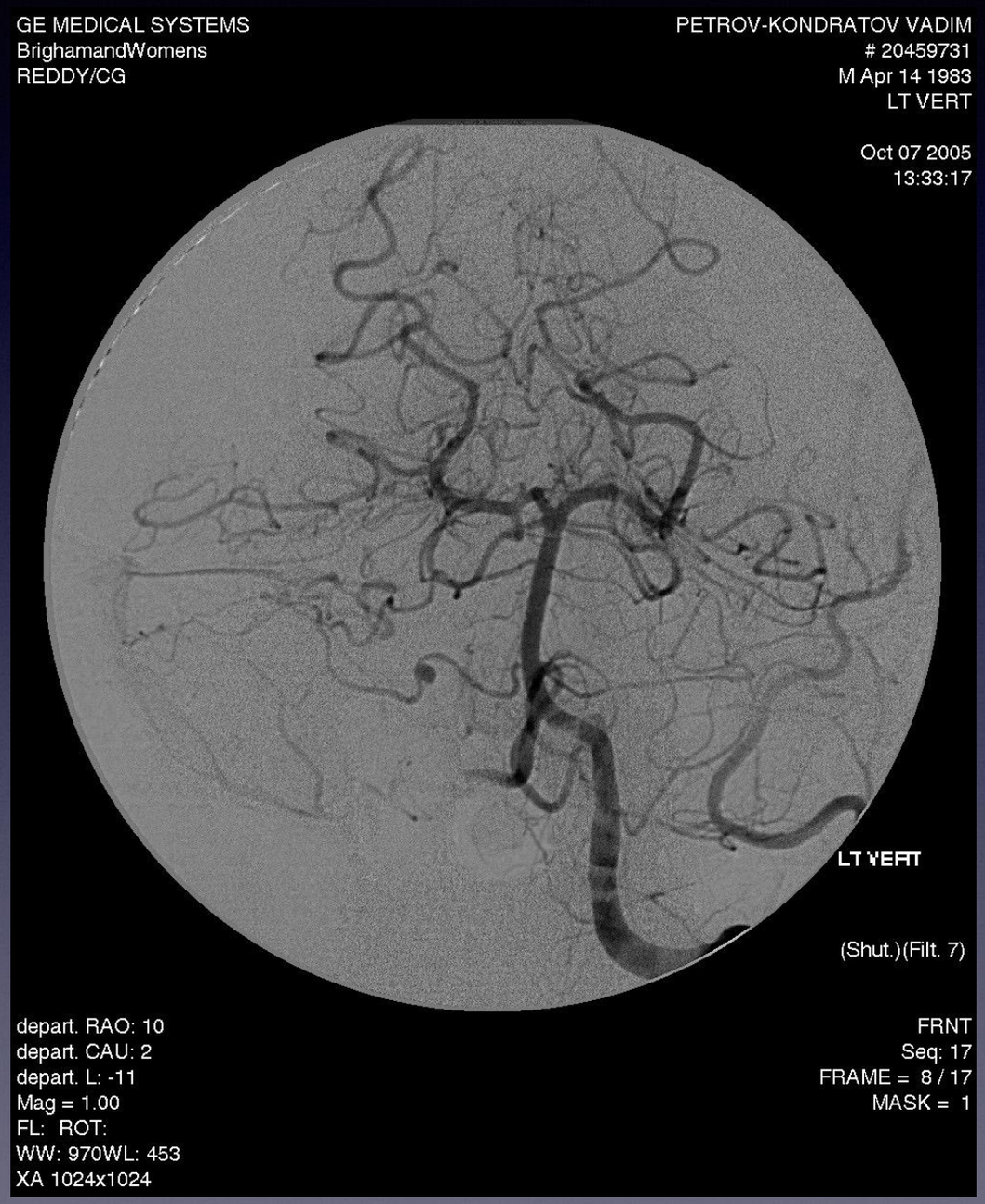
Initial angio







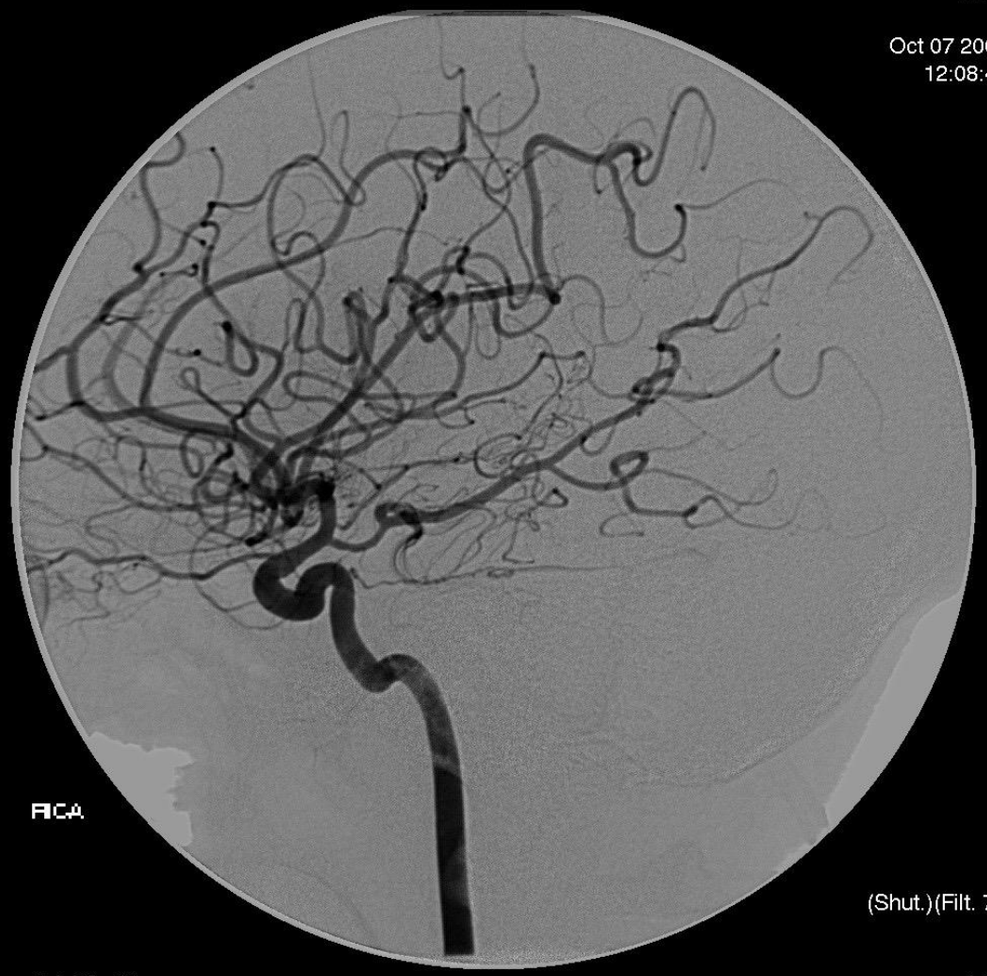
Control angio 6 days later



GE MEDICAL SYSTEMS
BrighamandWomens
REDDY/CG

PETROV-KONDRATOV VADIM
20459731
M Apr 14 1983
RICA

Oct 07 2005
12:08:45



(Shut.)(Filt. 7)

depart. LAO: 86
depart. CRA: 1

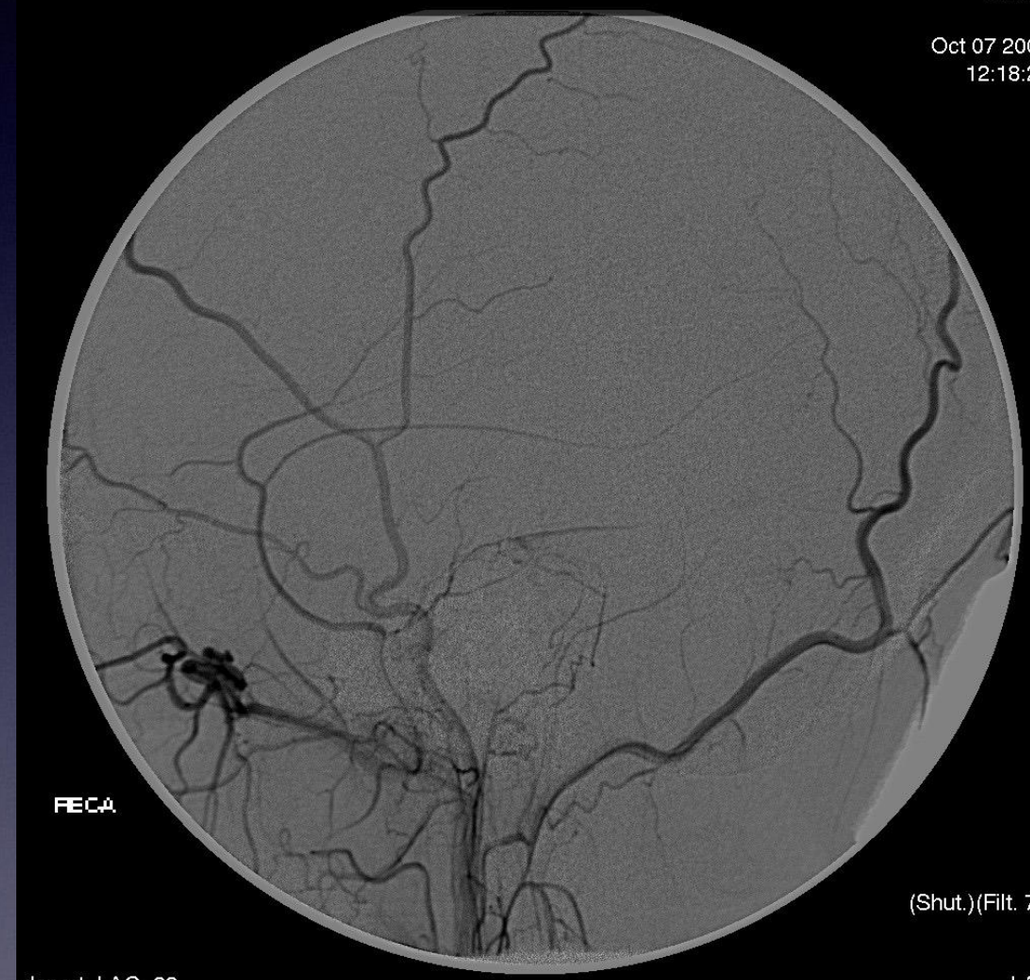
Mag = 1.00
FL: ROT:
WW: 941WL: 390
XA 1024x1024

LAT
Seq: 1
FRAME = 8 / 19
MASK = 1

GE MEDICAL SYSTEMS
BrighamandWomens
REDDY/CG

PETROV-KONDRATOV VADIM
20459731
M Apr 14 1983
RECA

Oct 07 2005
12:18:27



(Shut.)(Filt. 7)

depart. LAO: 88
depart. CRA: 4

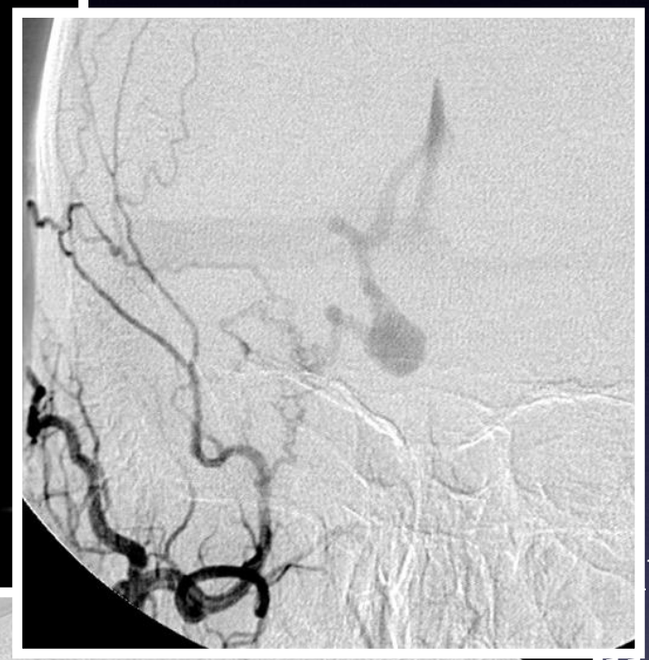
Mag = 1.00
FL: ROT:
WW: 959WL: 467
XA 1024x1024

LAT
Seq: 3
FRAME = 9 / 15
MASK = 1


3D
BrighamandWomens DAY A.
Se: 16
SA
PETROV-KONDRATOV VADIM
M 20459731
Oct 7 2005
13:22
MIP No cut
DFOV 13.0 cm
1600/3
REDDY/CG
L
A
R
P
No VOI
Voxel size: 0.3 mm
W = 2224 L = 2173
Angles
0 L 180 LAO 1 CRA
IP


3D4
BrighamandWomens DAY A.
Se: 16
SP
PETROV-KONDRATOV VADIM
M 20459731
Oct 7 2005
13:22
Volume Rendering No cut
DFOV 6.5 cm
1600/8
REDDY/CG
L
A
S
R
P
I
No VOI
Voxel size: 0.3 mm
W = 3711 L = 12587
Angles
0 L 170 LAO 16 CAU
IA

Dural AV fistula



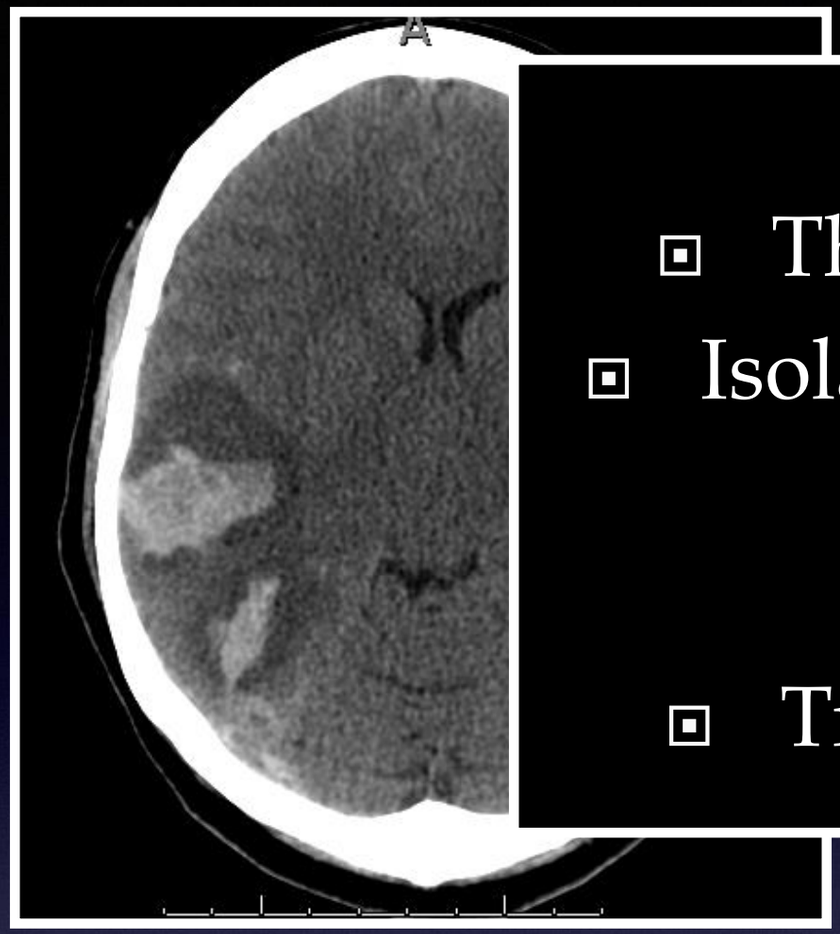
us or a bridging vein

us thrombosis

nual risk of ICH of 7.5%

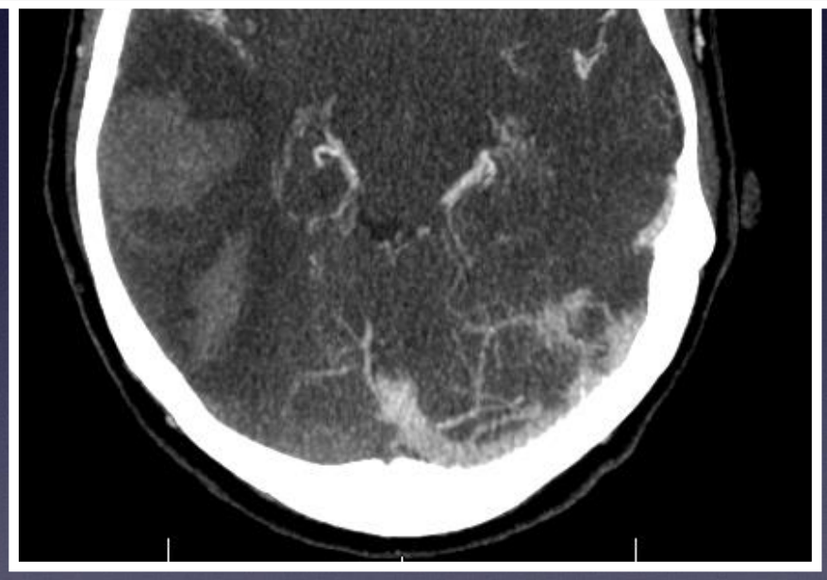

S
A
C3
C4
C5
C6
C7
T1
Sagittal Link / Key

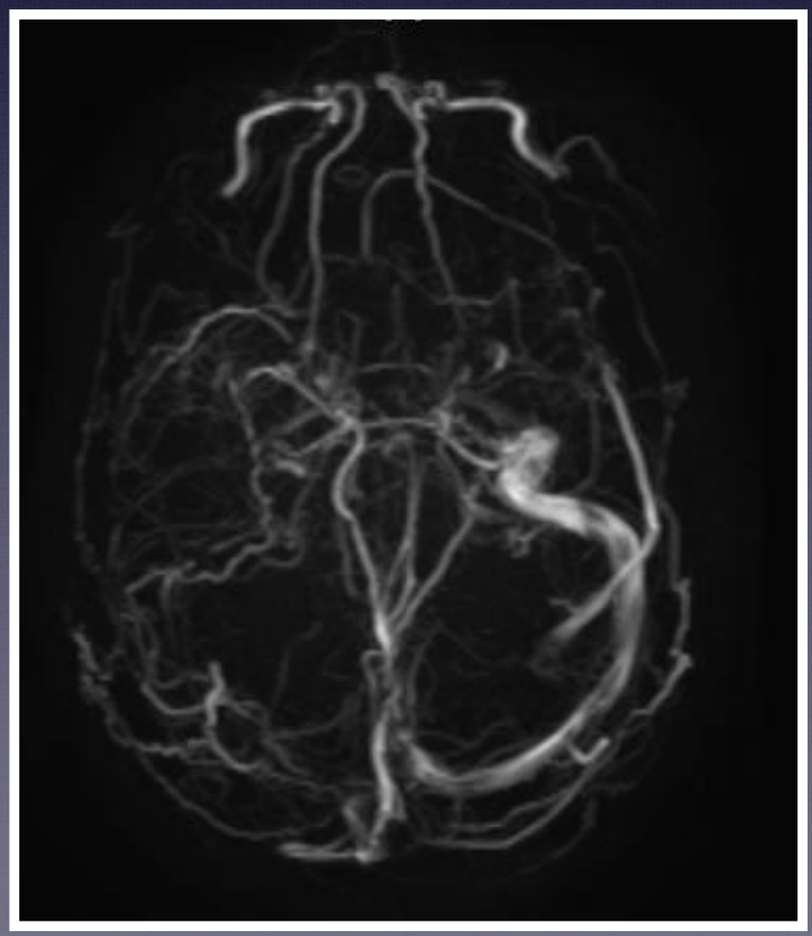

S
A
Sagittal Link

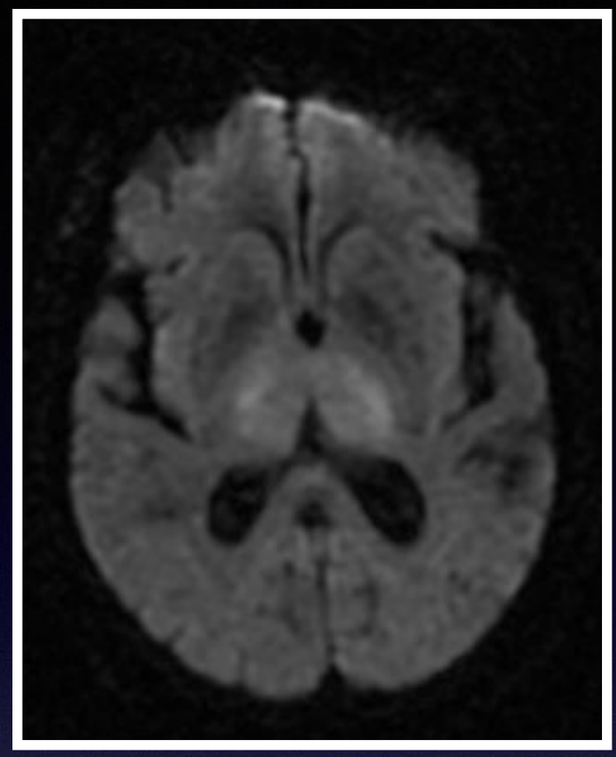


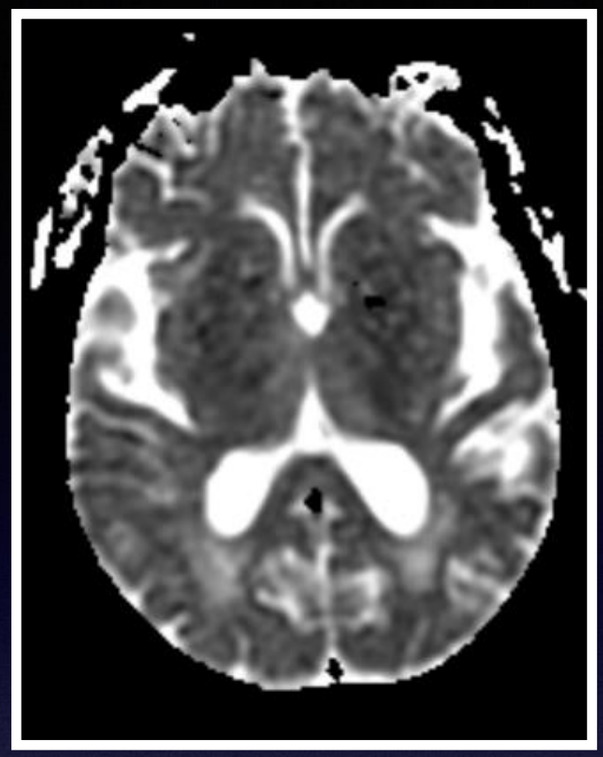
Hemorrhagic venous infarct

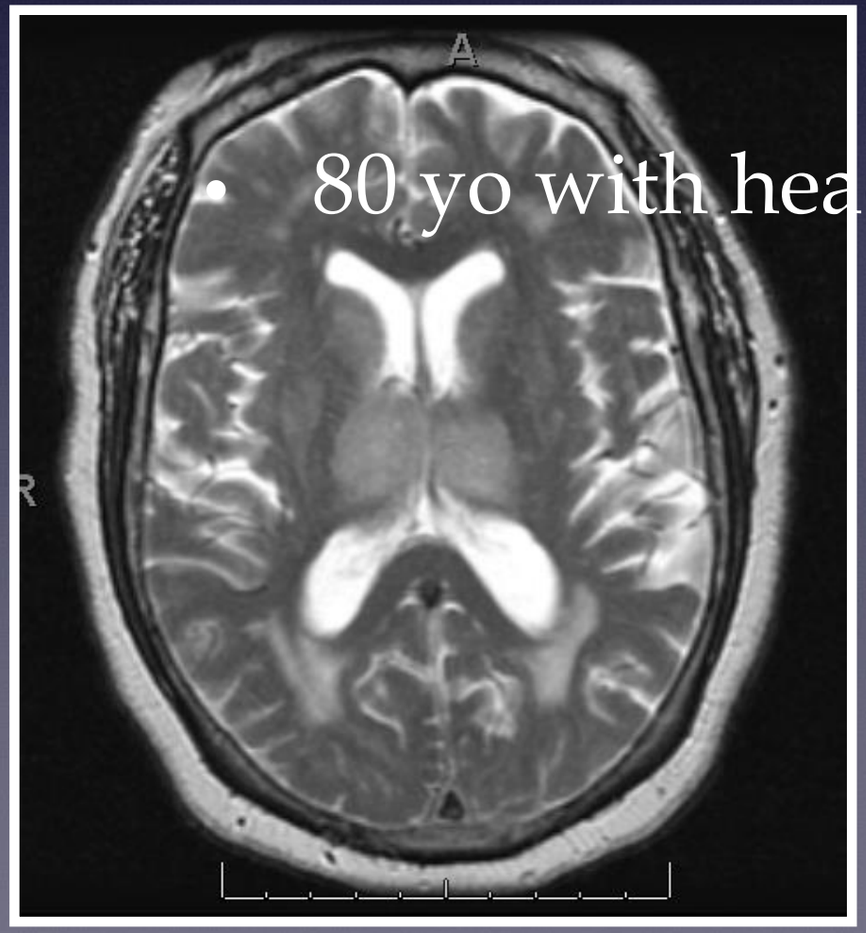
- Thrombosis of the transverse sigmoid sinus
- Isolated cortical vein/anastomotic vein (Labbe)
- ! signs of septic thrombophlebitis (otomastoiditis, orbital cellulitis)
- Treatment is with systemic anticoagulation



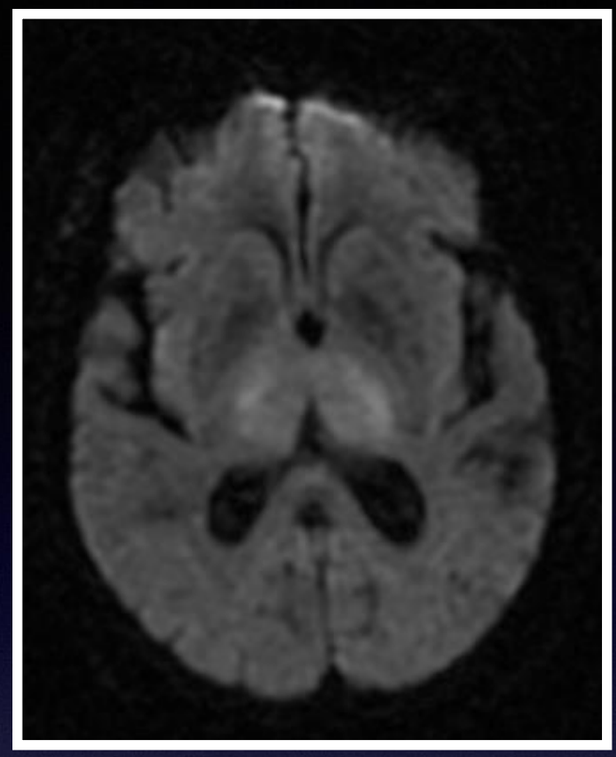


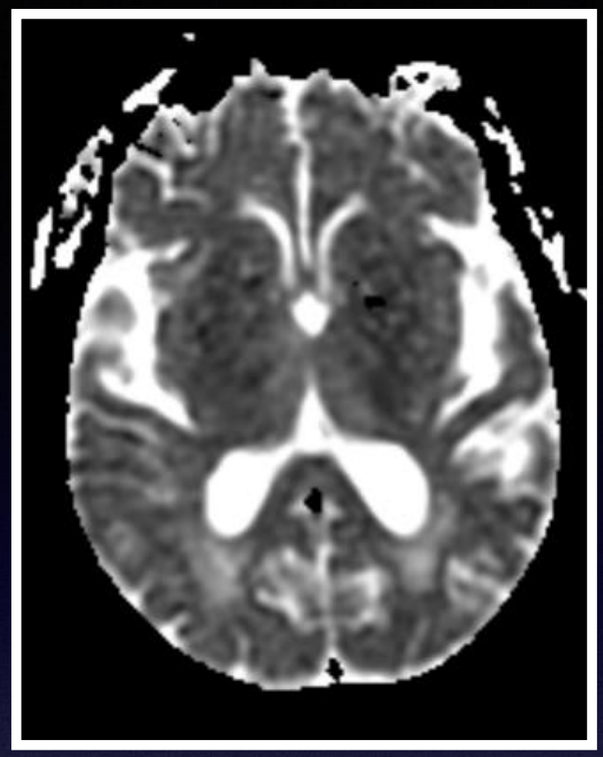


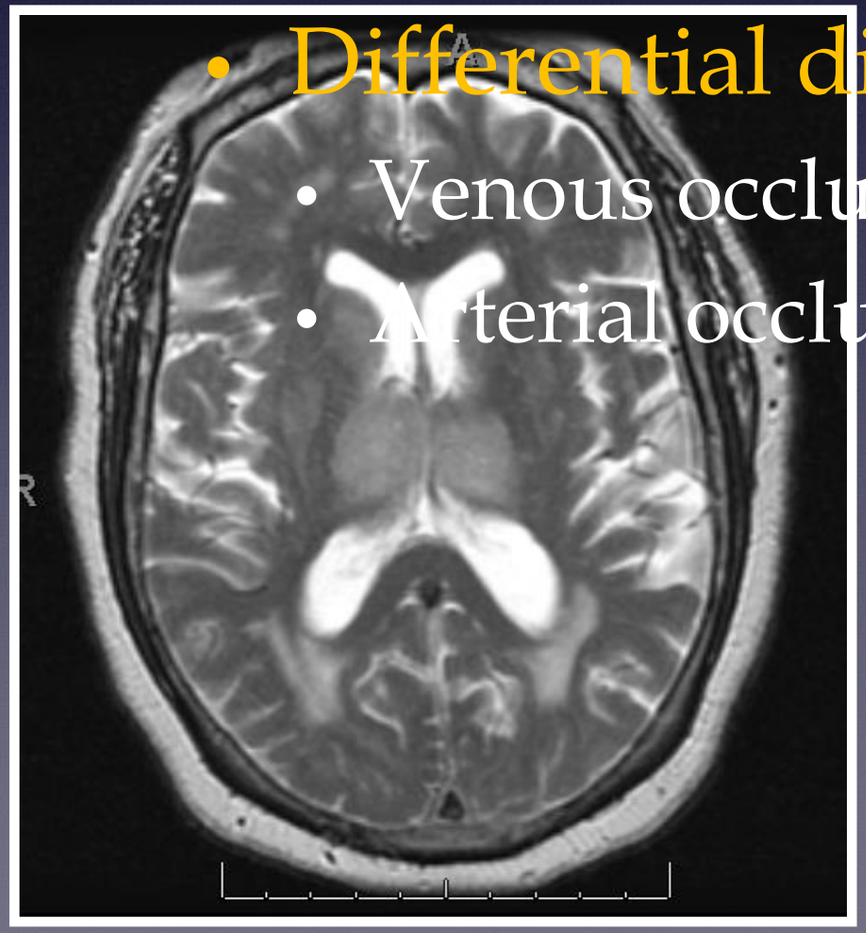




- 80 yo with headache and mental status changes

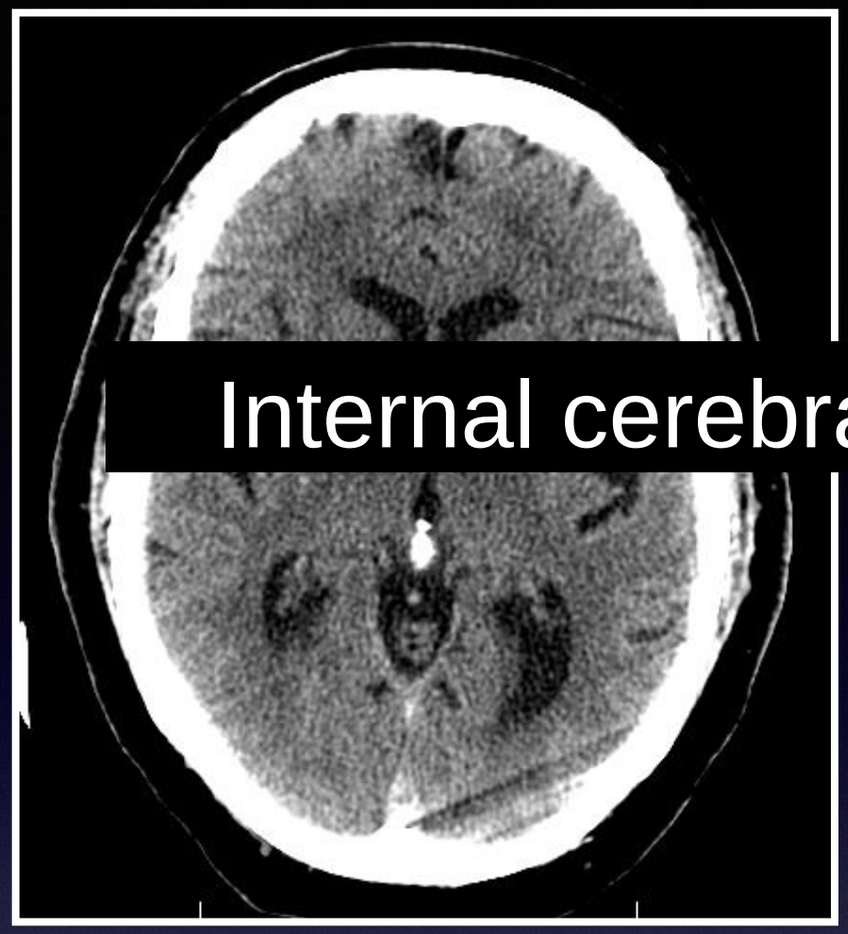


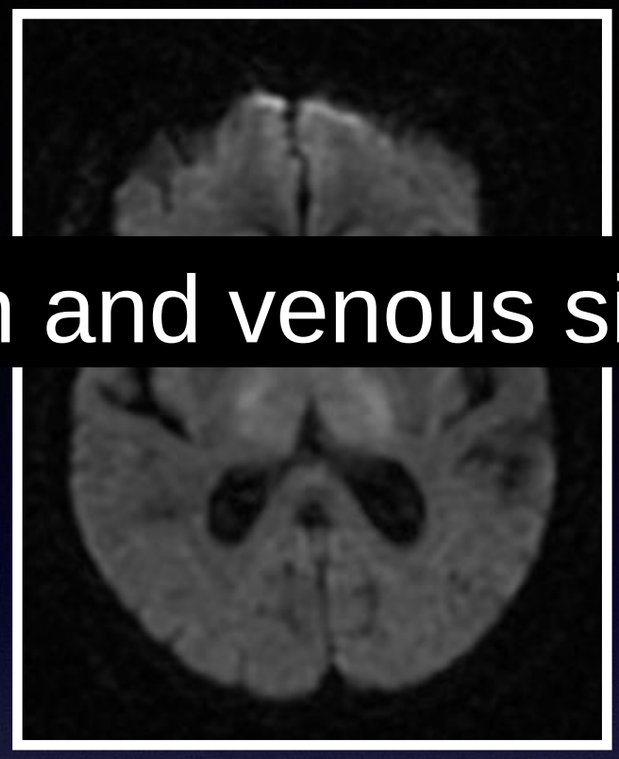


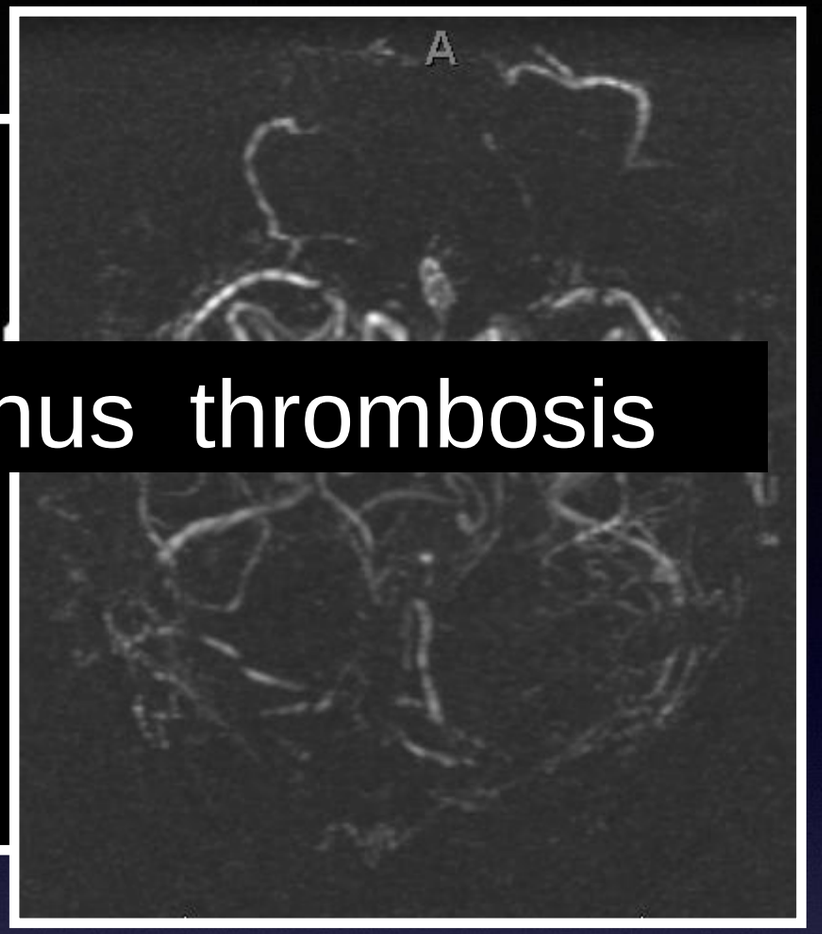


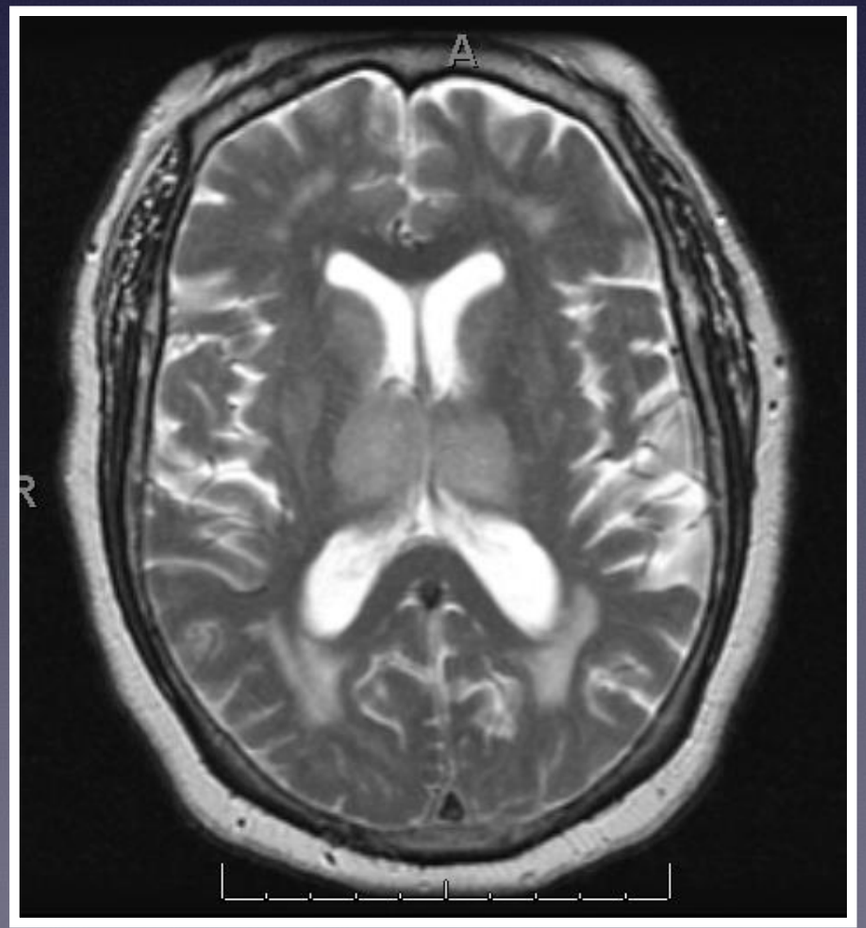
- Differential diagnosis:
  - Venous occlusion
  - Arterial occlusion (Percheron)

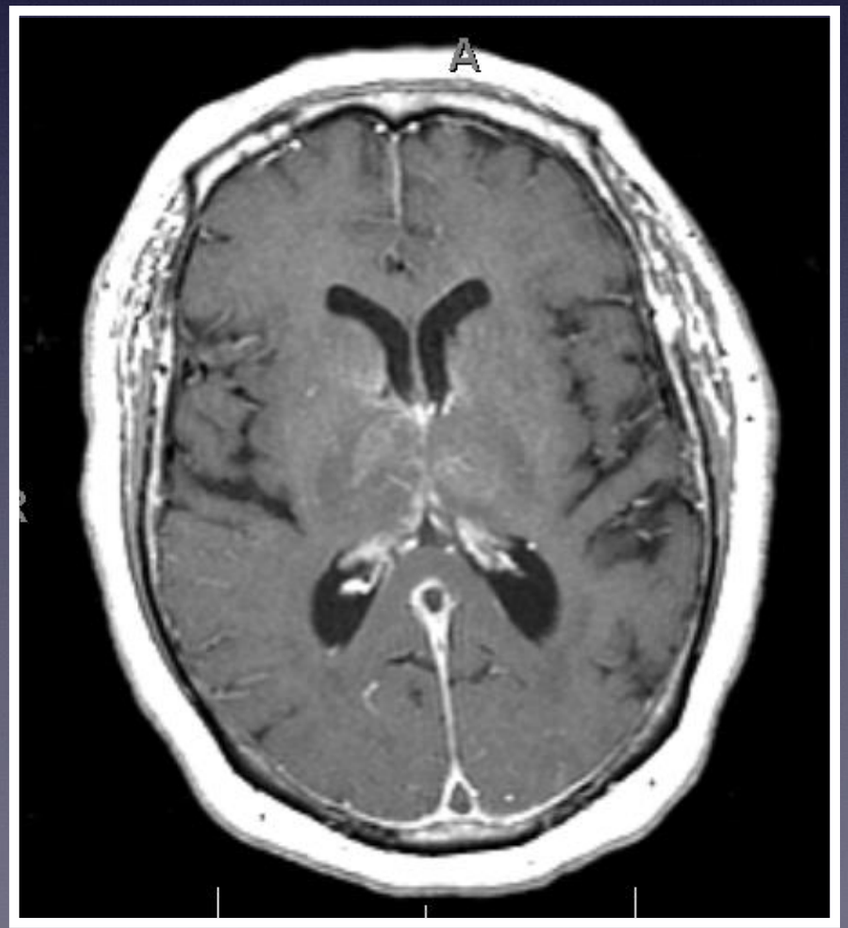
Internal cerebral vein and venous sinus thrombosis

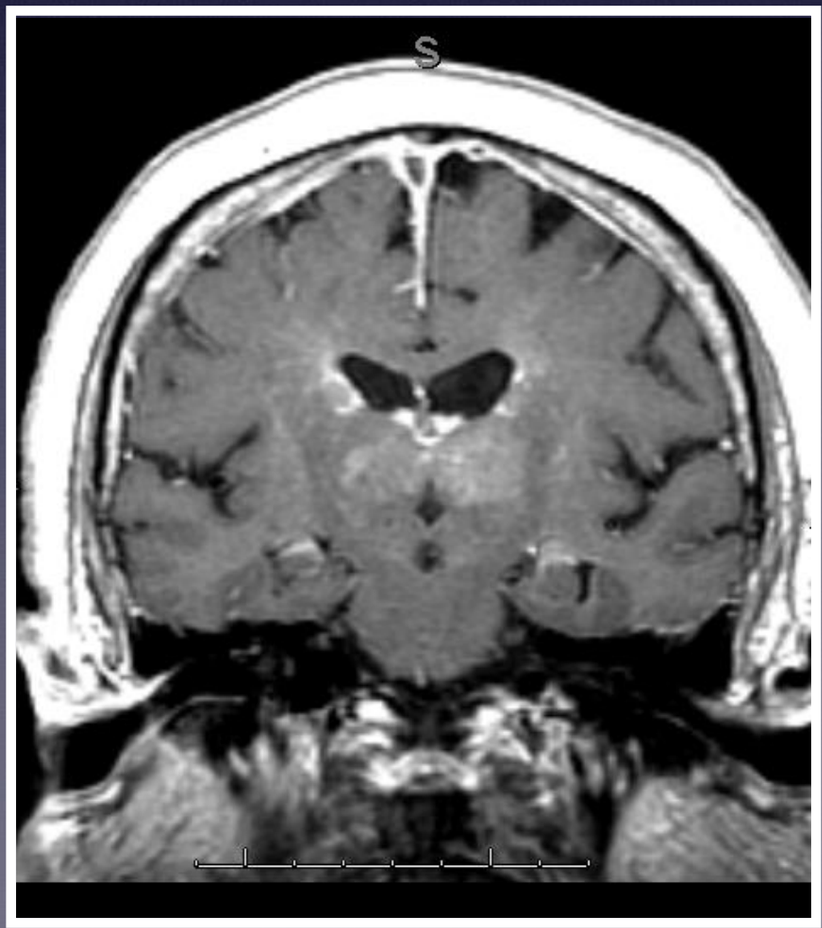




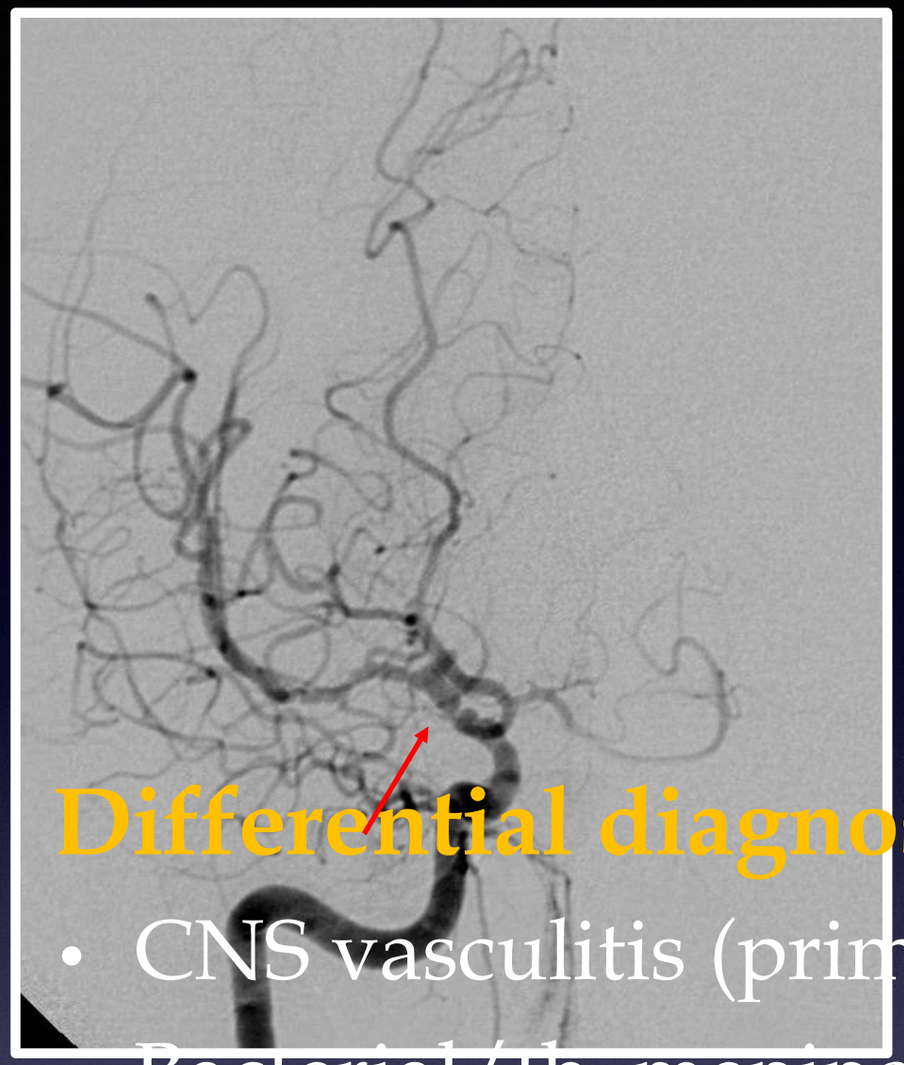


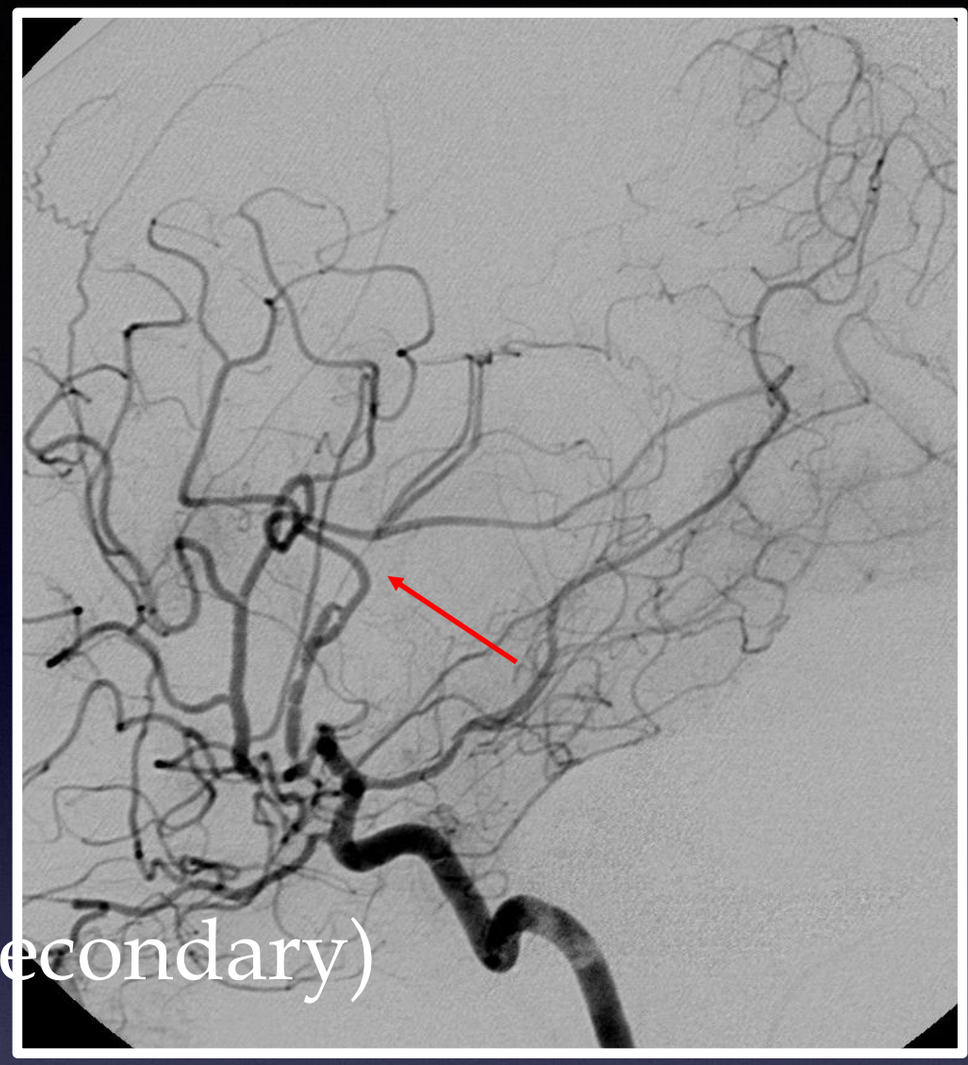






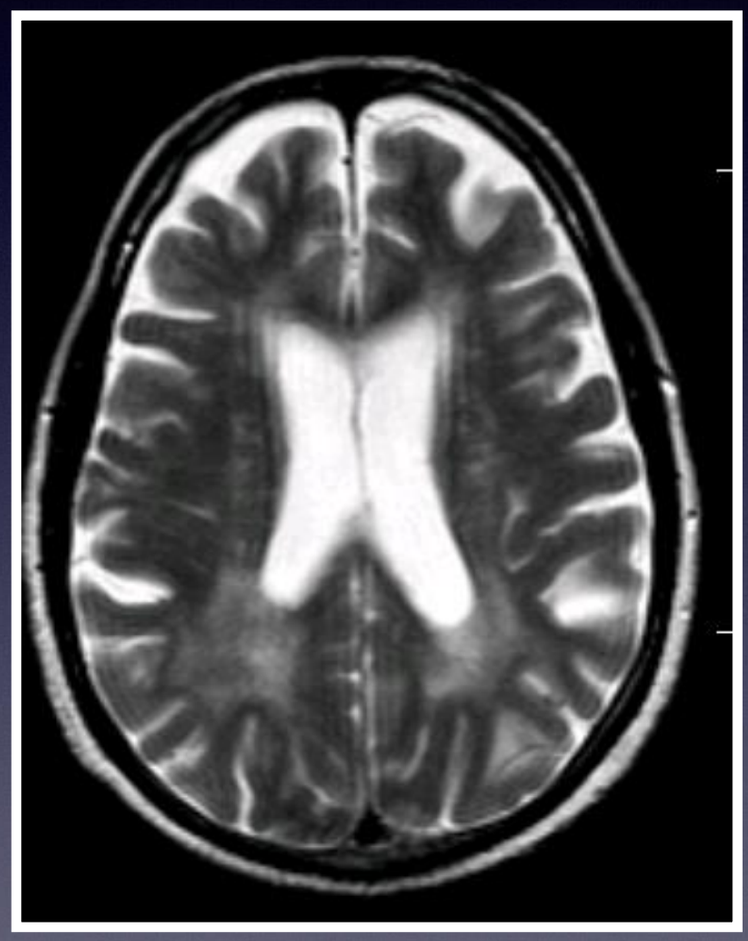
- 30 year old with severe headache and left upper + lower extremity weakness





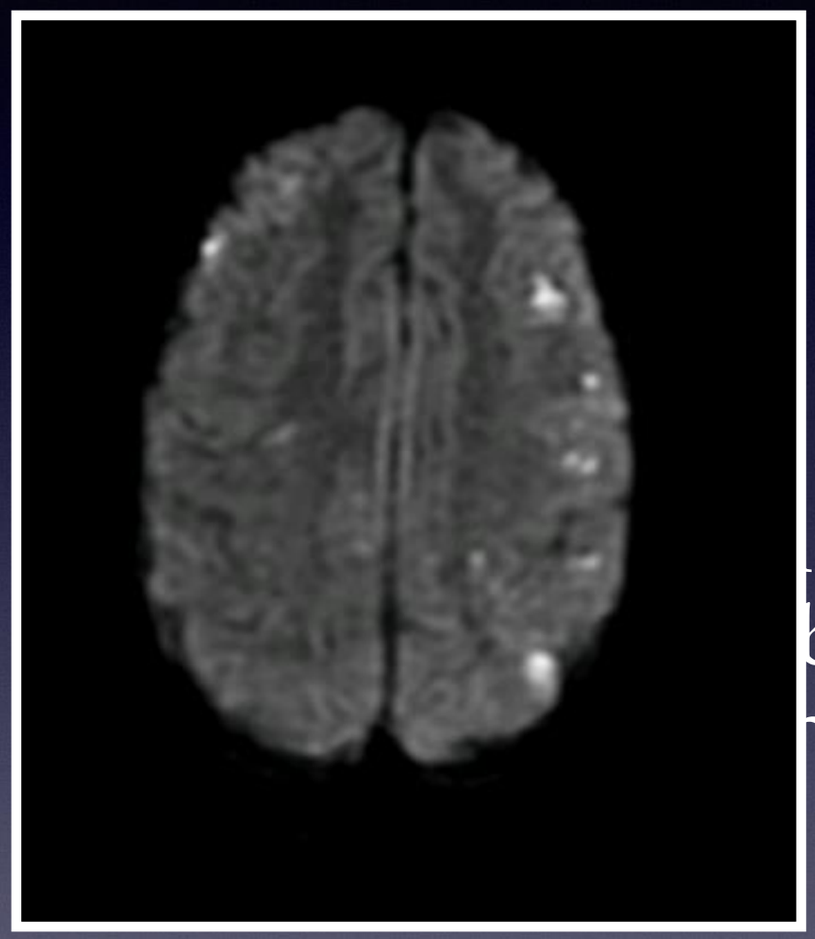
- **Differential diagnosis**
  - CNS vasculitis (primary/secondary)
  - Bacterial/tb meningitis
  - Reversible cerebral vasoconstriction syndrome
  - Cocaine/Amphetamine related vasculopathy

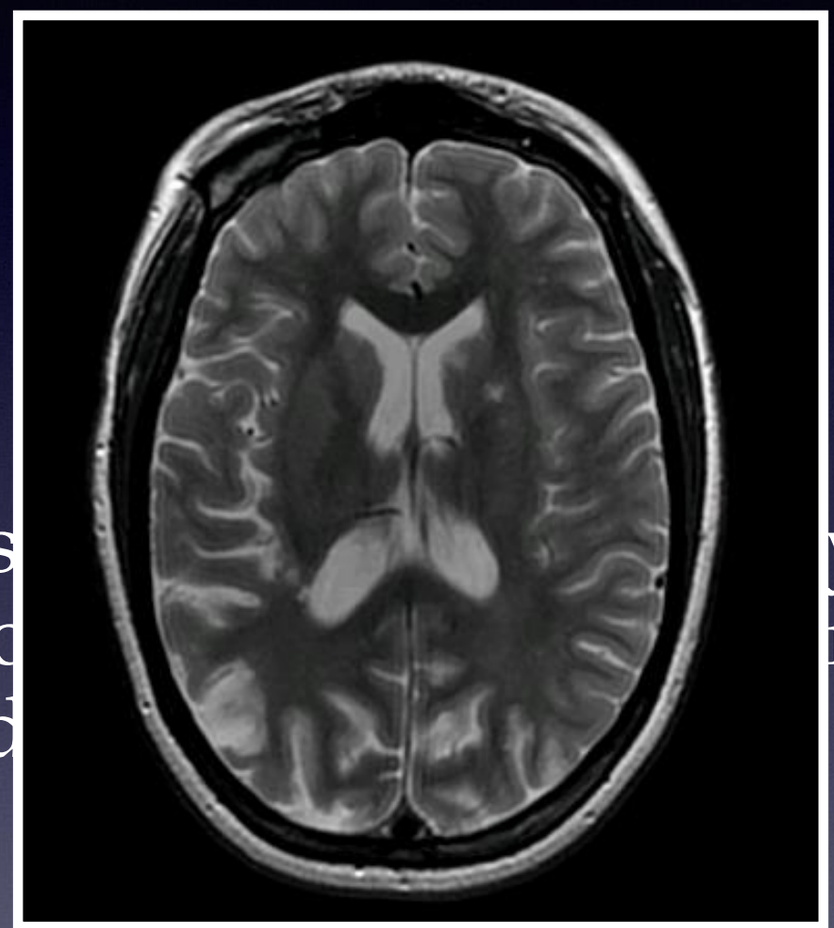
Primary CNS angiitis

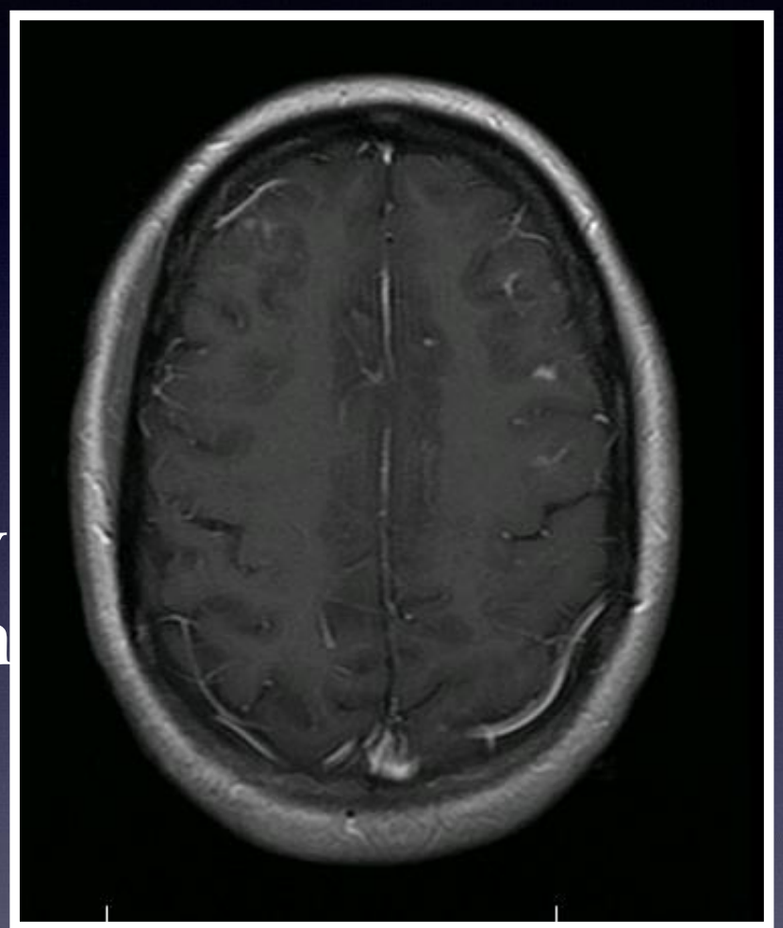


CAPS

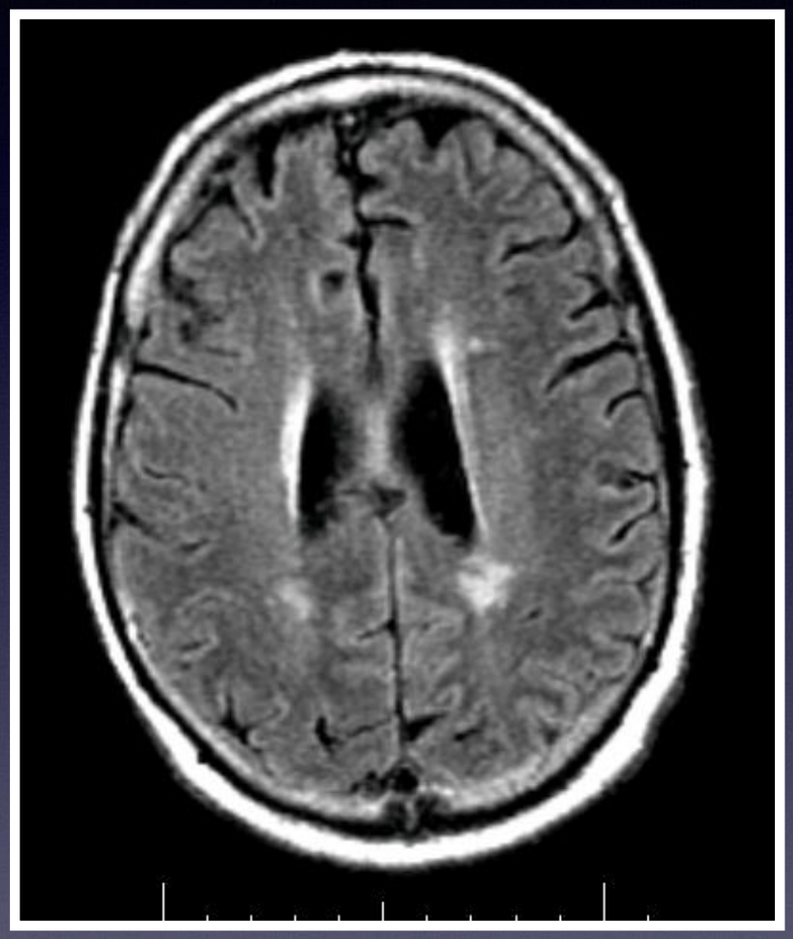
Cerebral antiphospholipid syndrome

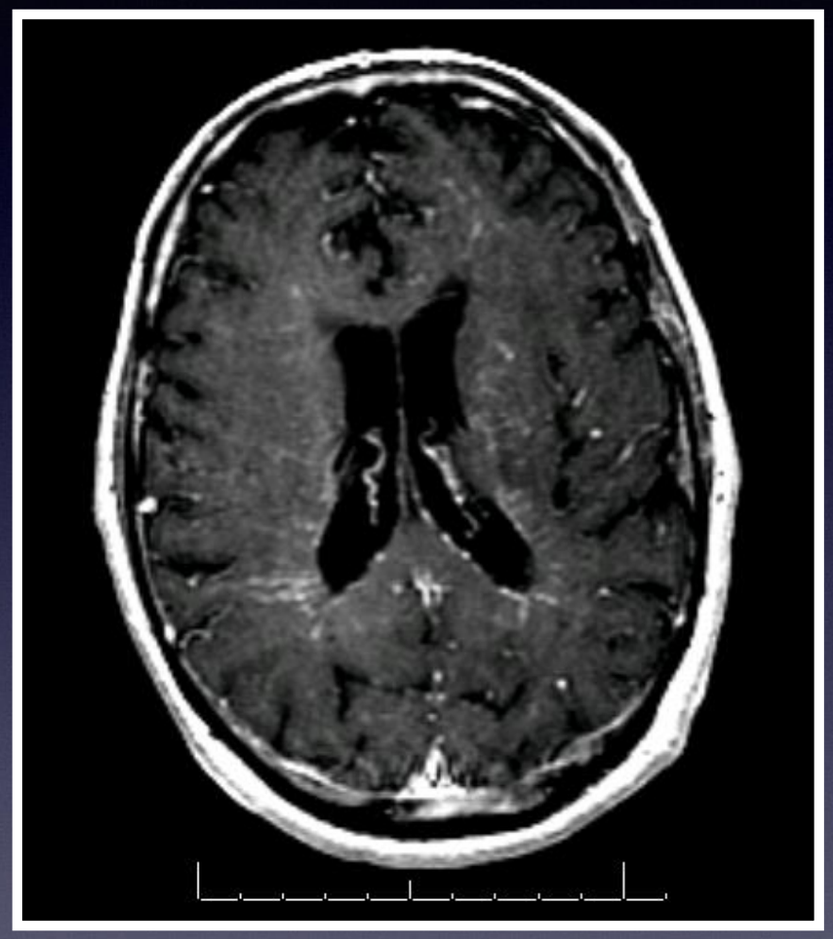




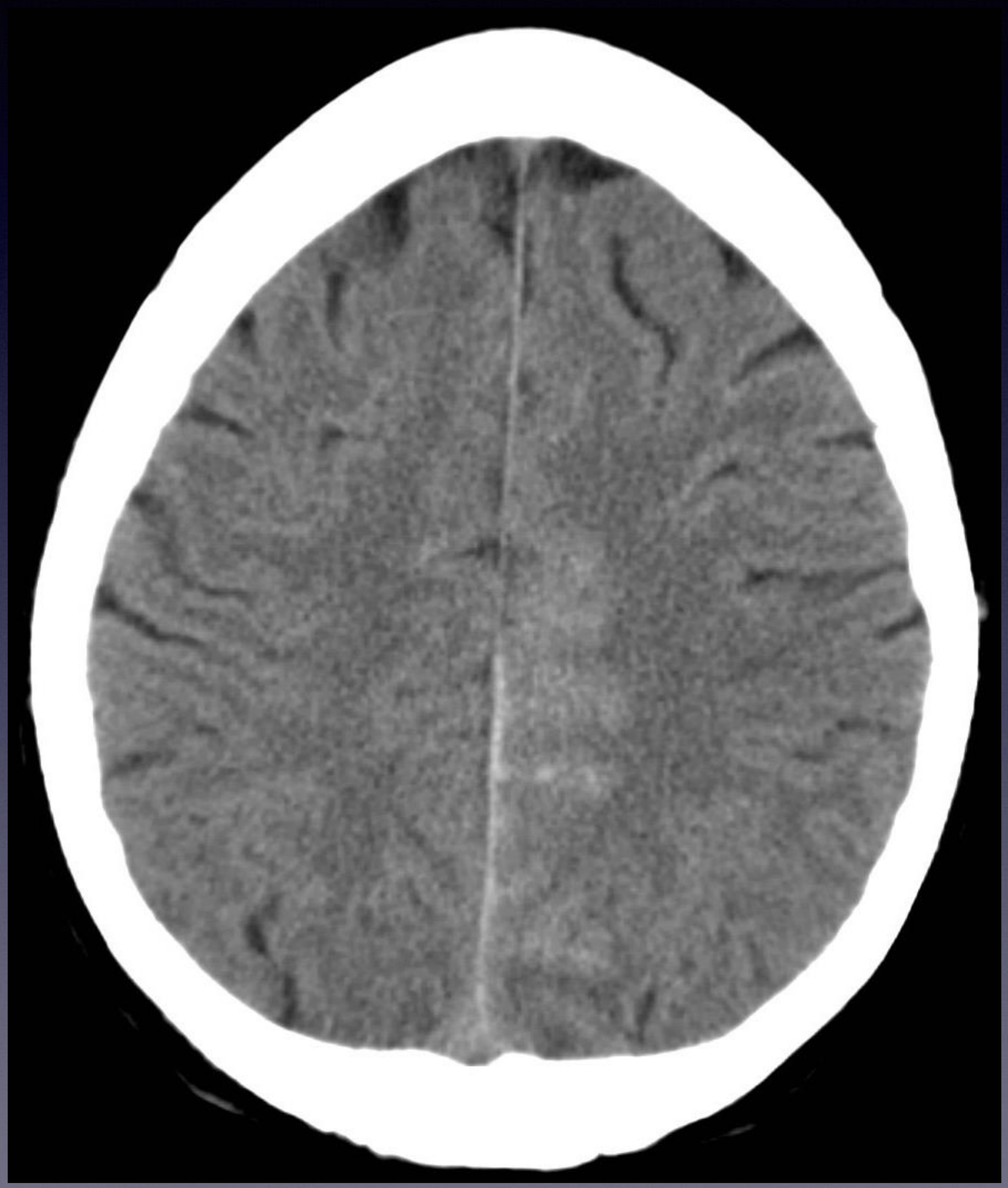


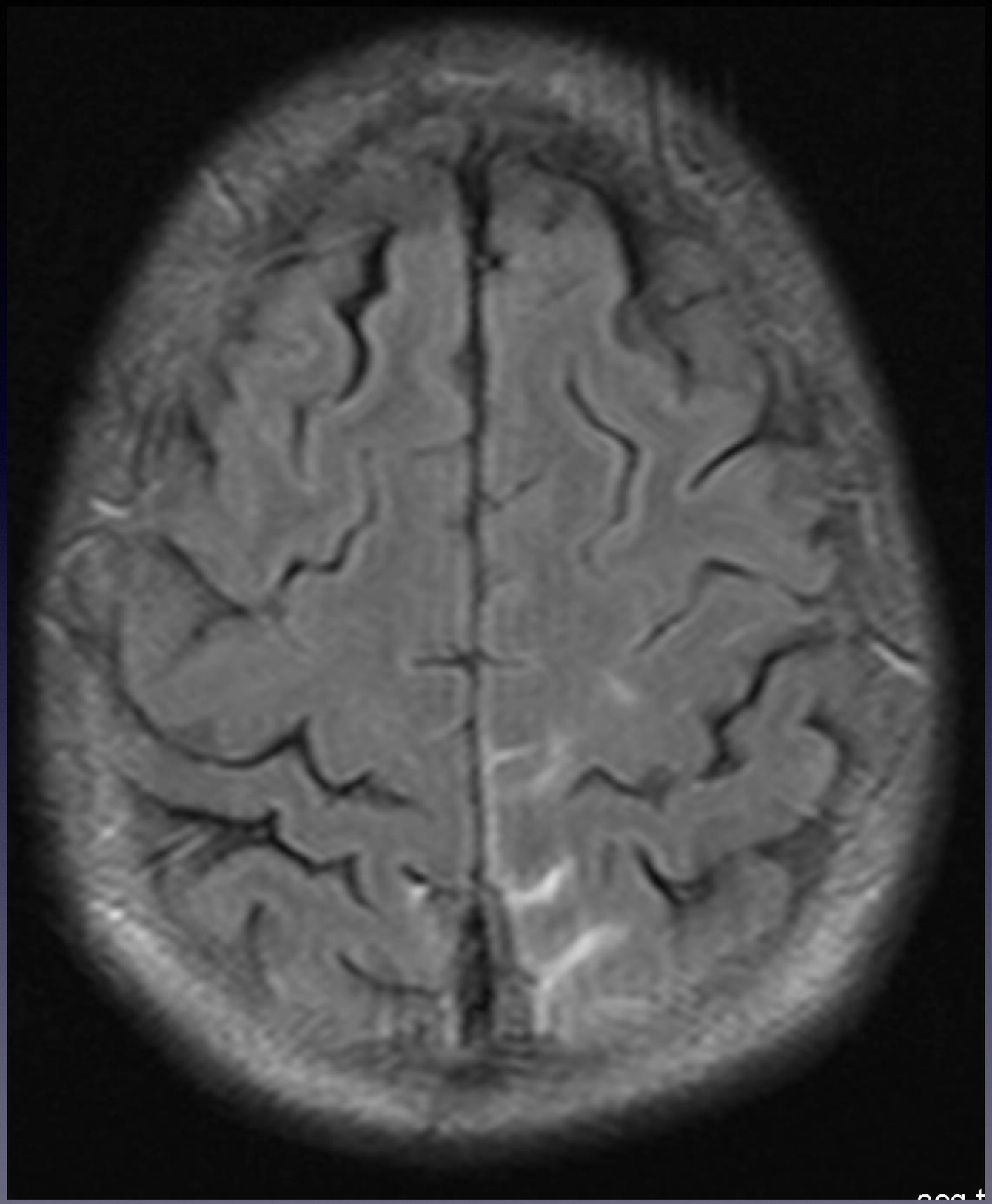
Angiocentric Lymphoma/ Lymphoid granulomatosis(rare form of NHL)

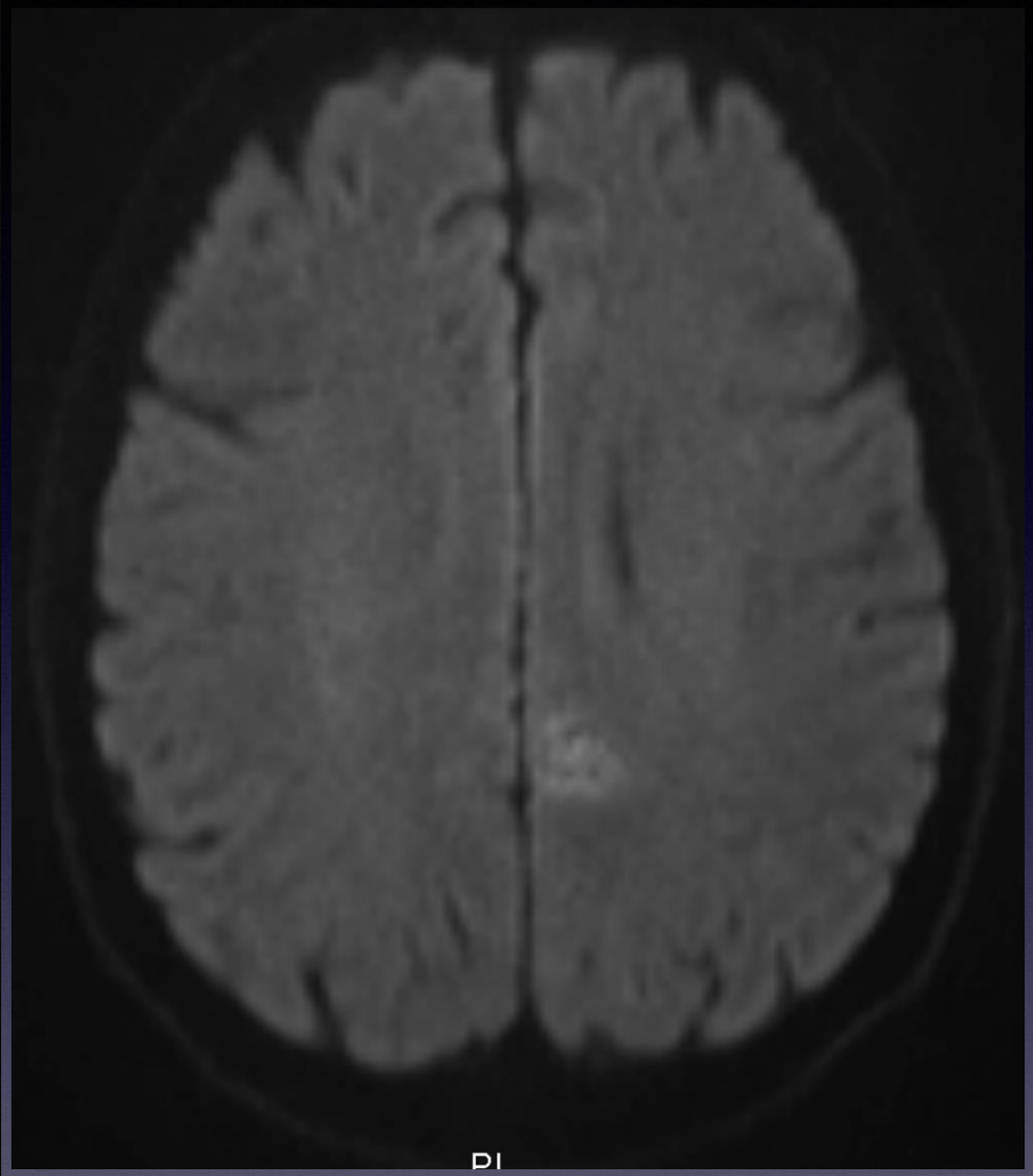


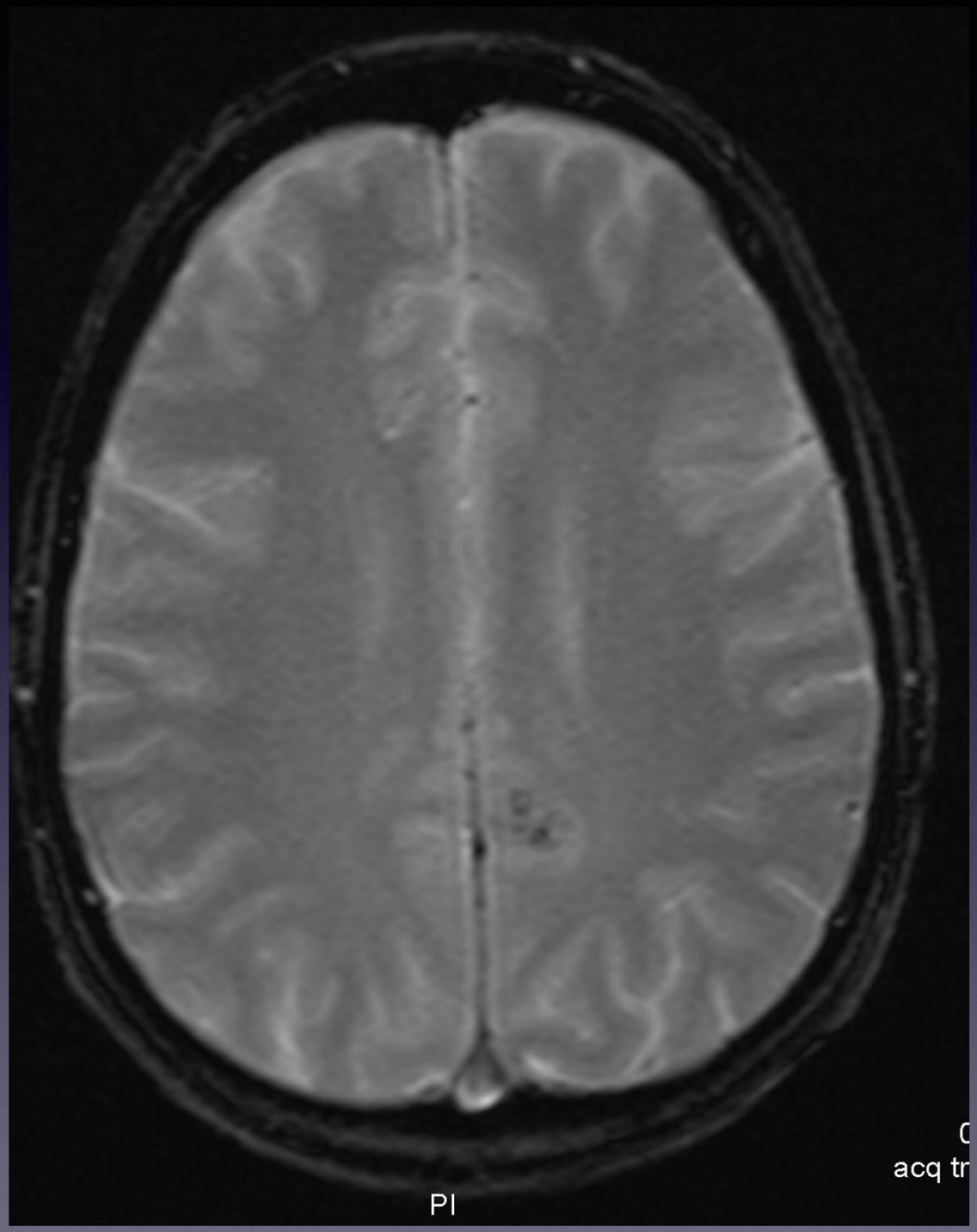


54 male acute onset HA





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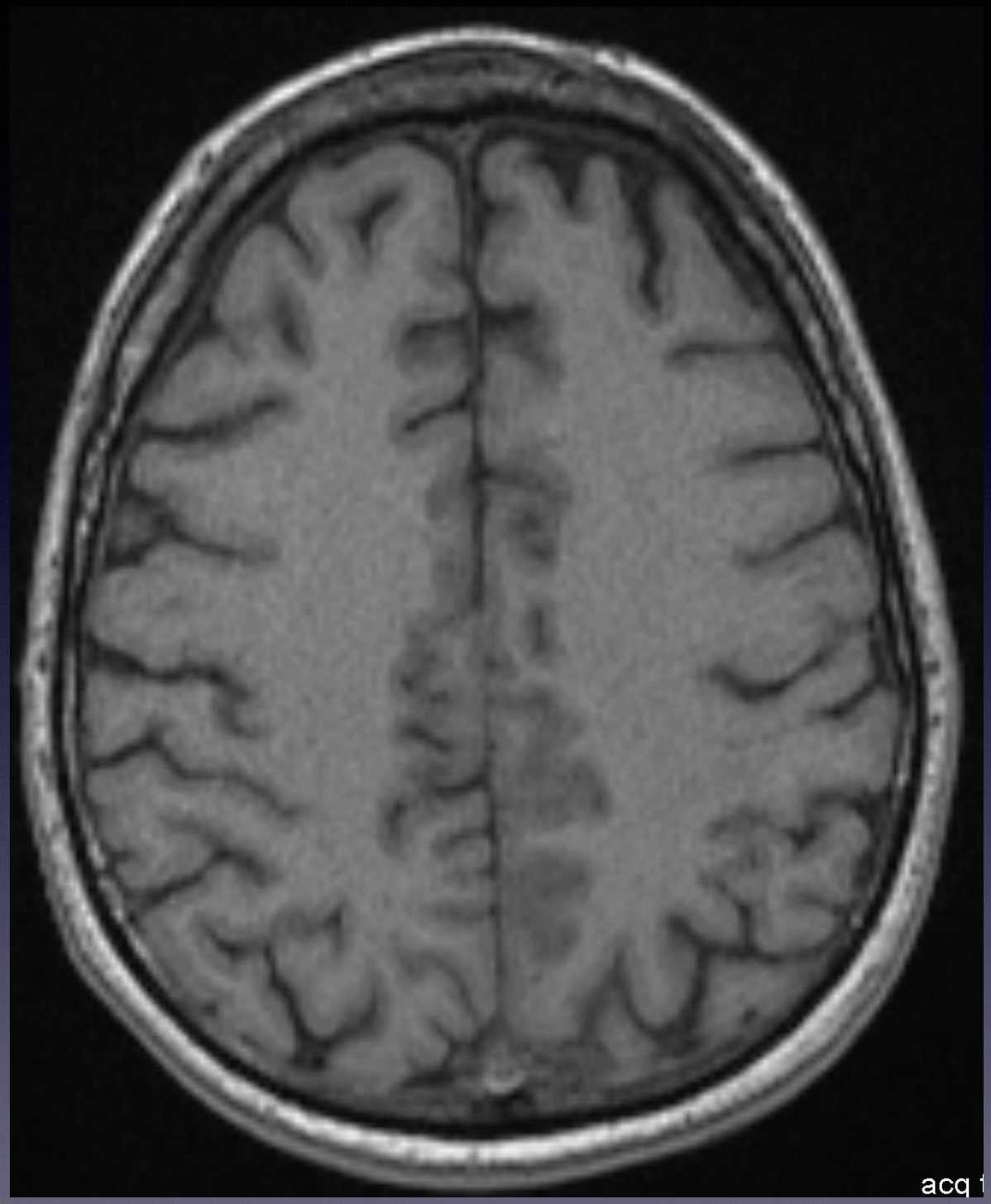
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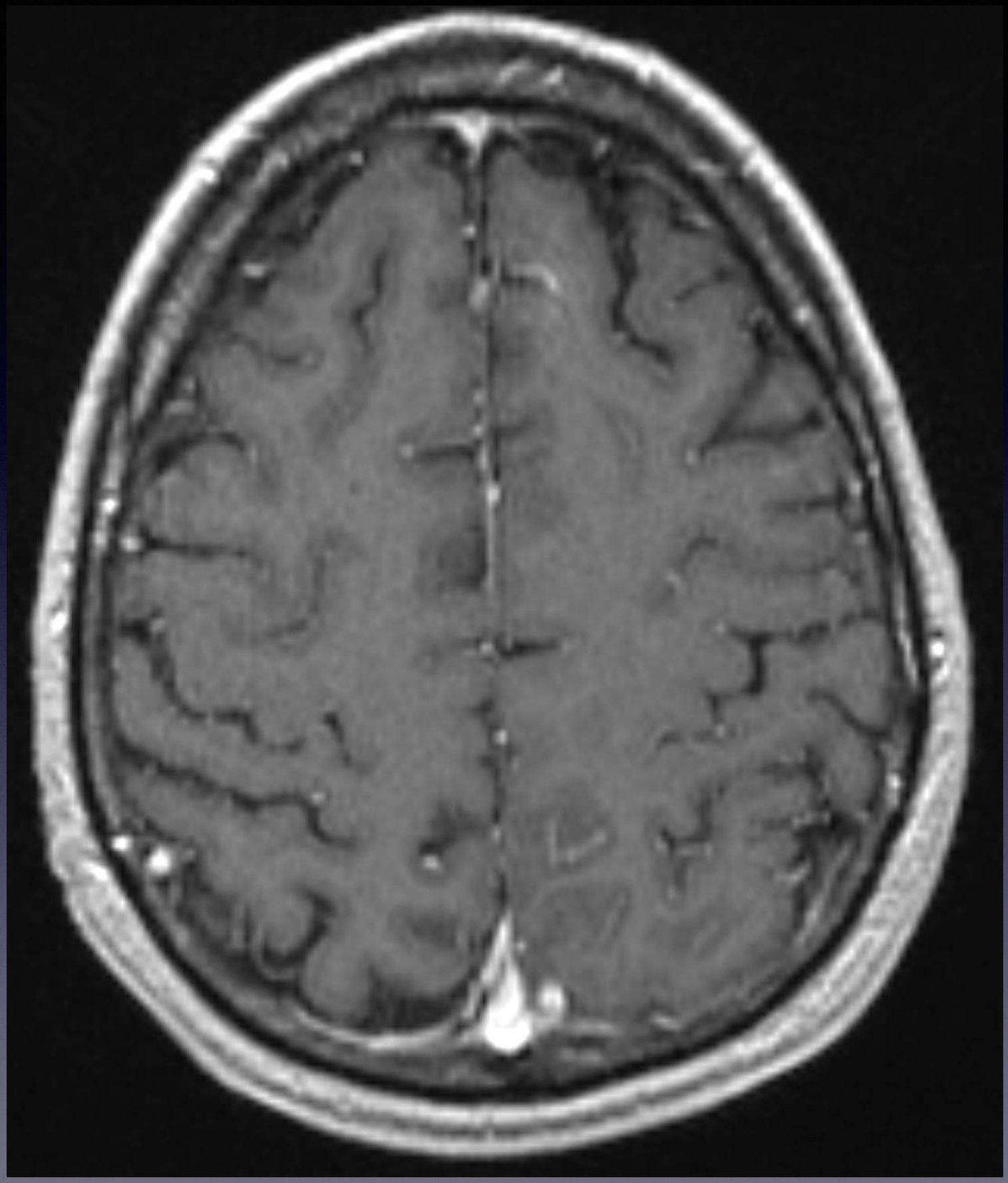
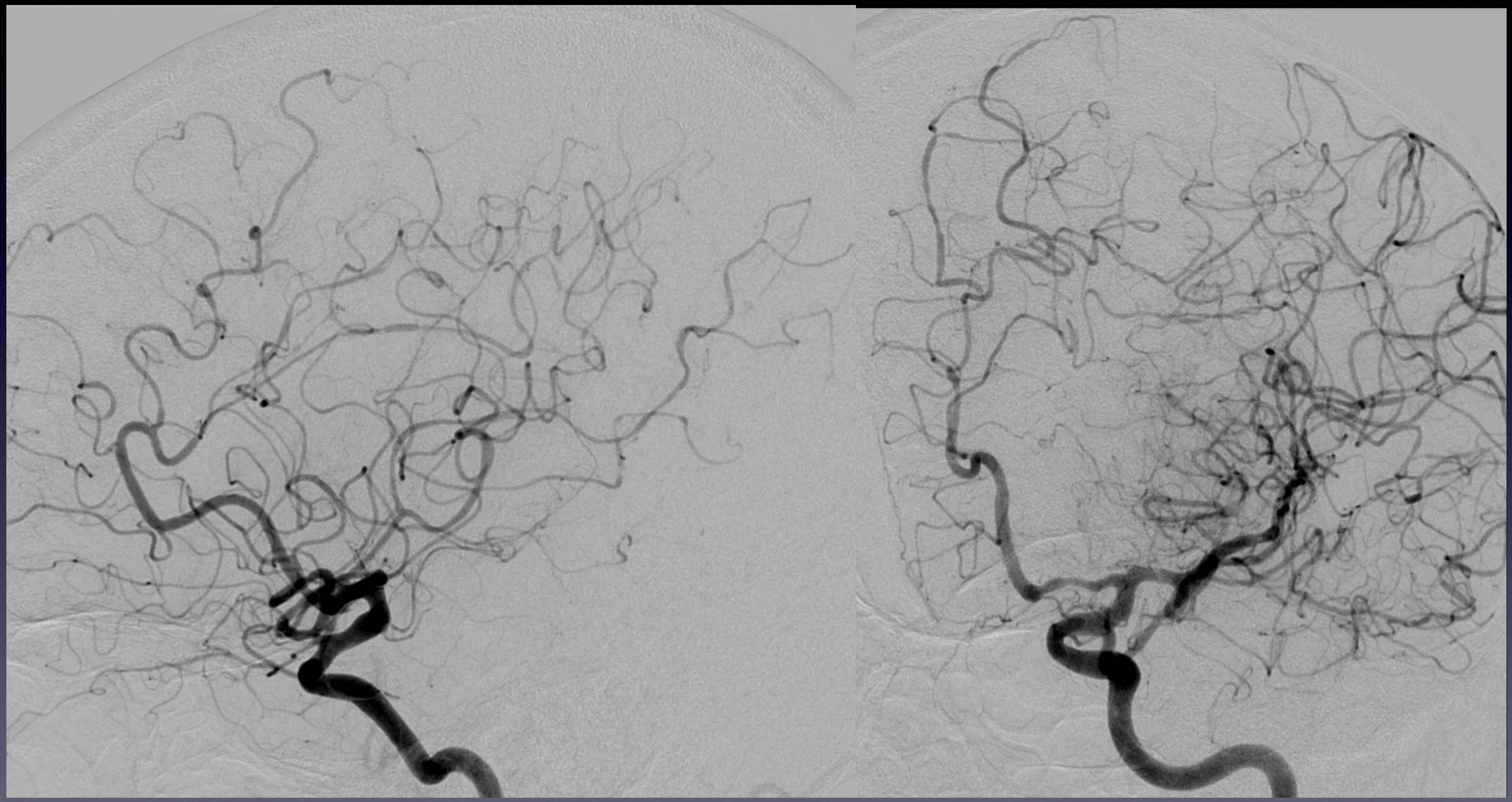




CNS Vasculitis

- Vasculitis -**diffuse angiopathy**

-primary angiitis of CNS PACNS

-Benign angiopathy of CNS BACNS

-systemic vasculitis

-atherosclerosis

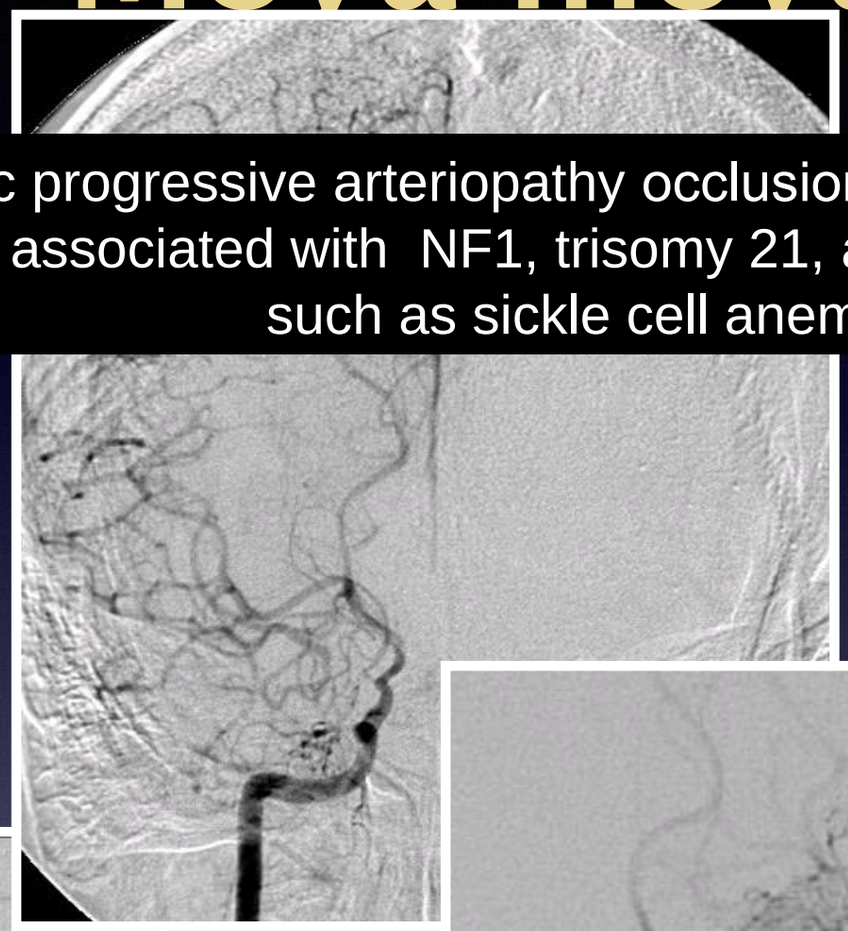
-intravascular lymphoma

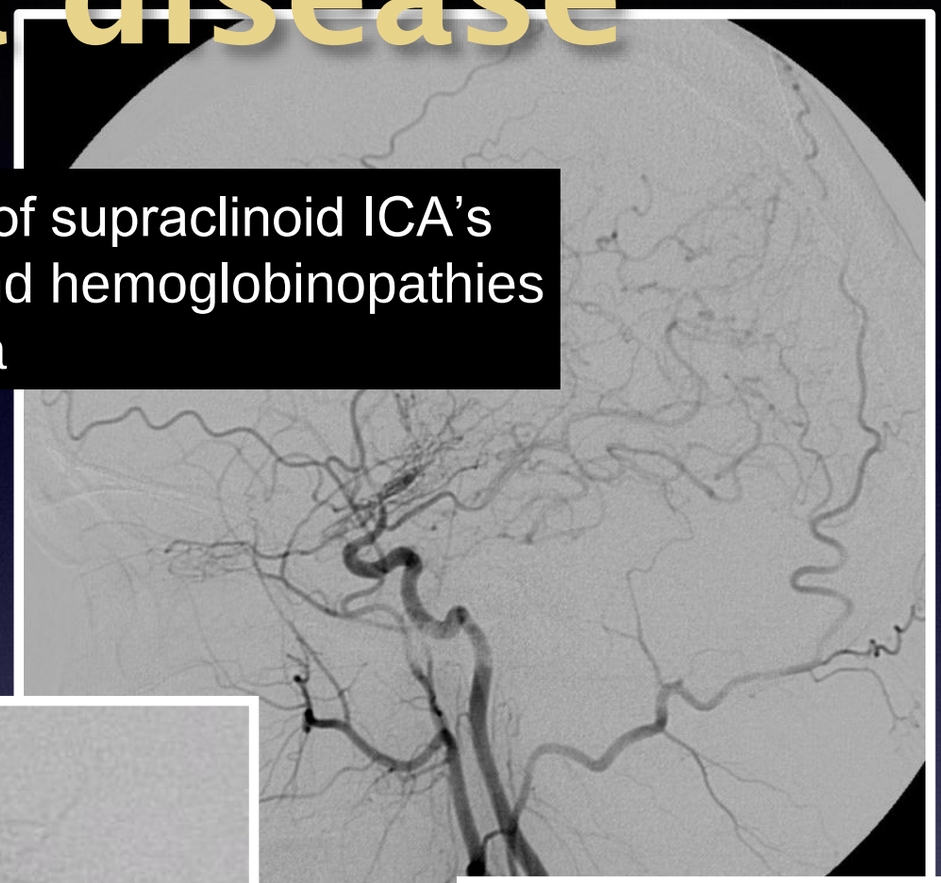
-preeclampsia

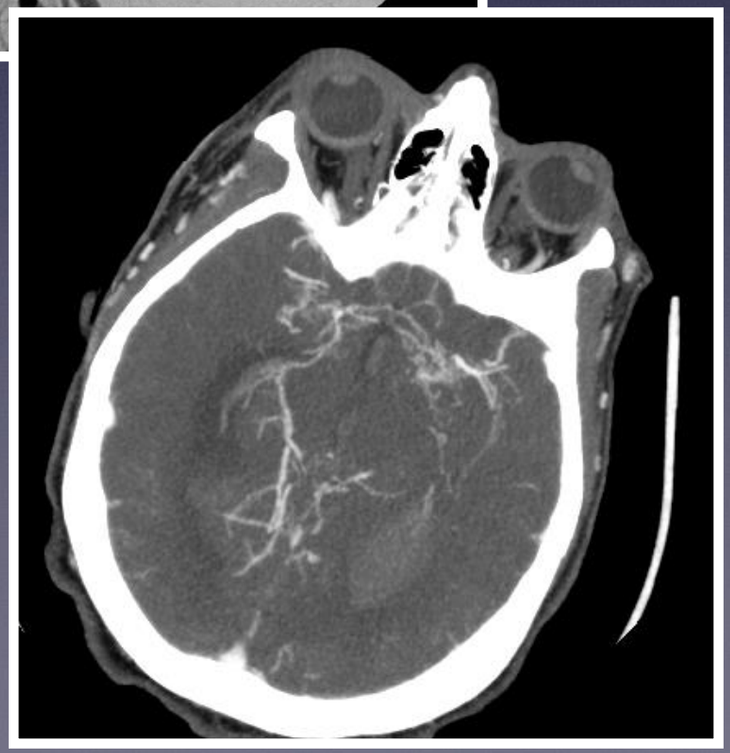
-cocaine use

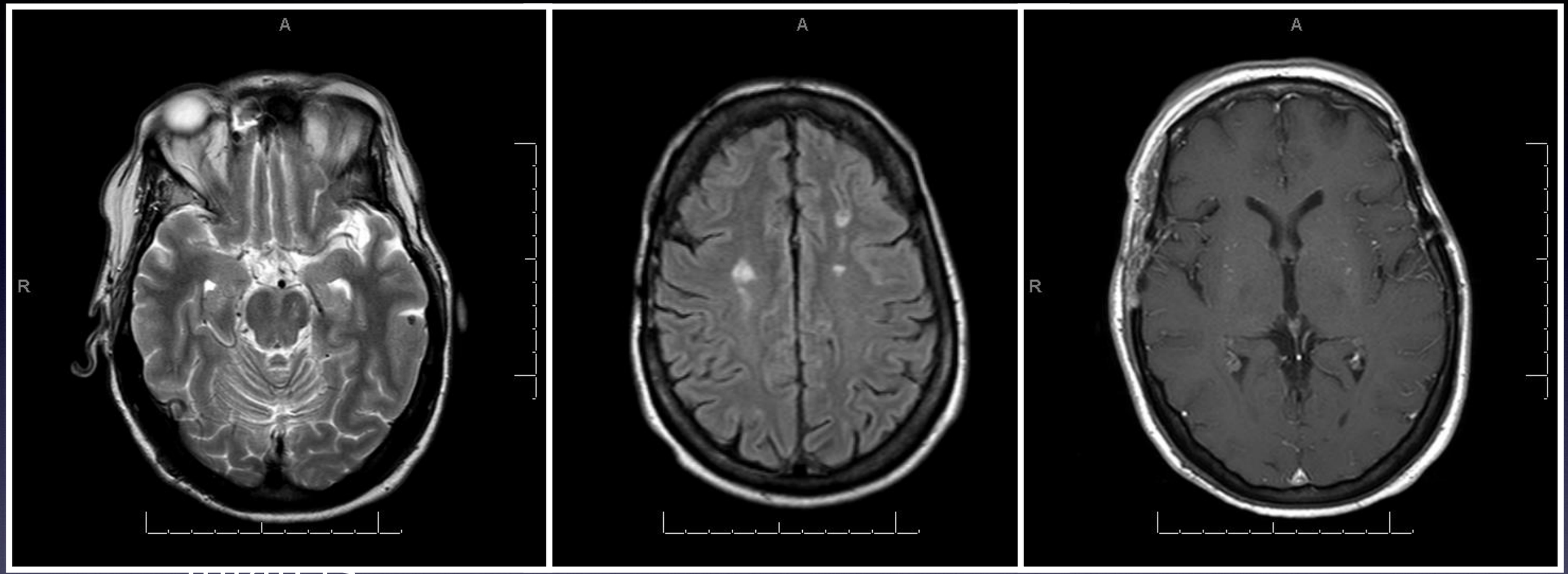
Moya-moya disease

- Idiopathic progressive arteriopathy occlusion of supraclinoid ICA's
- Syndrome: associated with NF1, trisomy 21, and hemoglobinopathies such as sickle cell anemia









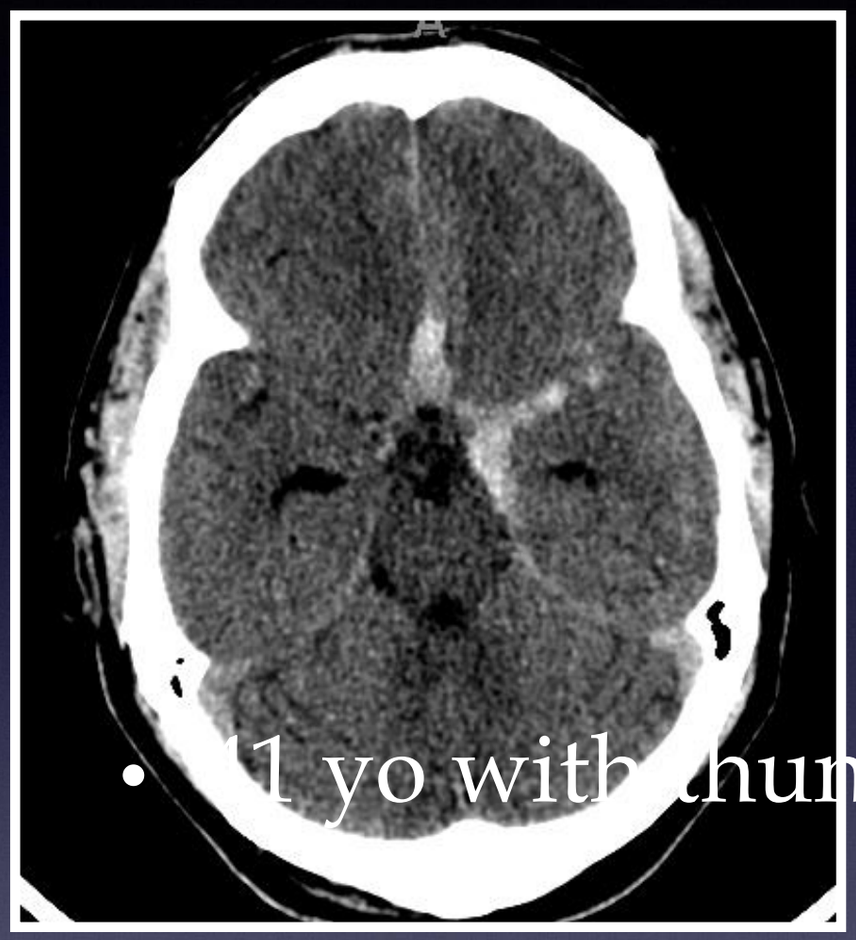
infarcts

- DSA: dg, staging

Σημαντικα Μυνηματα

- **Απεικόνιση στο ισχαιμικό ΑΕΕ-Triage για ενδοαγγειακή θεραπεία**

- **Συνδυασμός** των απεικονιστικών μεθόδων αποτελεί συχνά κλειδί για τη διάγνωση της αιτίας της υπαραχνοειδούς αιμορραγίας
- **Επαναληπτικές** αγγειογραφίες χρήσιμες στις υπαραχνοειδείς αιμορραγίες λόγω της δυναμικής φύσης των αγγειακών βλαβών

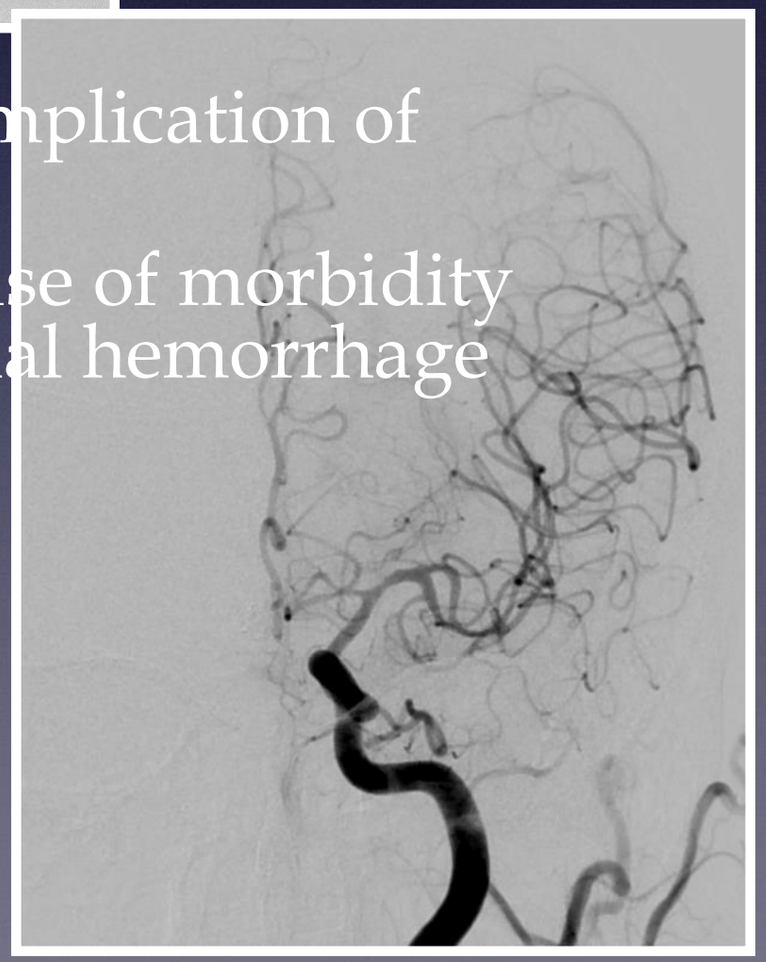


- 11 yo with thunderclap headache

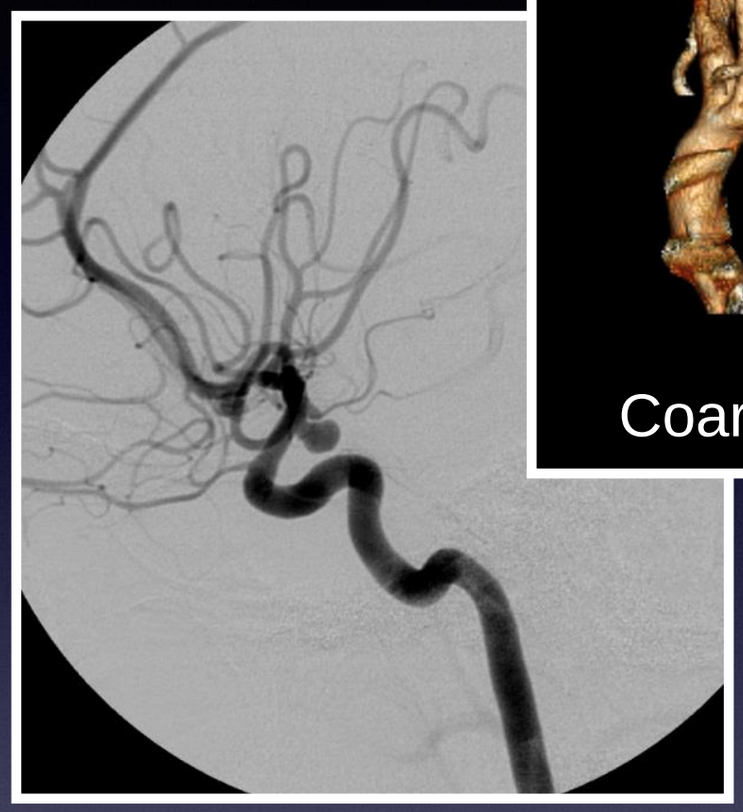
- Subarachnoid hemorrhage
  - Basal cisterns
  - Perimesencephalic
  - Convexity
  - +/- IVH

- Saccular aneurysms
- 85-90% of SAH
- Lack the internal elastic lamina and the muscular layer
- CoW: 90% anterior circulation including Pcom.

- Cerebral vasospasm
  - Common (20%) but poorly understood complication of SAH
  - Delayed cerebral ischemia is the major cause of morbidity and death in patients who survive the initial hemorrhage

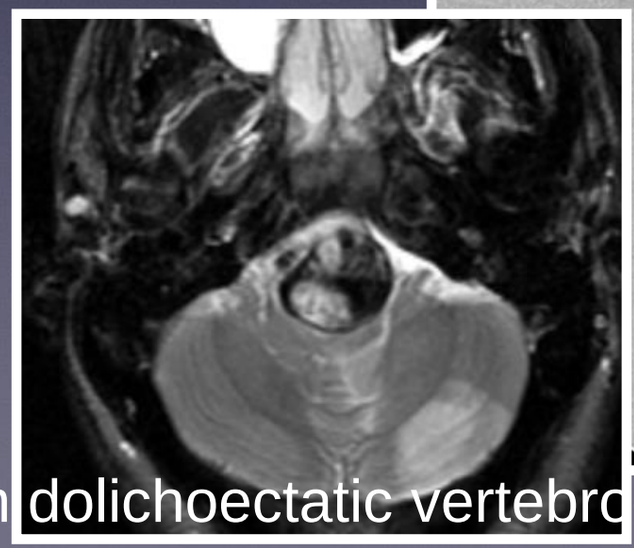


Cerebral Aneurysms

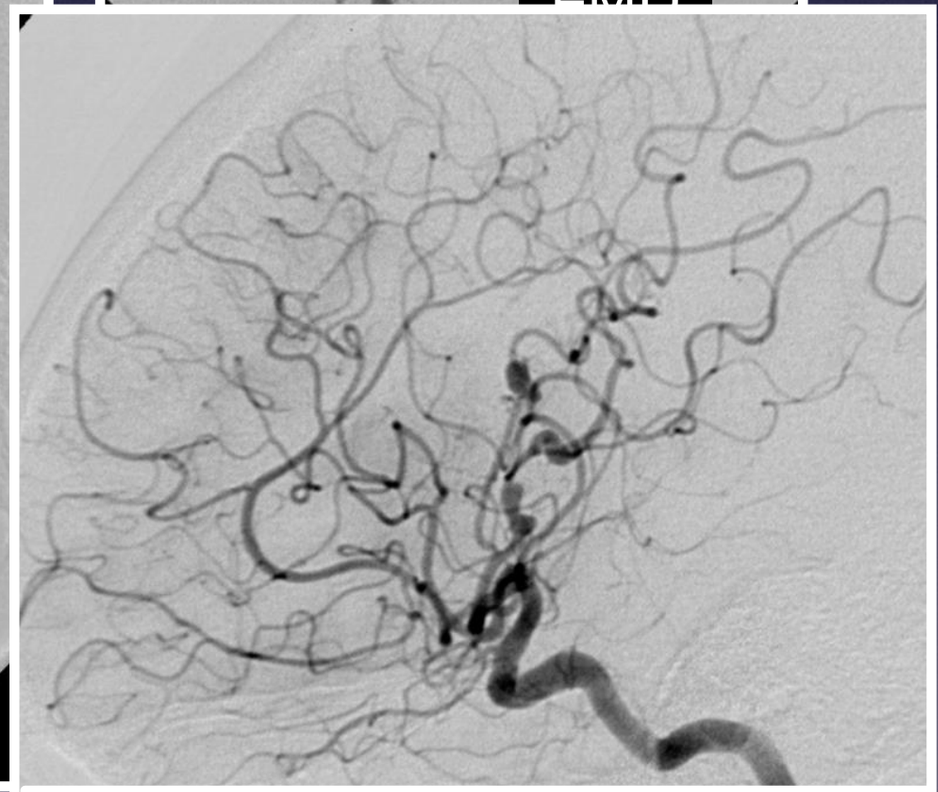


Coarctation

EMB



Fusiform dolichoectatic vertebro-basilar aneurysm



Mycotic pseudoaneurysms