

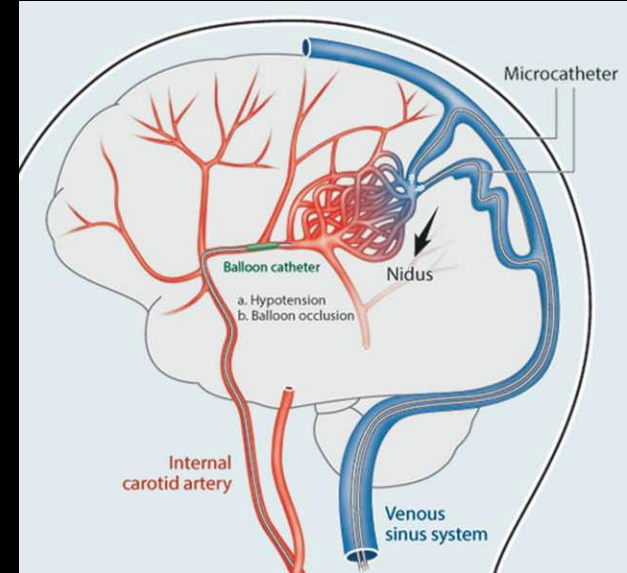


*medicina mínimamente invasiva
liderando el camino*

*minimally invasive medicine
leading the way*

**XXV SEMANA DEL INTERVENCIONISMO
MINIMAMENTE INVASIVO
BUENOS AIRES ARGENTINA**

4/6 JULIO 2016 HOTEL HILTON



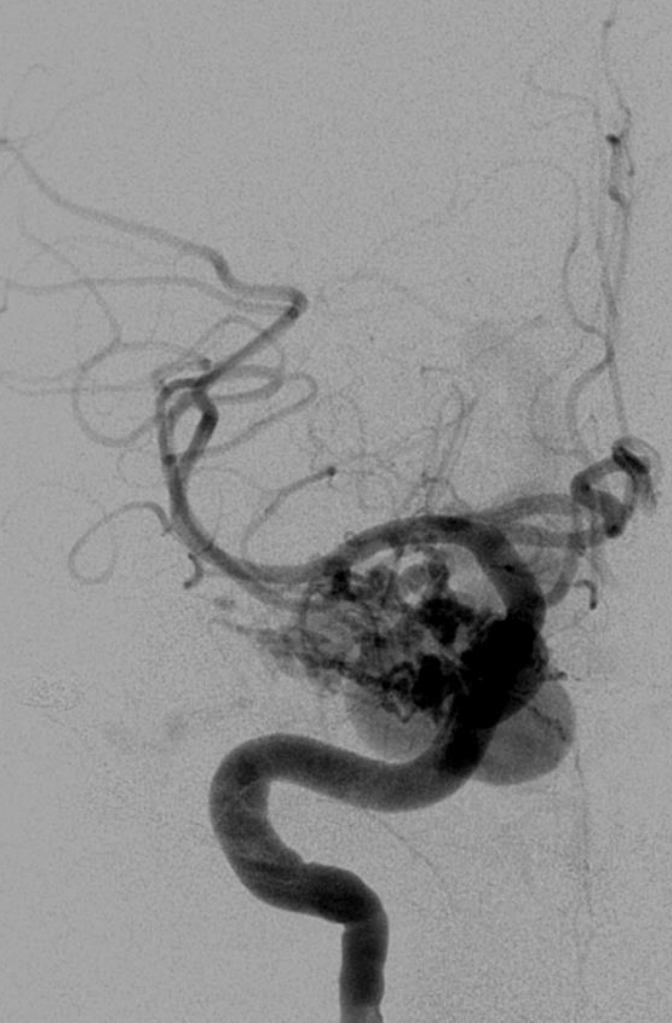
Transvenous Approach for Brain AVM's

Dr. Angel Ferrario

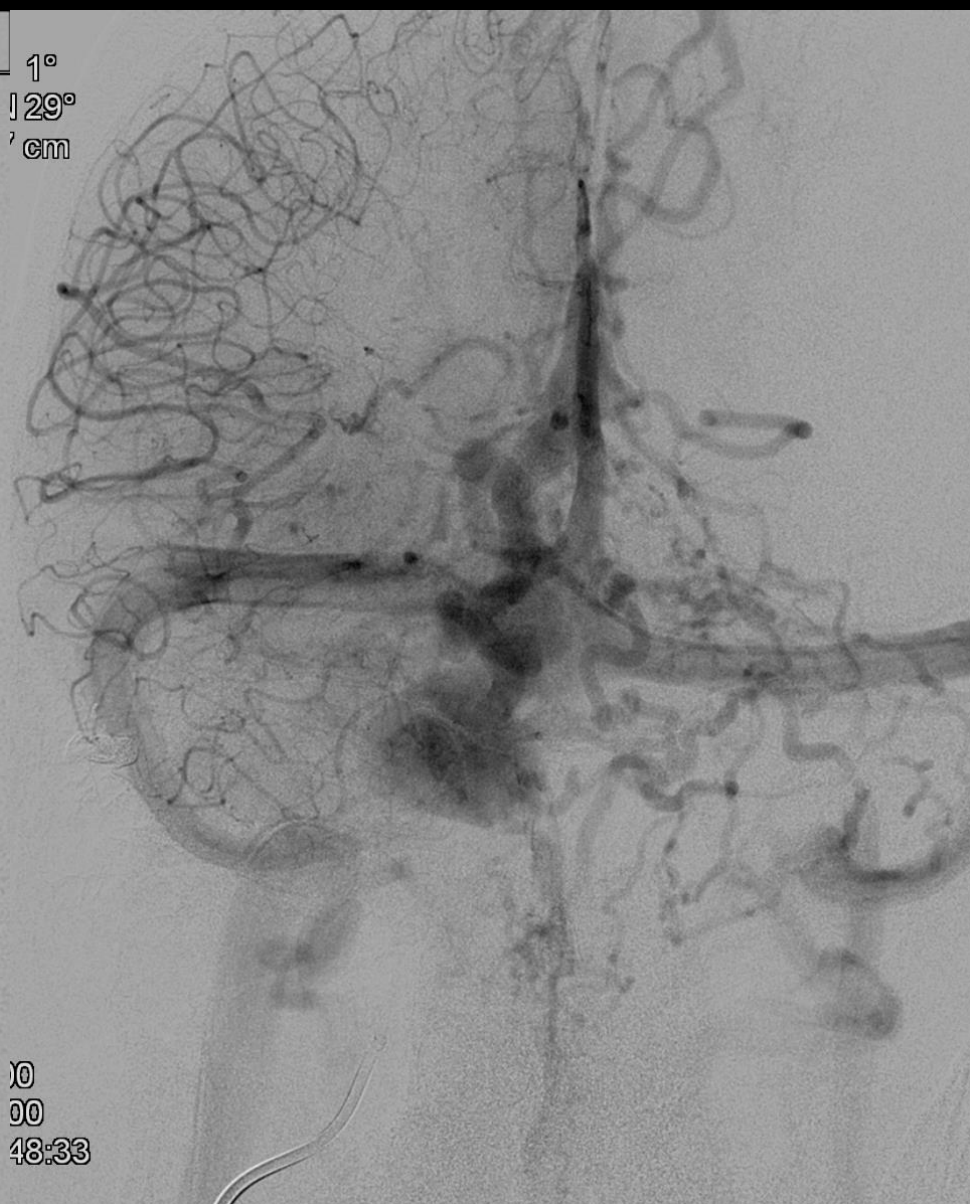


CAR.INT.DER.FRENTE.PRE EMBOL

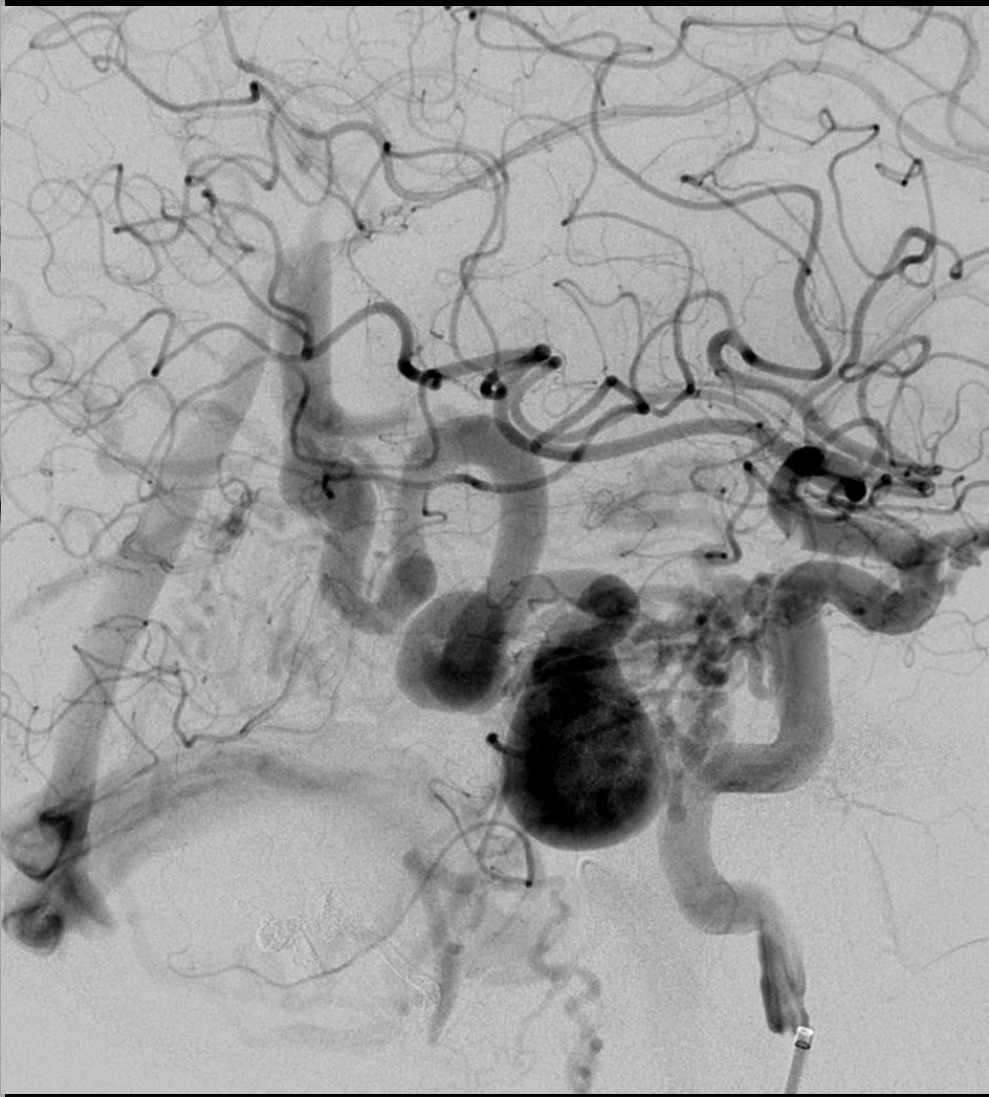
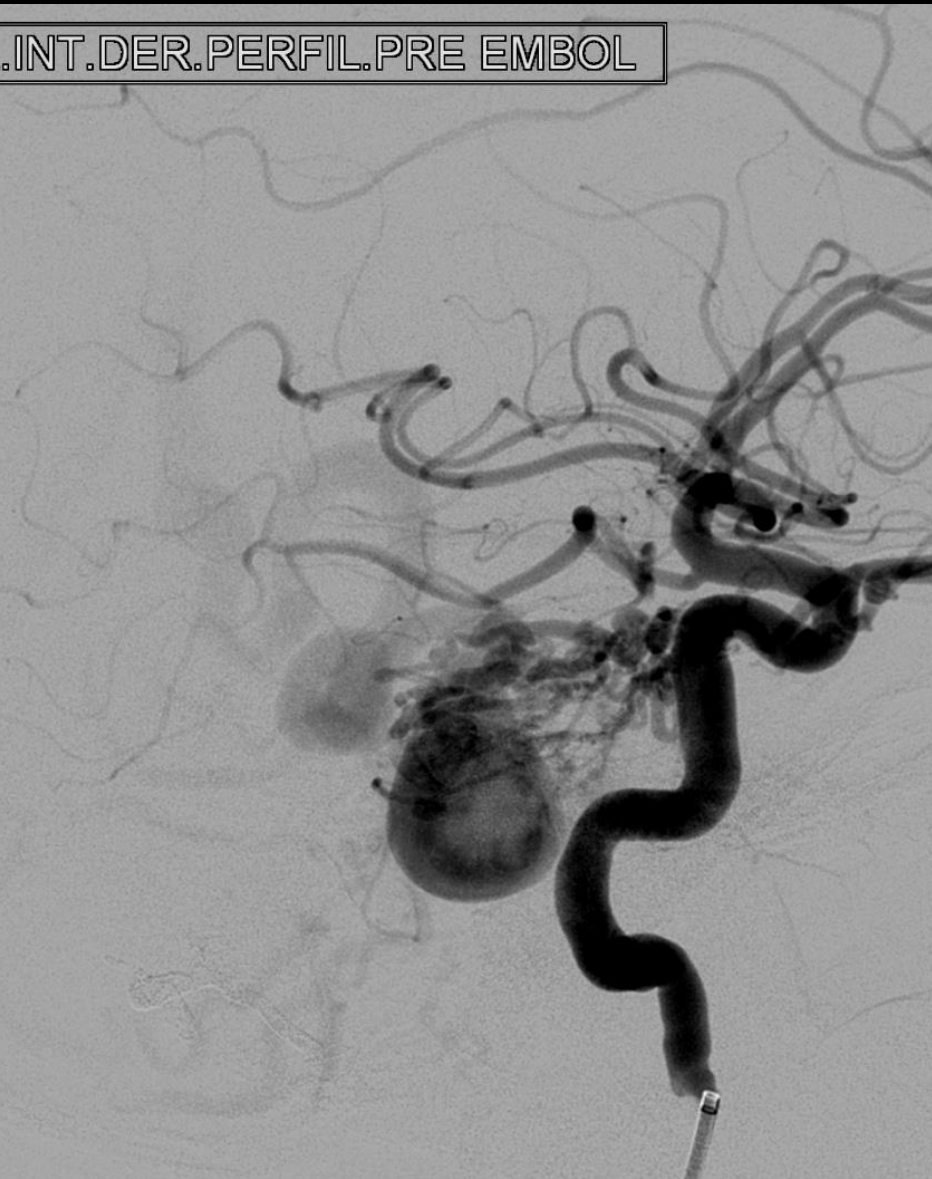
1°
129°
cm

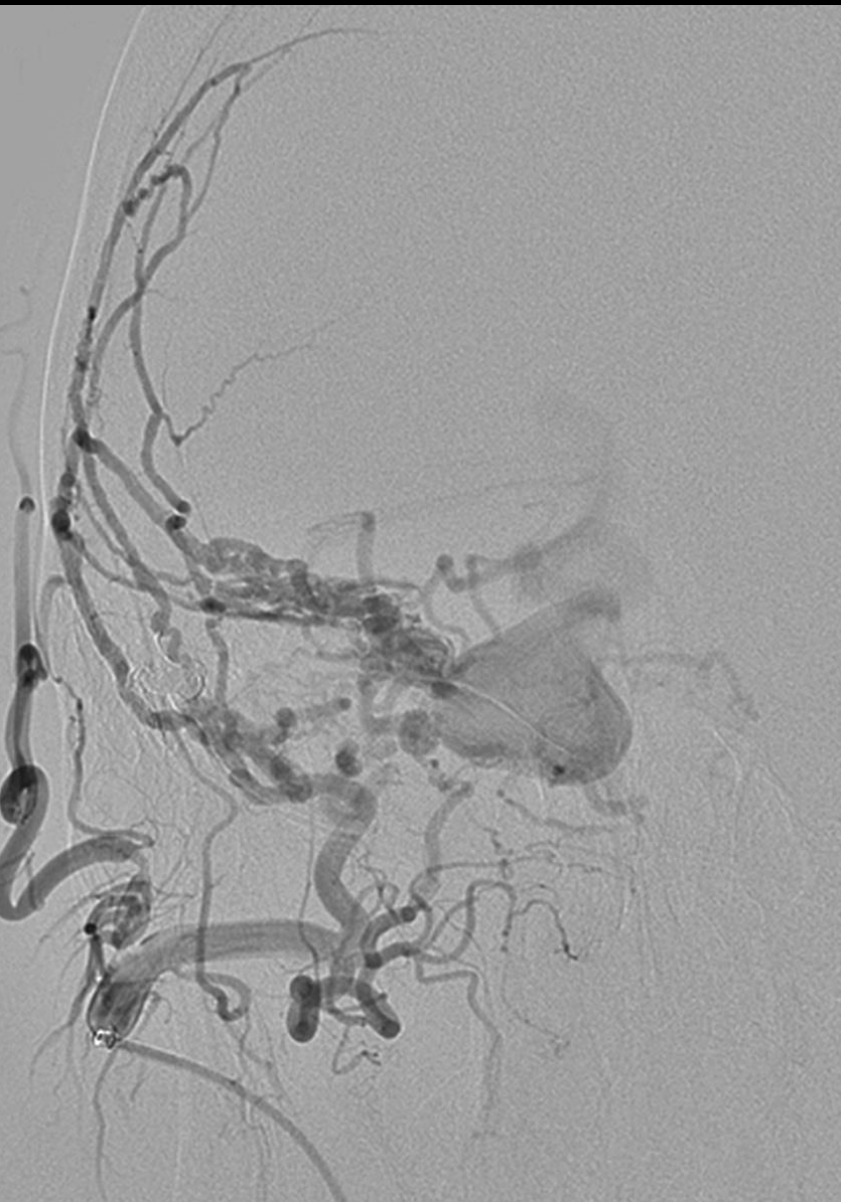


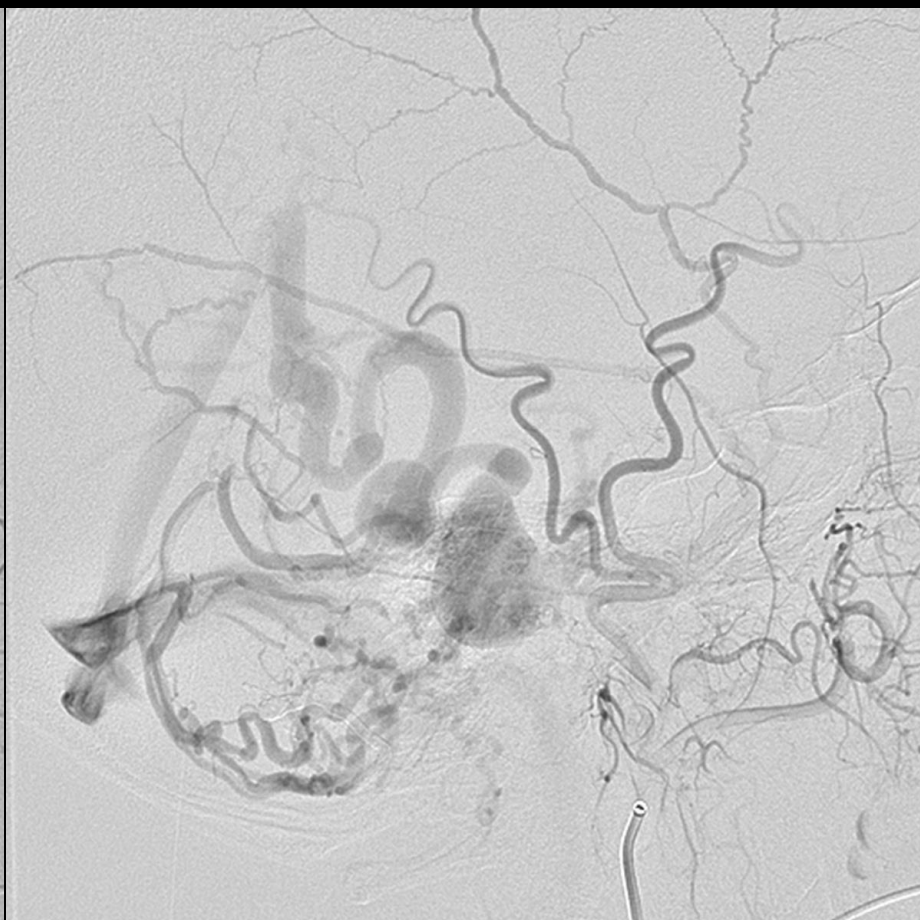
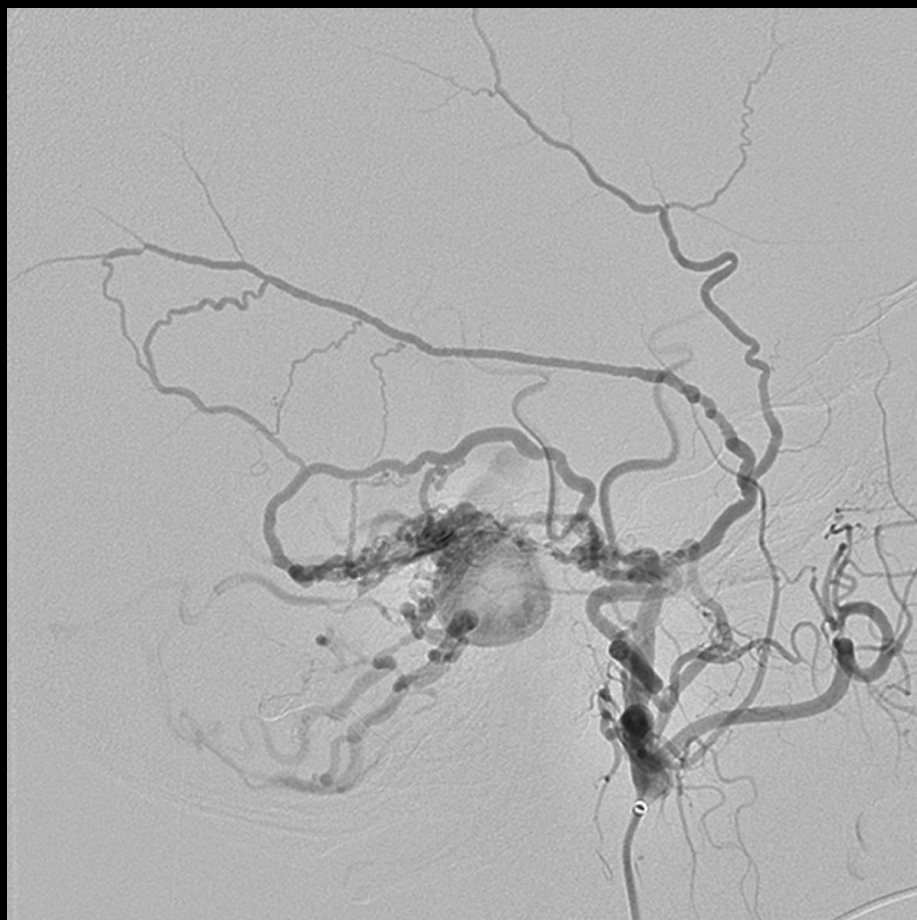
10
00
48:33

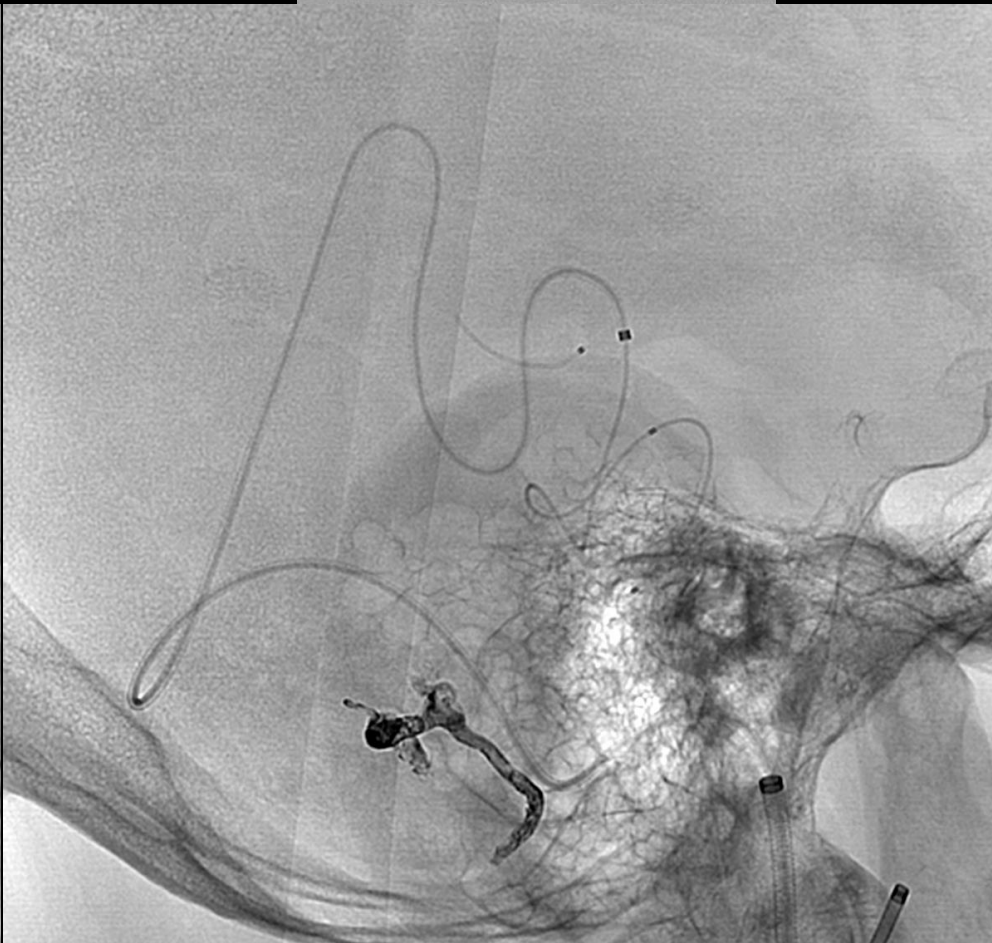
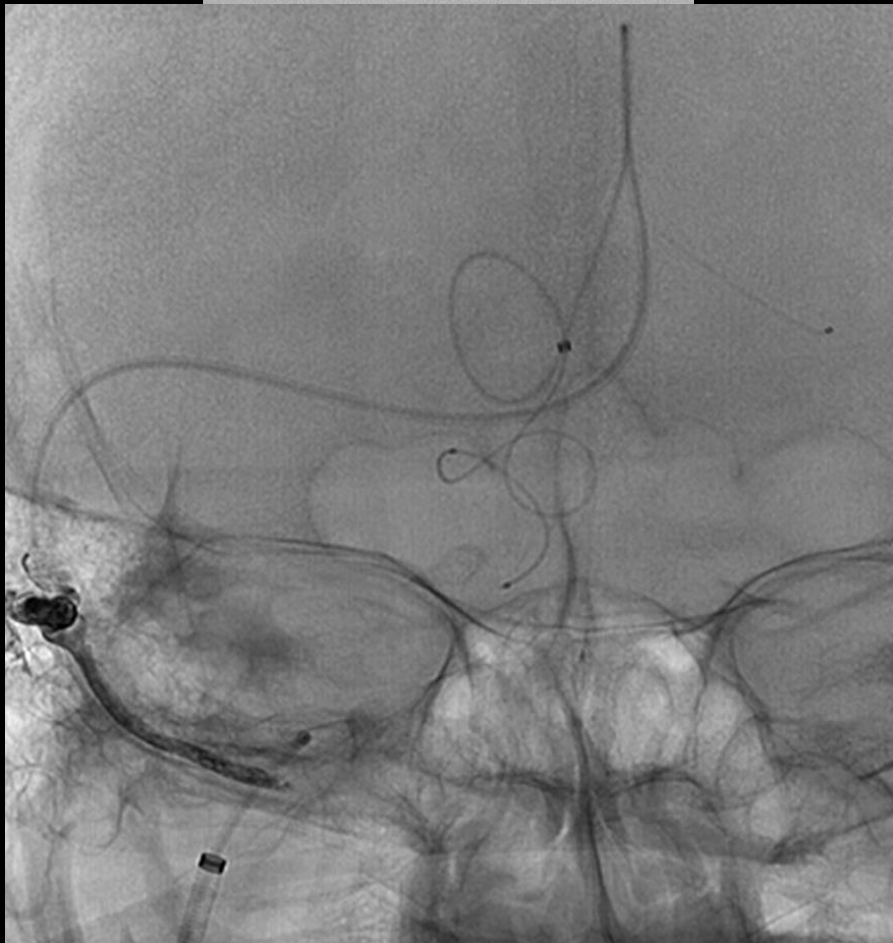
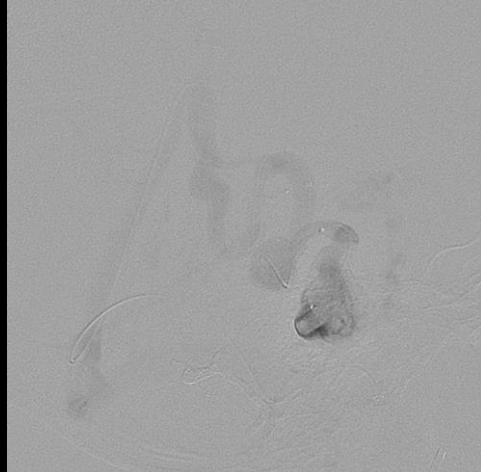
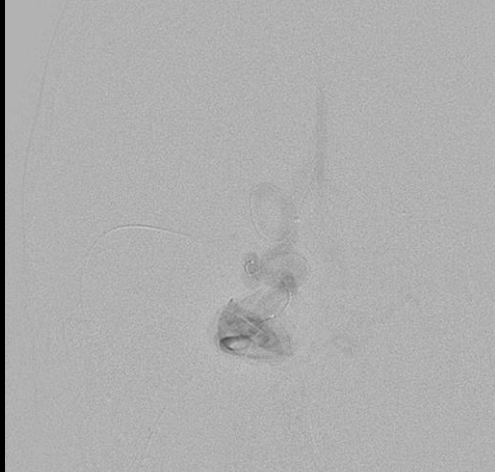


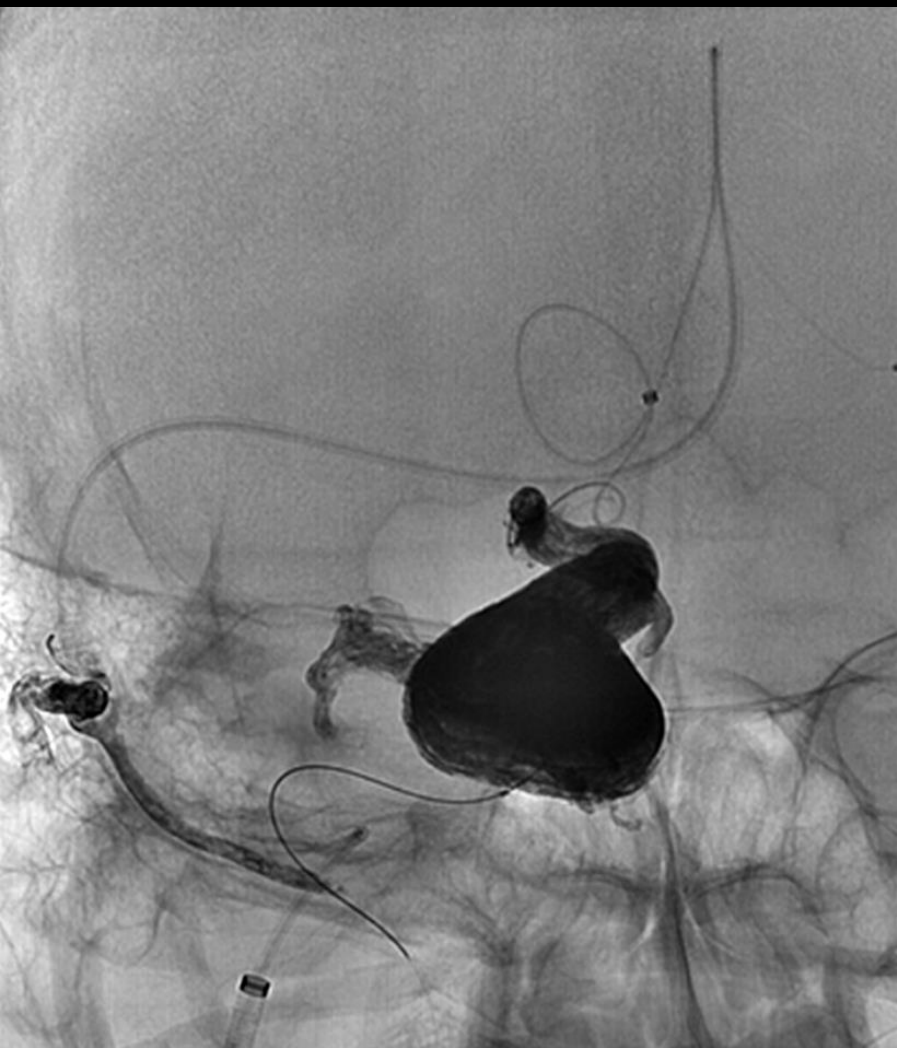
.INT.DER.PERFIL.PRE EMBOL









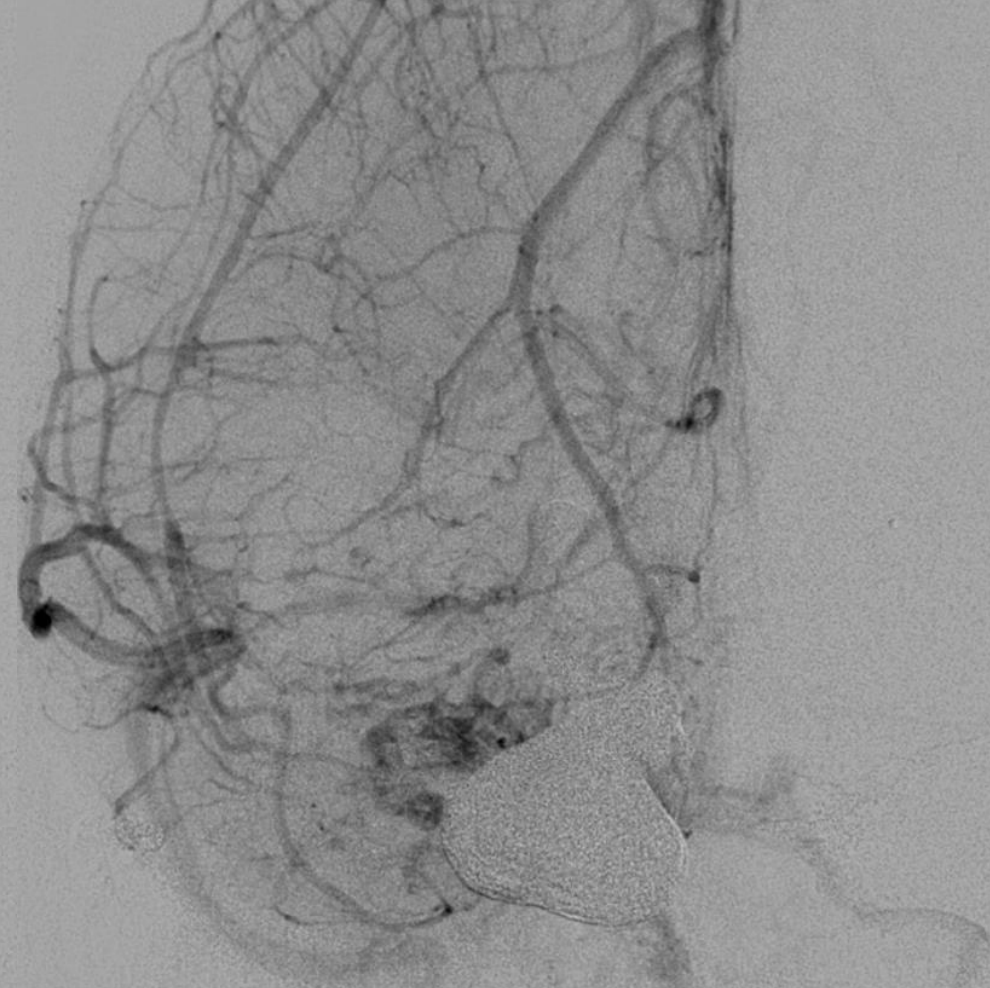
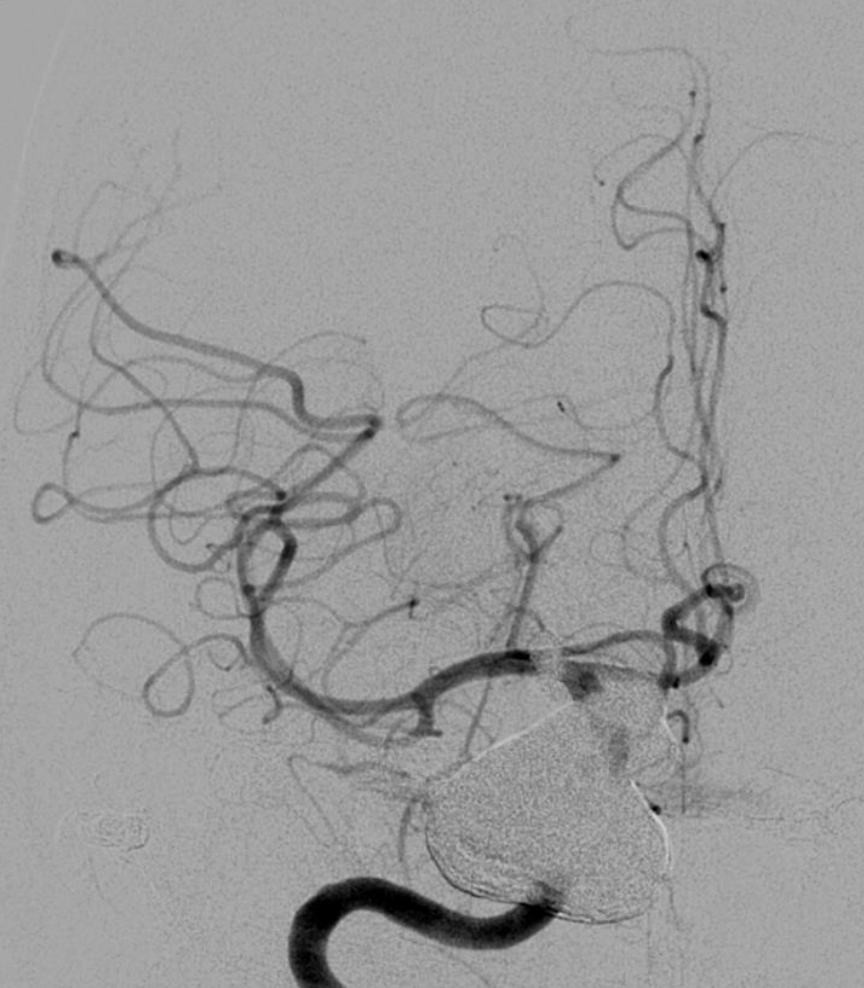


1°
AN 31°
27 cm

CAR.INT.DER.FRENTE.POS

1°
AN 31°
27 cm

>



2:00
3:67
7:55:49

2:00
10:50
7:55:49

OAI 1°
CRAN 30°
FD 27 cm

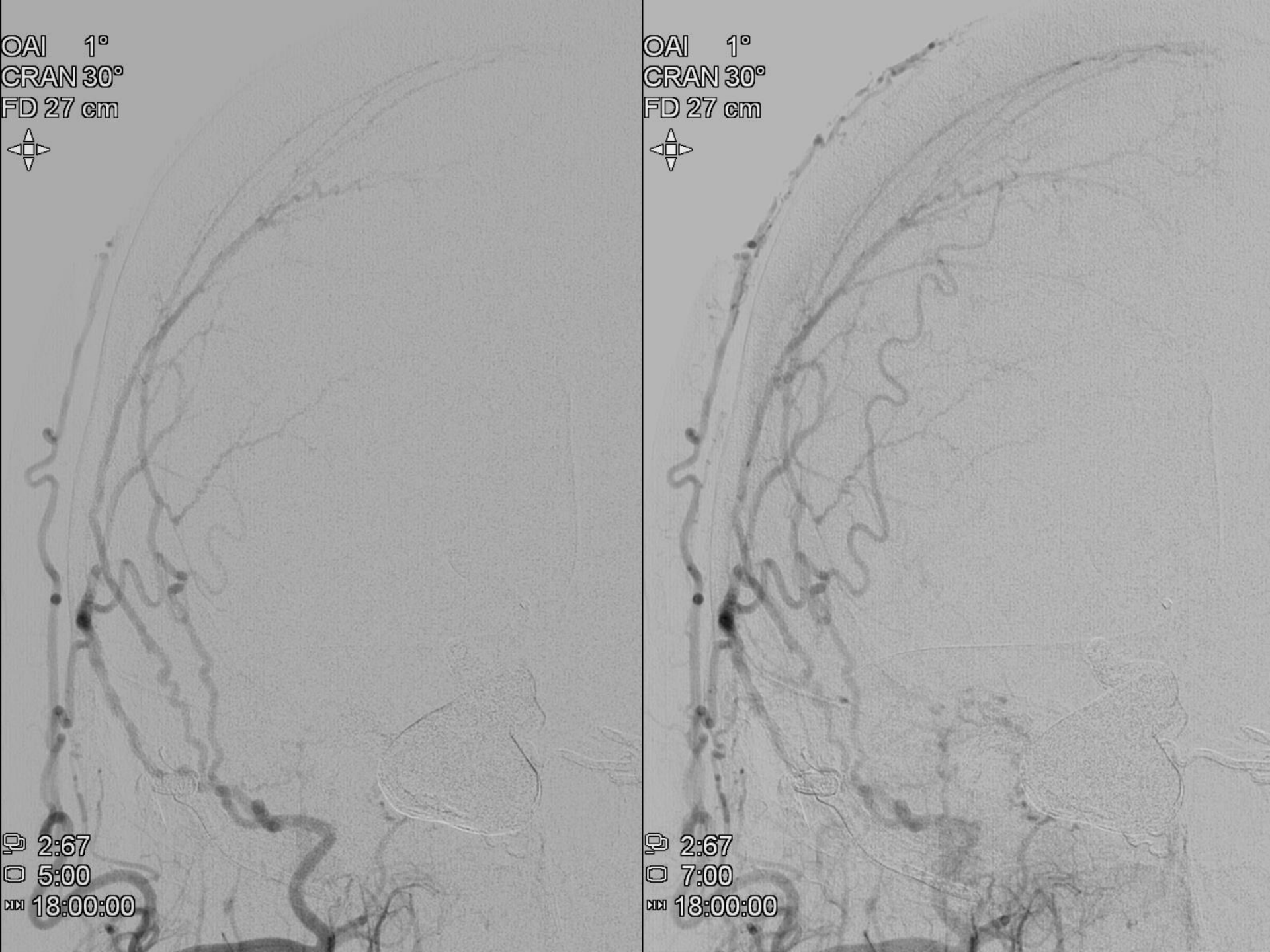


2:67
5:00
18:00:00

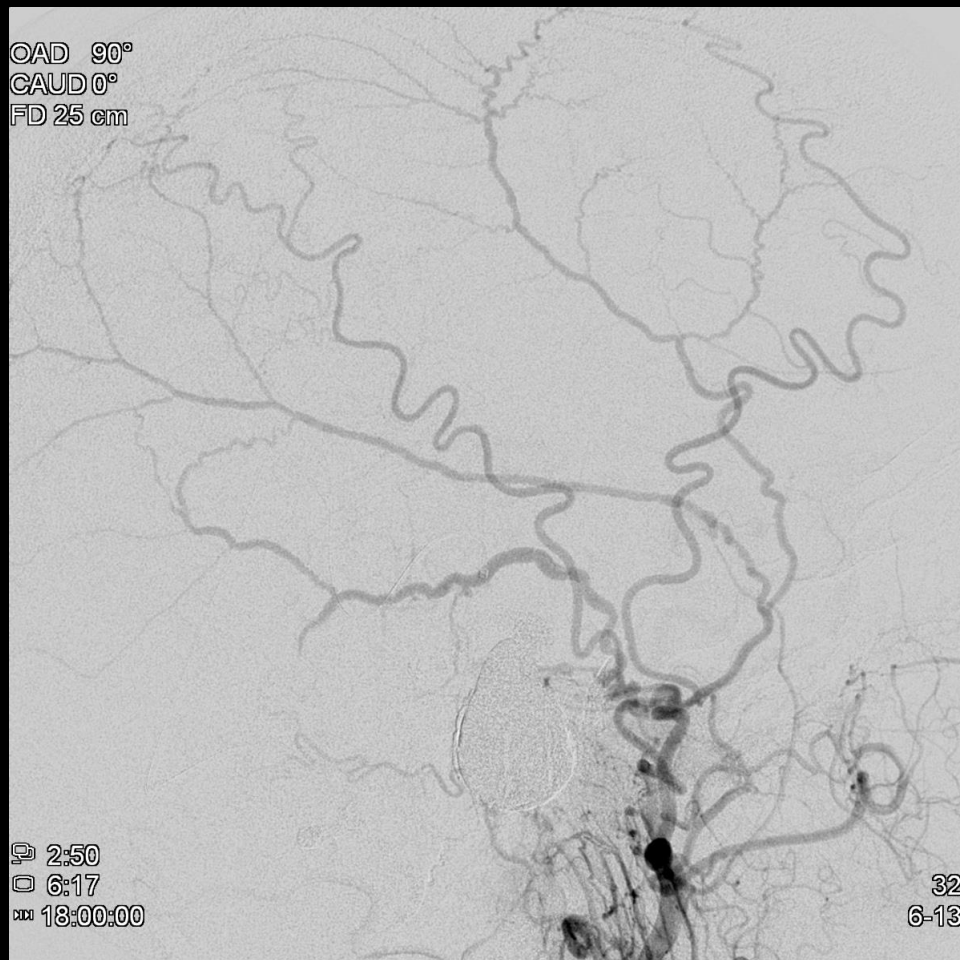
OAI 1°
CRAN 30°
FD 27 cm



2:67
7:00
18:00:00

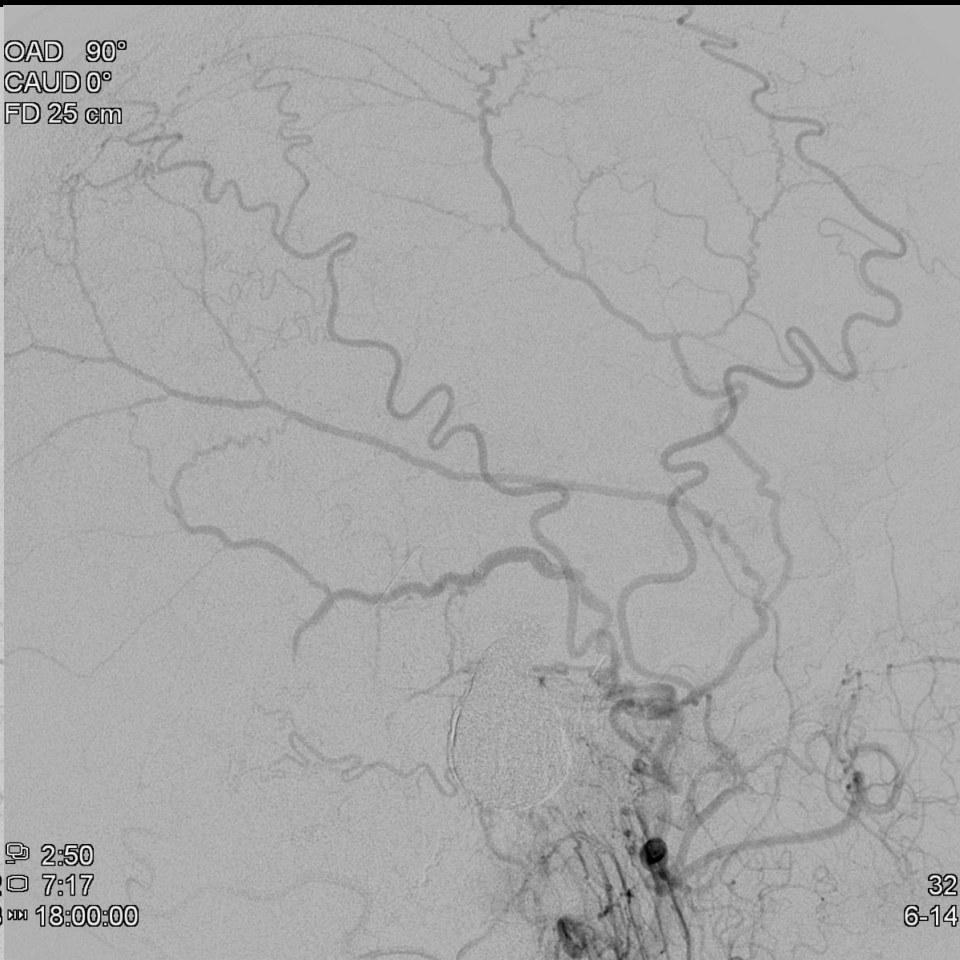


OAD 90°
CAUD 0°
FD 25 cm



2:50
6:17
18:00:00

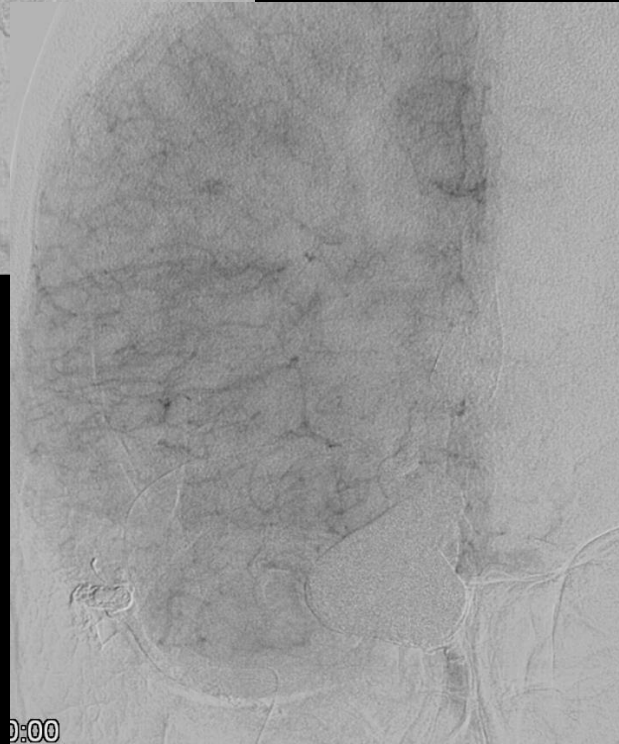
OAD 90°
CAUD 0°
FD 25 cm



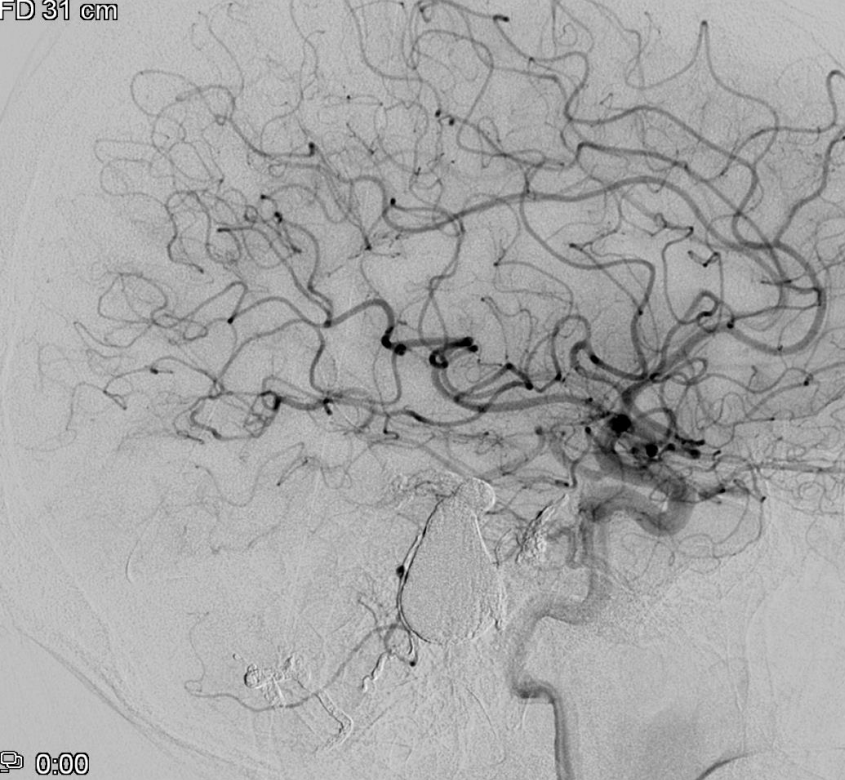
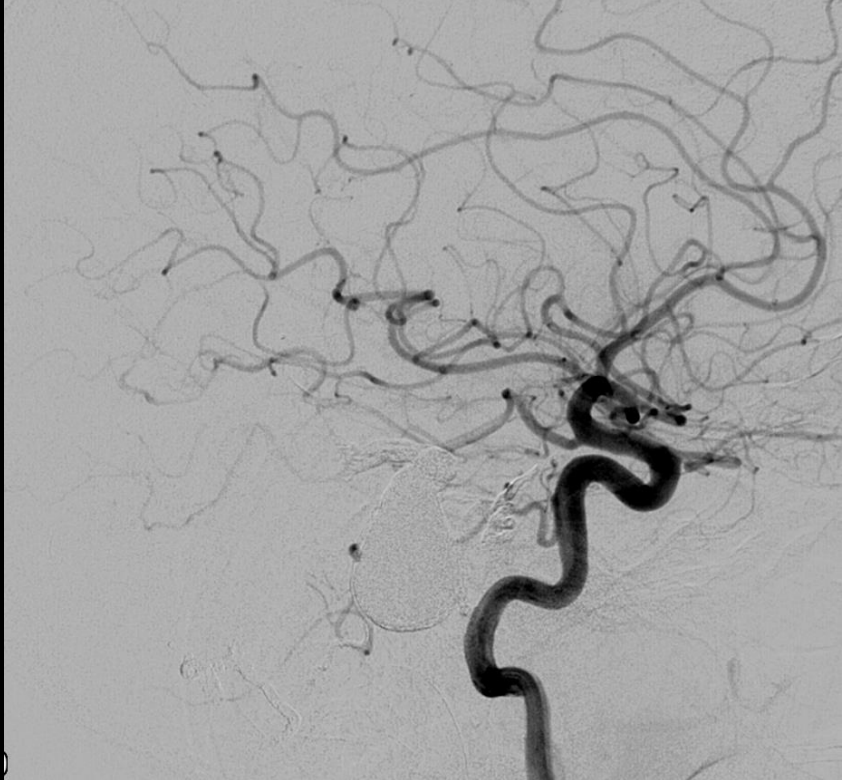
2:50
32 6:13
7:17
18:00:00

32
6:14

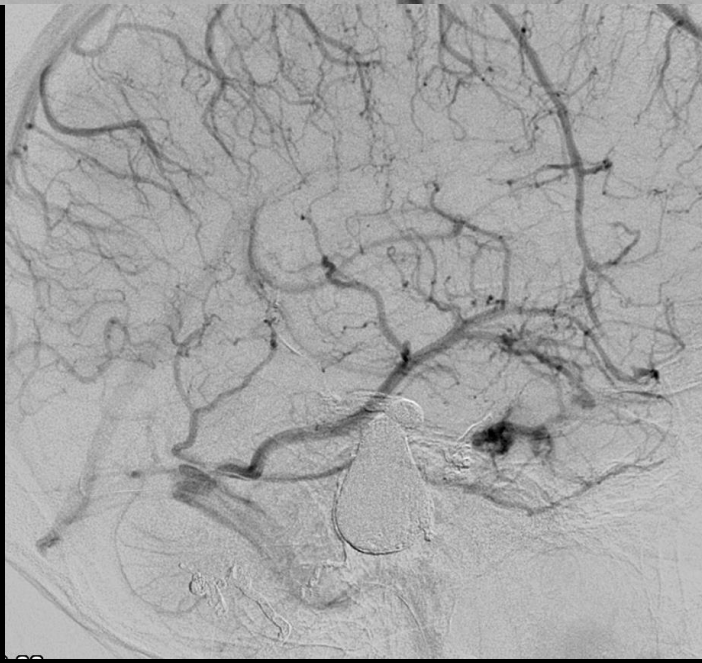
DSA F-Up 6 M



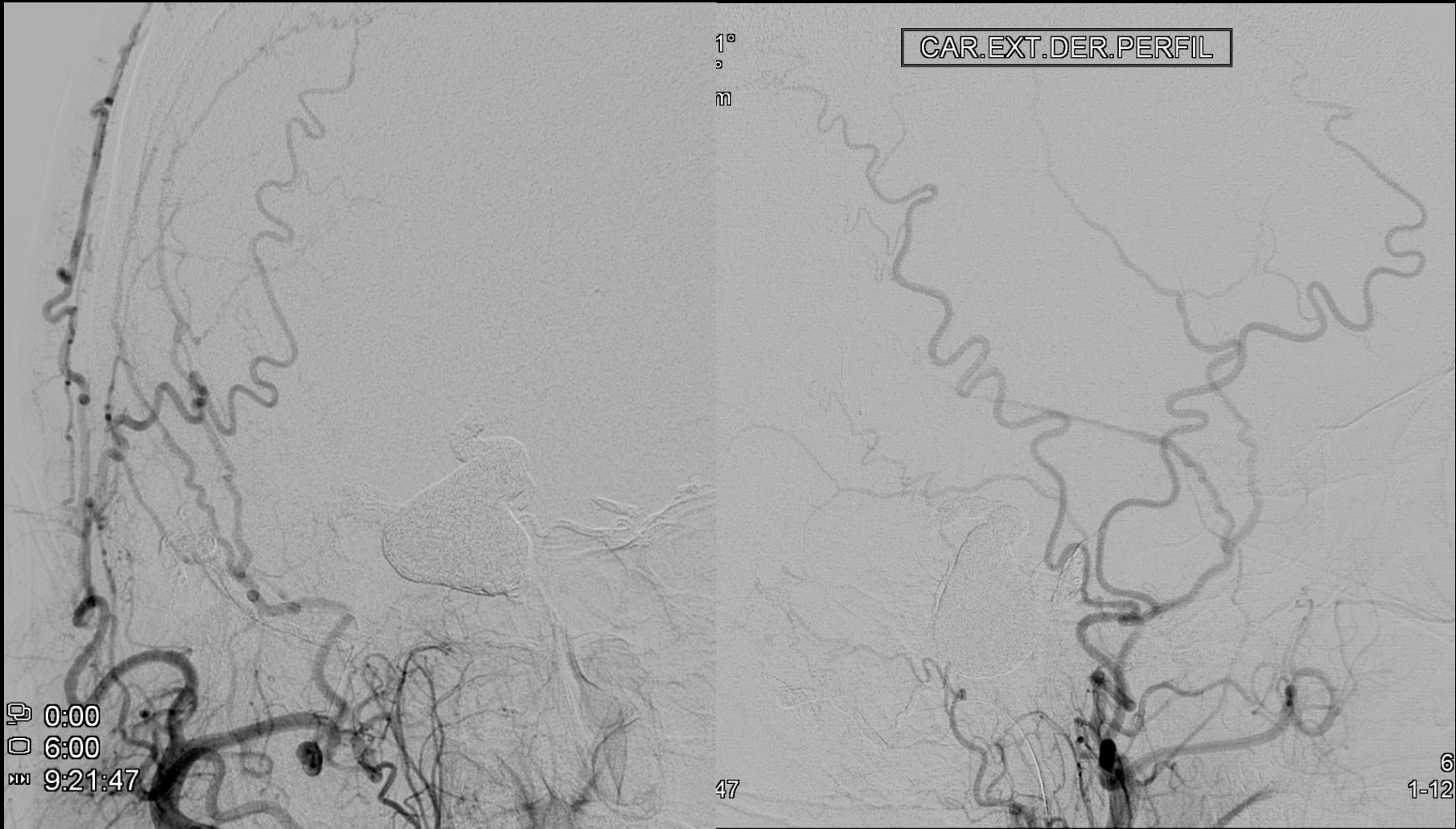
FD 31 cm



0:00



0:00
11:00



CAR. EXT. DER. PERFIL

1°
3
m

0:00
6:00
9:21:47

47

6
1-12

THE VENOUS « CONCEPT »

- Complete venous occlusion

Complete anatomical cure

Increased risk of bleeding

VENOUS APPROACH

INDICATIONS

IT DOES APPLY FOR

- > VIRGIN AVMs
- > POST EVT. REMNANT
- > POST SURGICAL REMNANT
- > POST RADIO-SURGICAL REMNANT

VENOUS APPROACH

TECHNIQUE

- Jugular access
- Intermediate catheter
- Detachable tip microcatheter
- Arterial Micro-microcatheter
- Onyx -Phil



VENOUS APPROACH FOR BRAIN ARTERIO- VENOUS MALFORMATIONS

A Ferrario, R Ceratto, E Scrivano, J Chudyk, R Romero, J Lundquist, P Lylyk

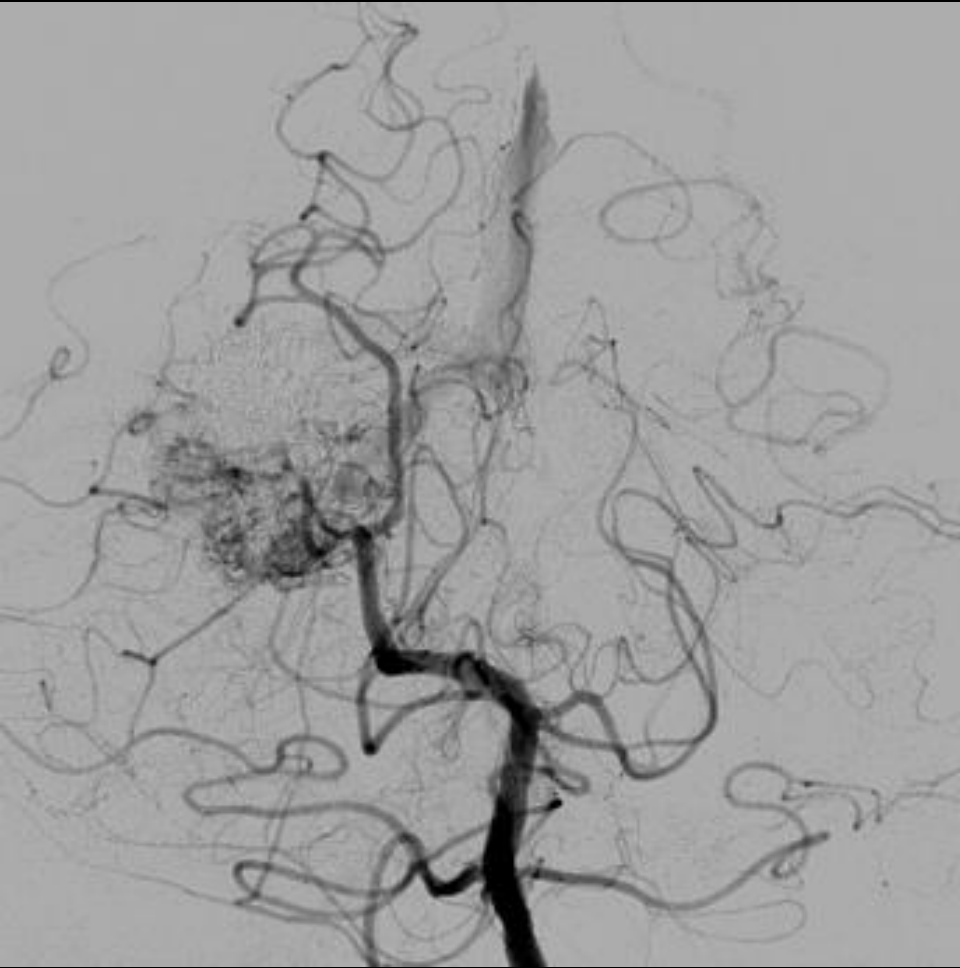
August 2012 and April 2013

3 patients (2 males; mean age, 32.5 years) underwent trans-venous embolization of residual brain AVM.

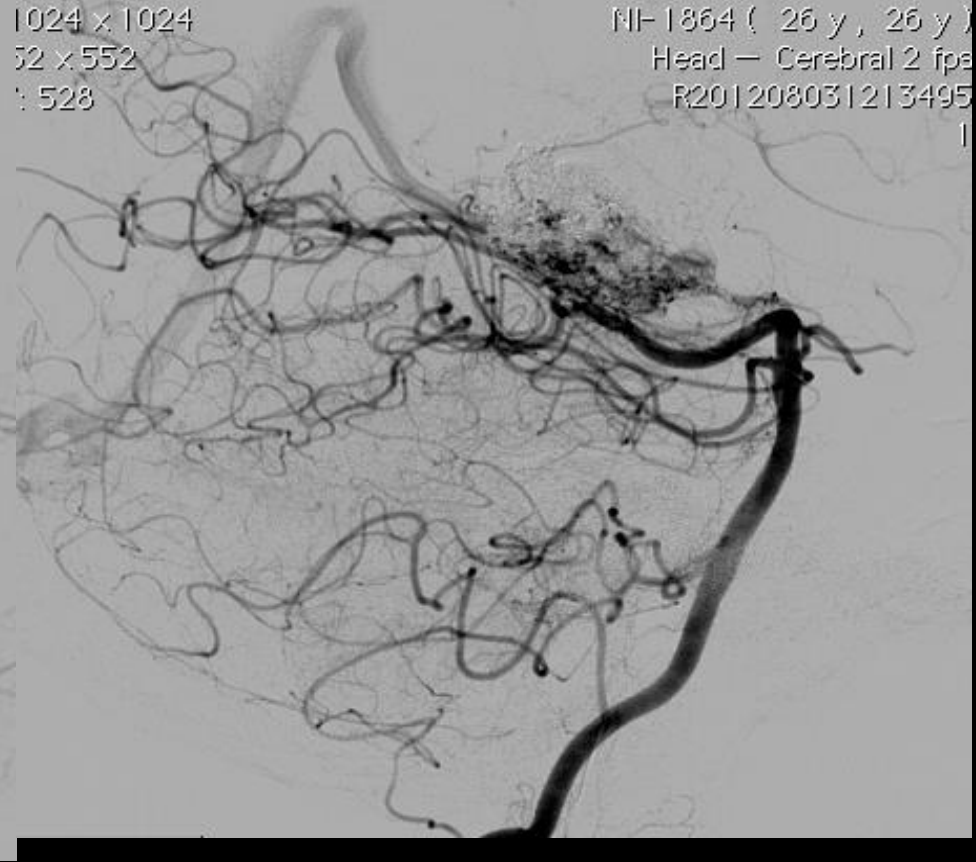
The clinical presentation was intraventricular hemorrhage in two cases and headache and seizures in the last one.

Two patients were previously treated with arterial approach and the other, with arterial approach and radiosurgery Leksell Gamma-knife.

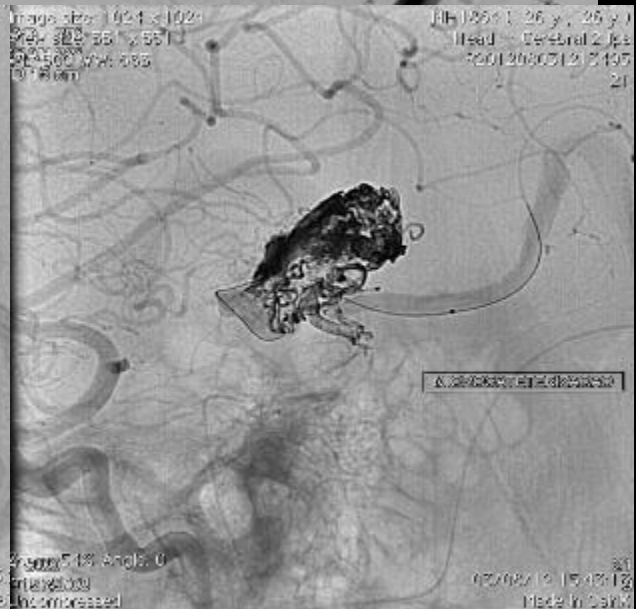
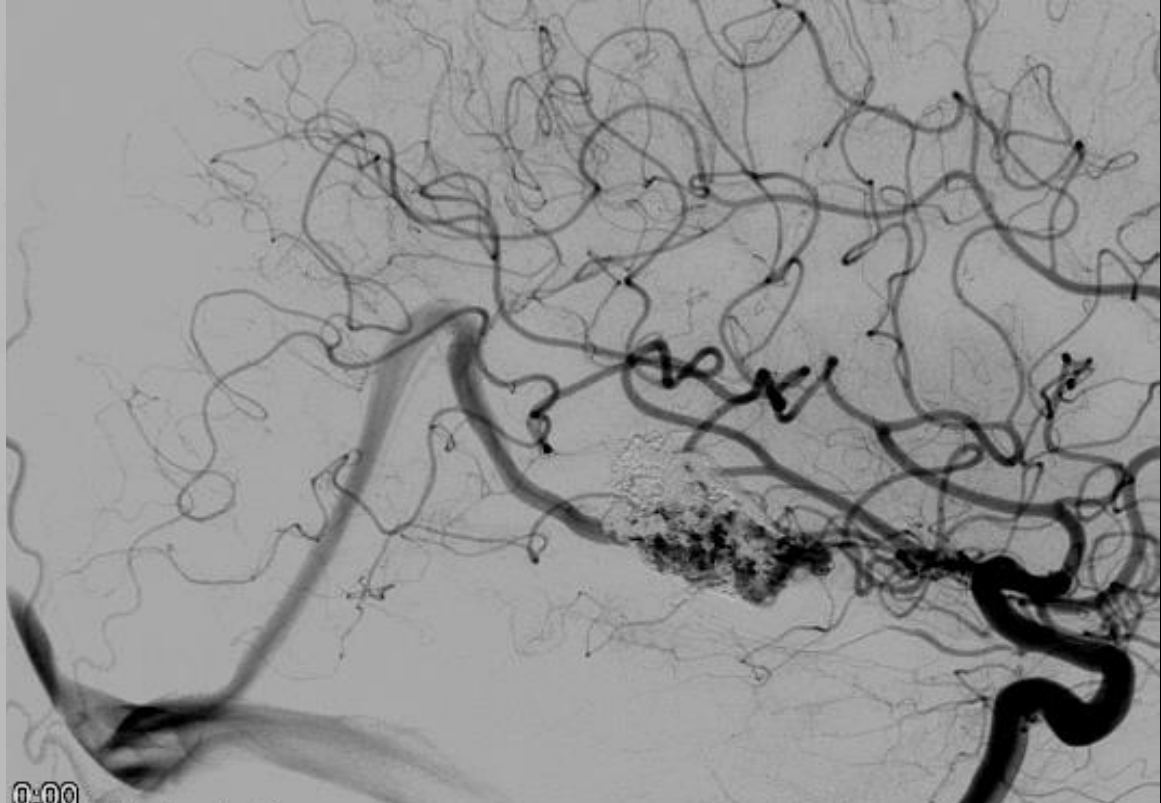
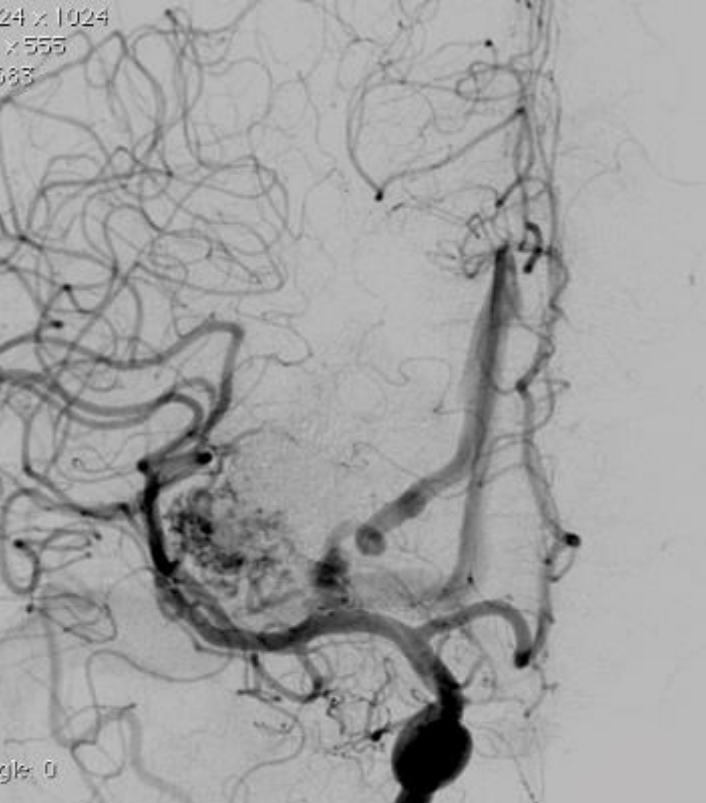
Transvenous Approach AVM



1024 x 1024
52 x 552
: 528



NI-1864 (26 y , 26 y)
Head — Cerebral 2 fps
R201208031213495
1

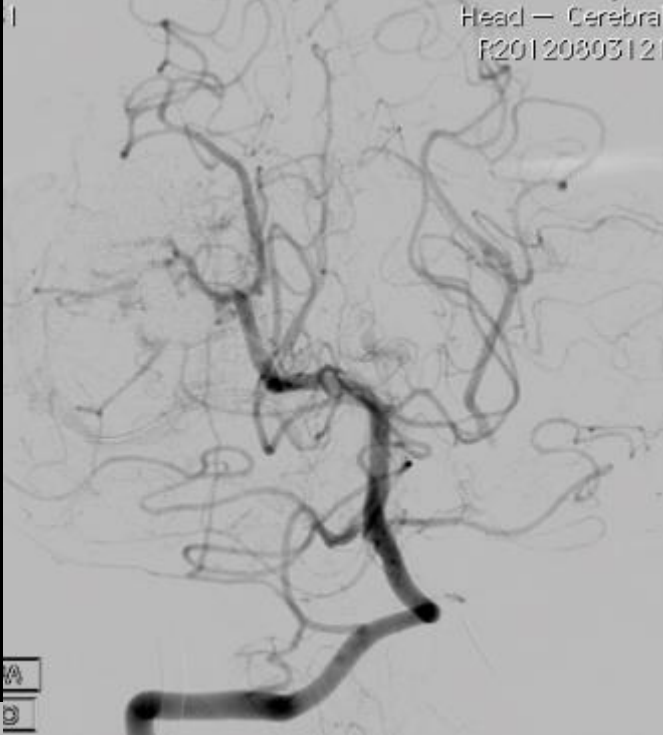


RF: 12011 26 y, 26 y 16
Head - Cerebral 2 Ips
R201200012 2495
17

RF: 12011 26 y, 26 y 16
Head - Cerebral 2 Ips
R201200012 2495
21

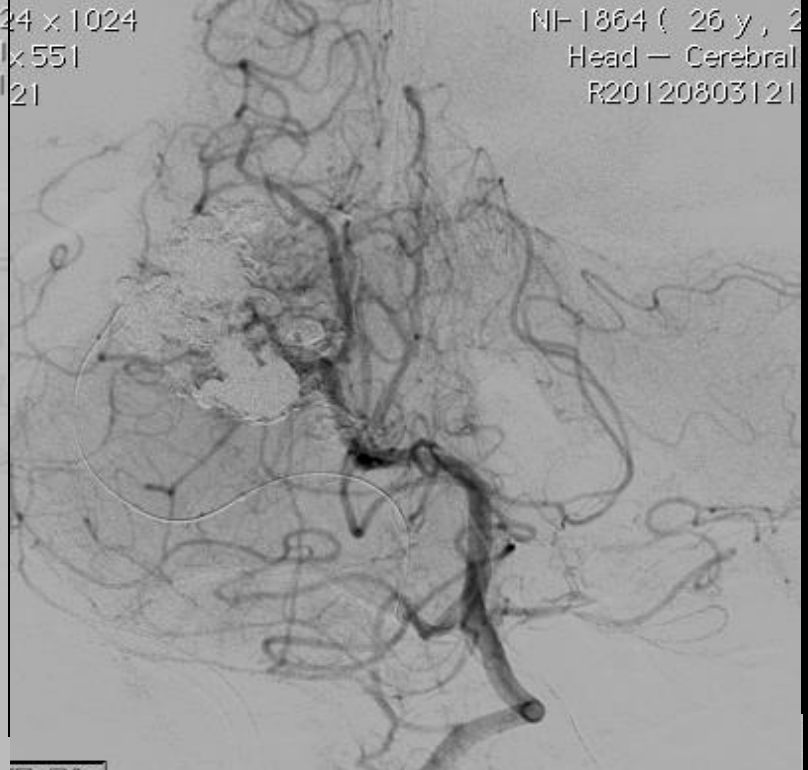
1024

NH-1864 (26 y , 24 x 1024
Head - Cerebral x 551
R20120803121 21

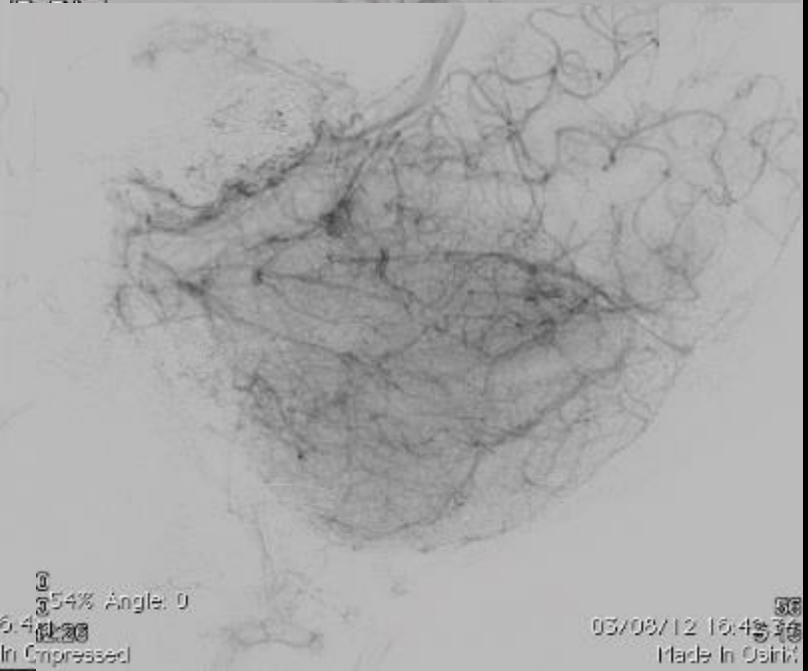


A
B

NH-1864 (26 y , 2
Head - Cerebral
R20120803121



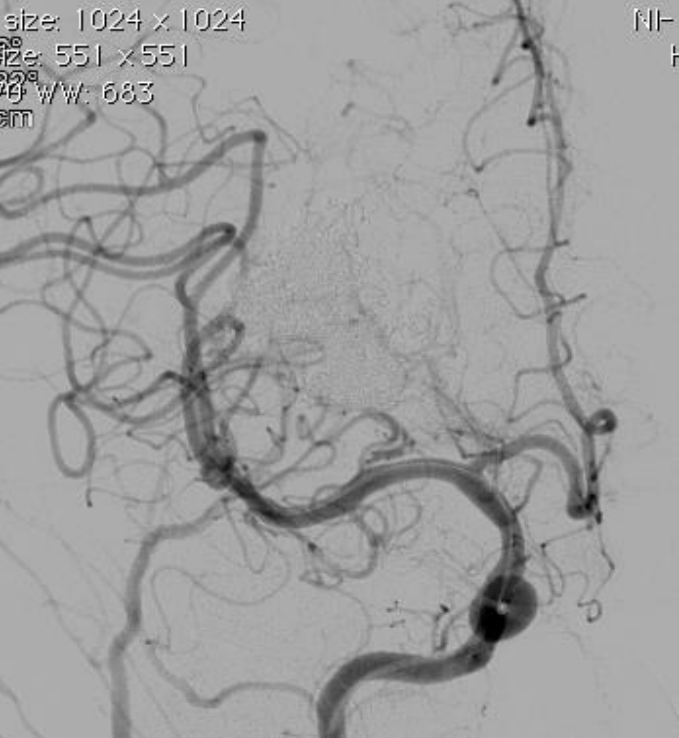
2:50
3:40
3:41
Uncompressed



3:54
3:54
3:54
Made In Ostrich

3:58
3:58
3:58
Made In Ostrich

size: 1024 x 1024
size: 551 x 551
W/W: 683
FD 25 cm



NIH image size: 1024 x 1024
size: 551 x 551
W/W: 490
FD 25 cm

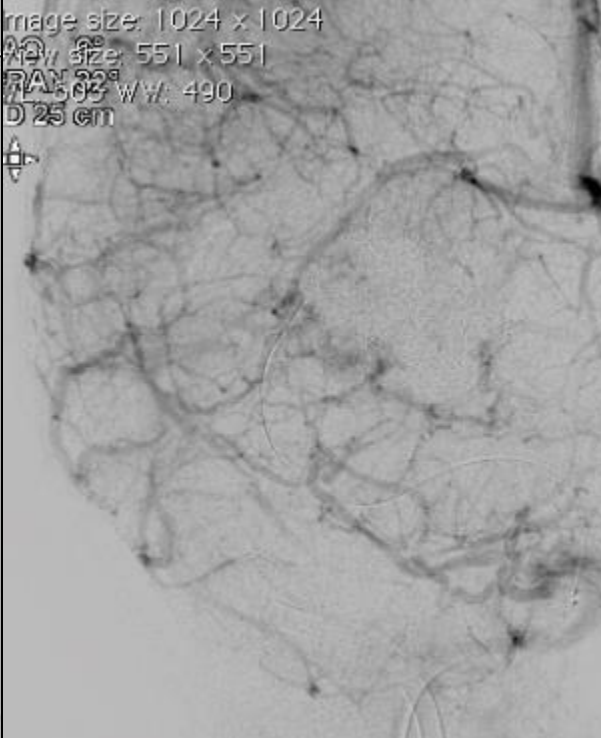
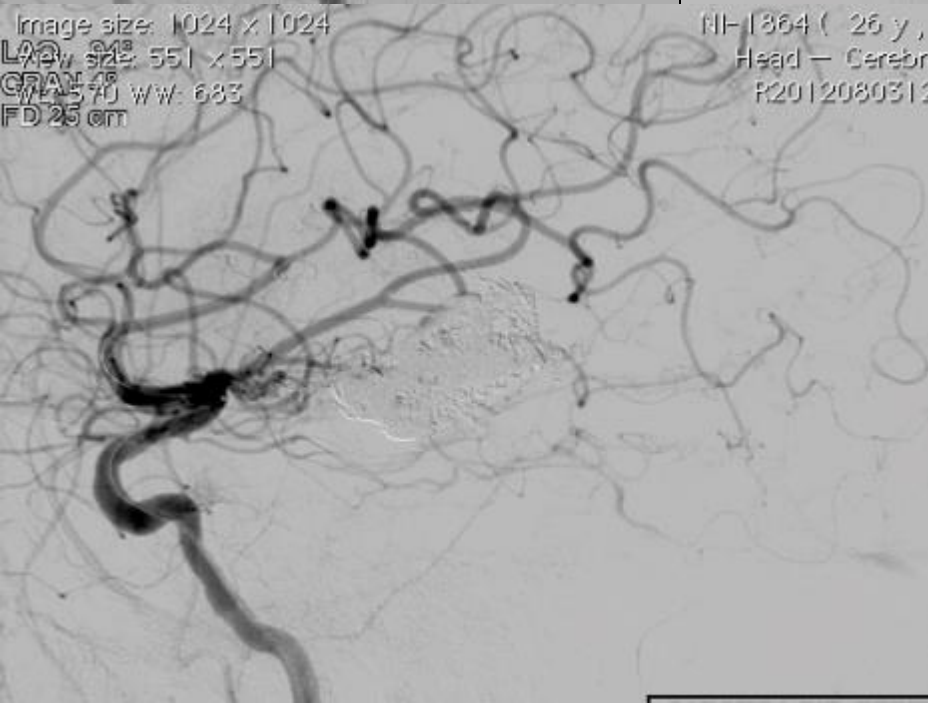
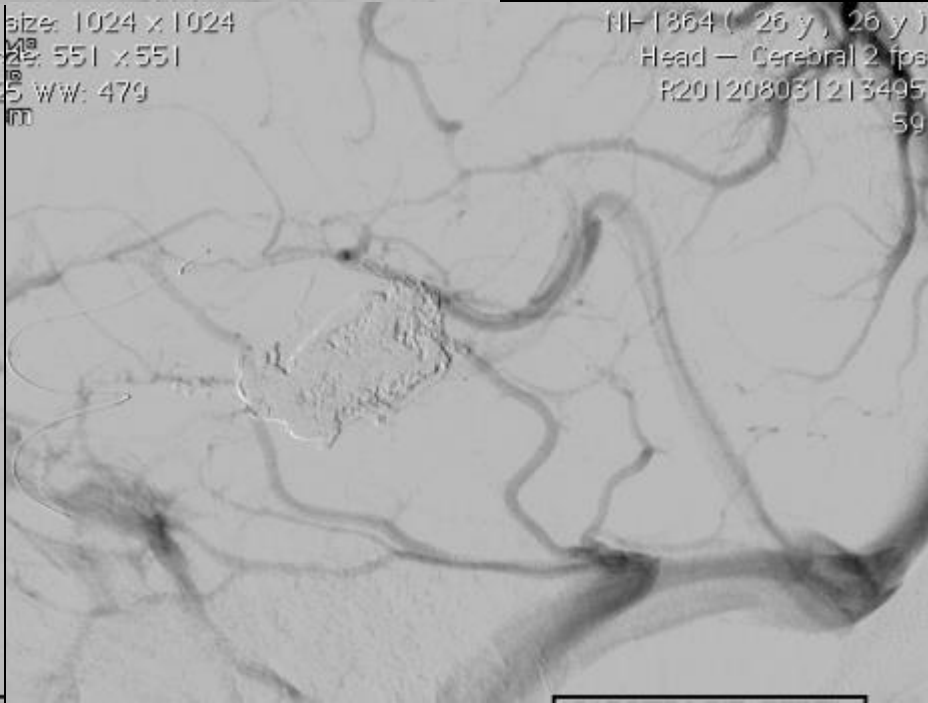


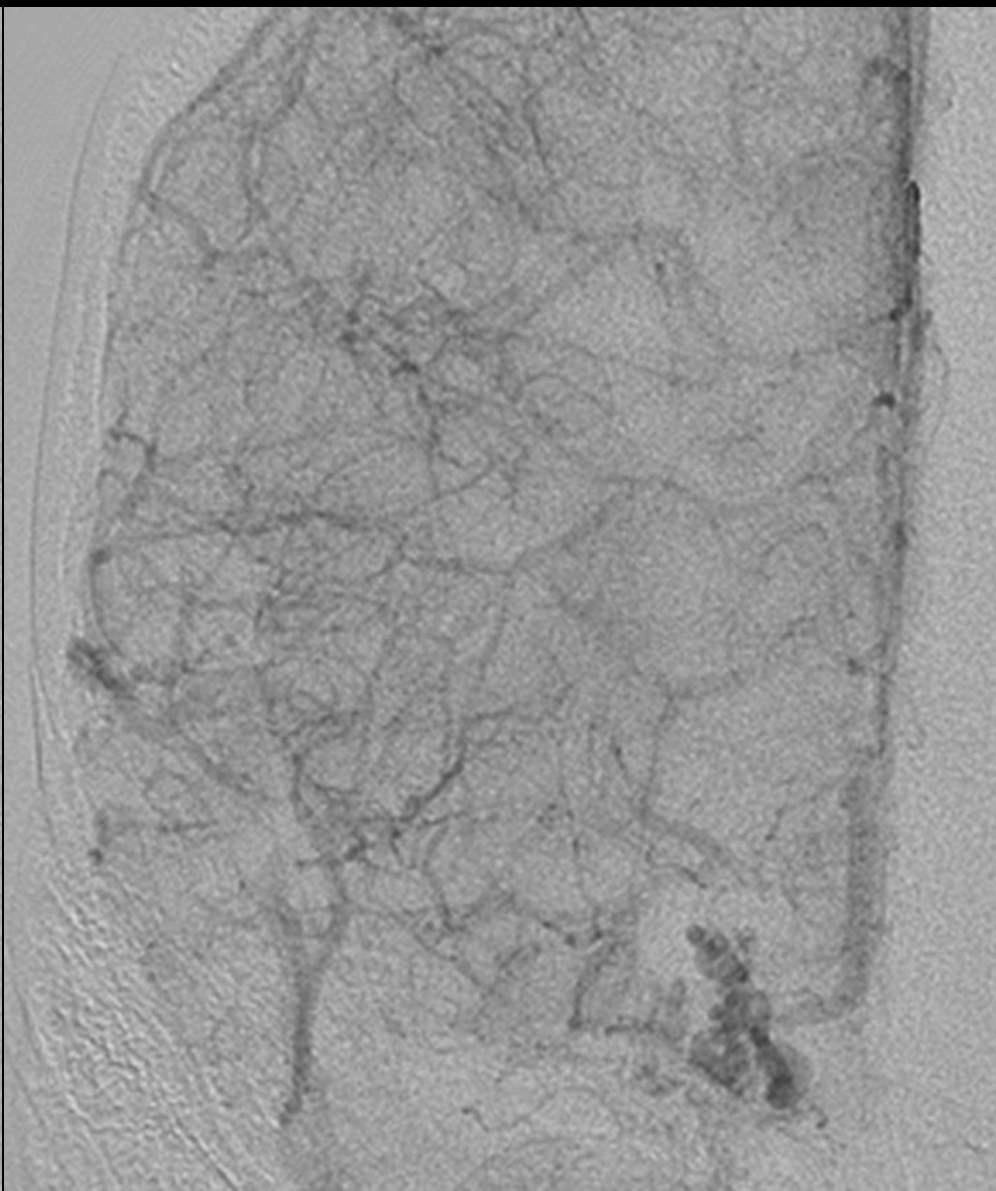
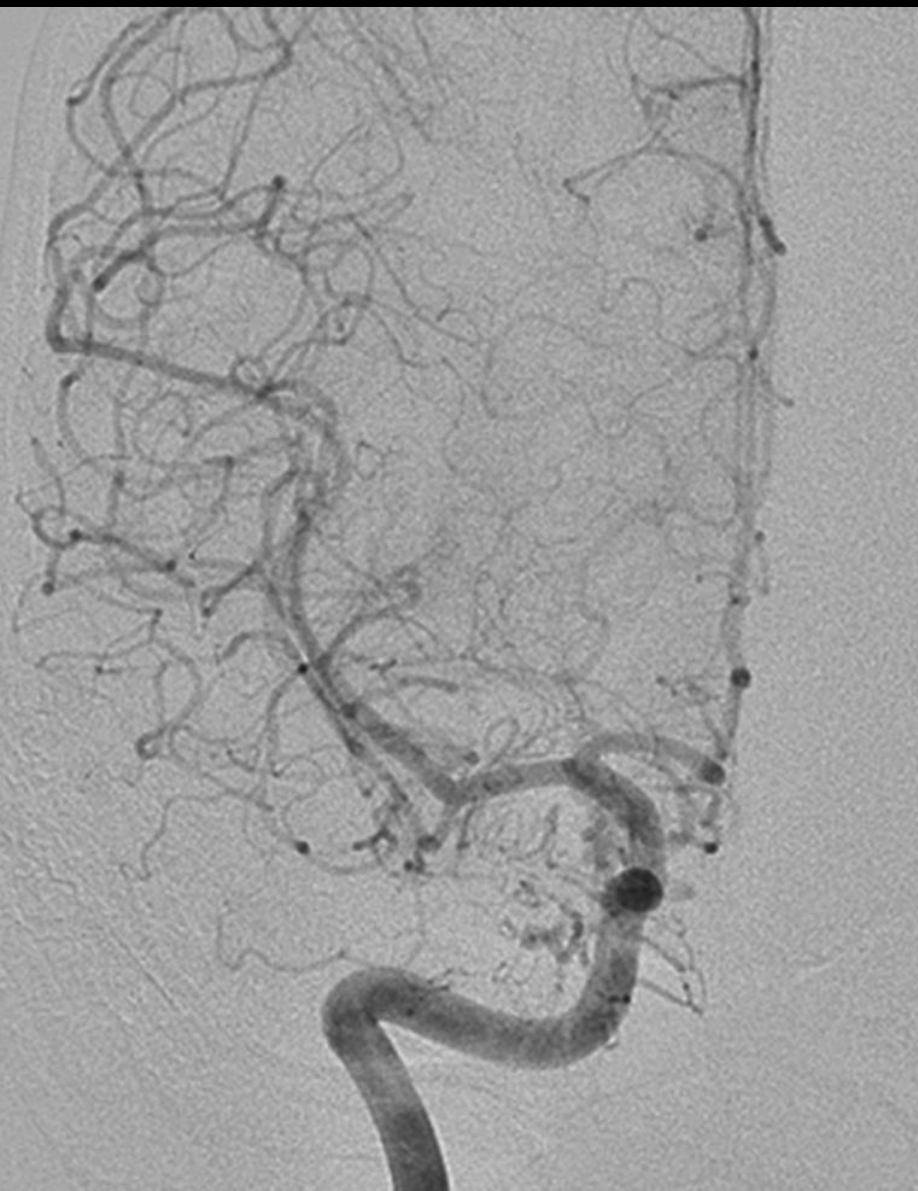
Image size: 1024 x 1024
size: 551 x 551
W/W: 683
FD 25 cm



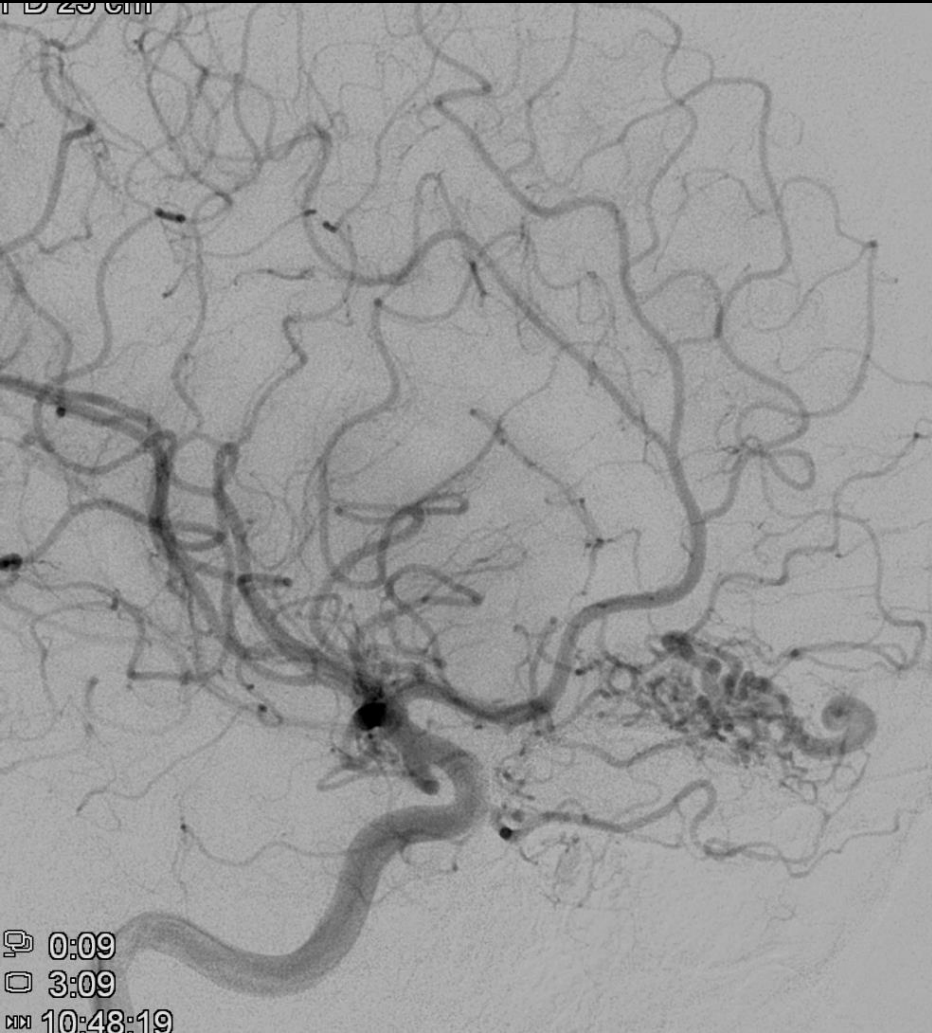
NIH-1864 (26 y , size: 1024 x 1024
Head - Cerebral 2 size: 551 x 551
R20120803125 W/W: 479
FD 25 cm



NIH-1864 (26 y , size: 1024 x 1024
Head - Cerebral 2 size: 551 x 551
R20120803125 W/W: 479
FD 25 cm

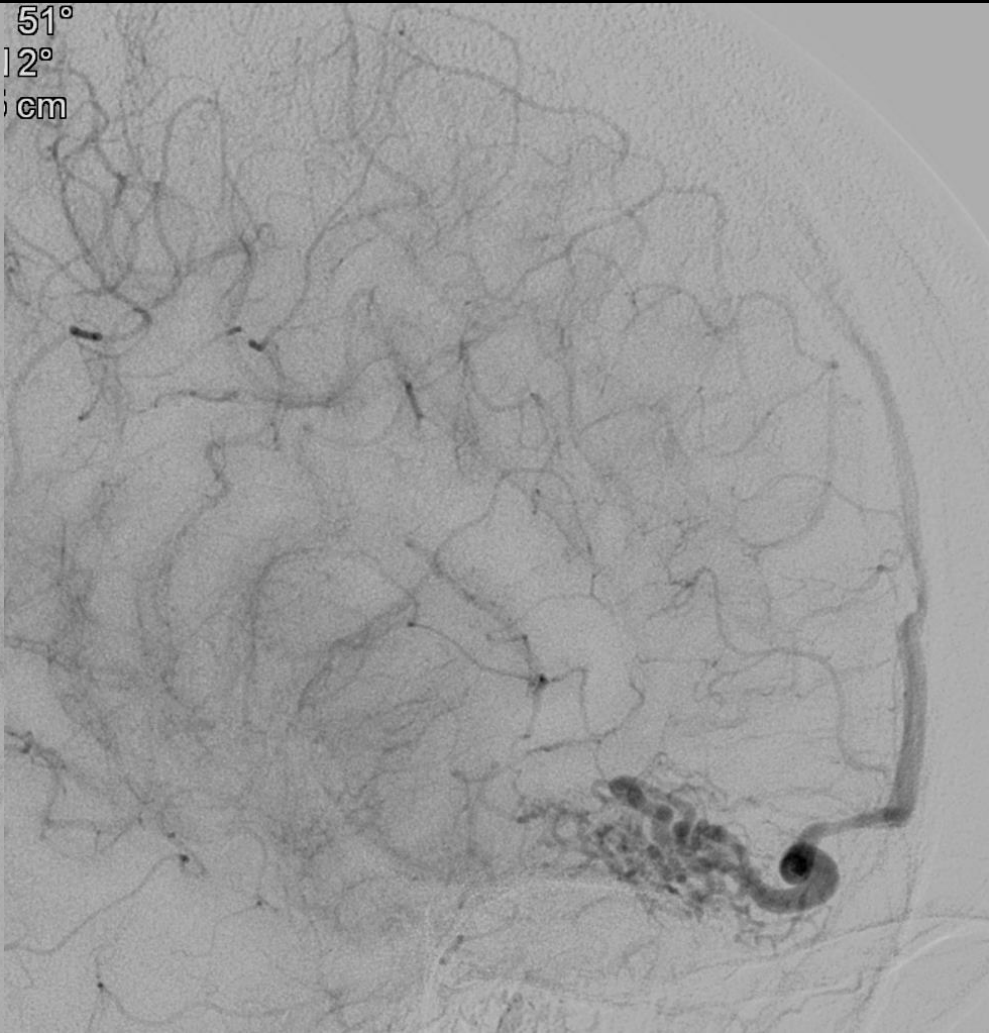


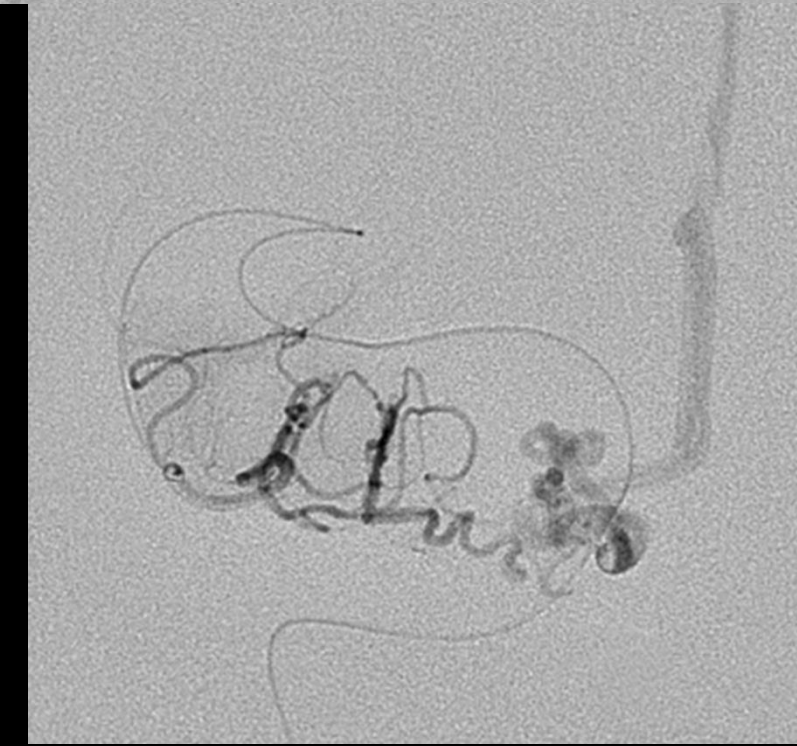
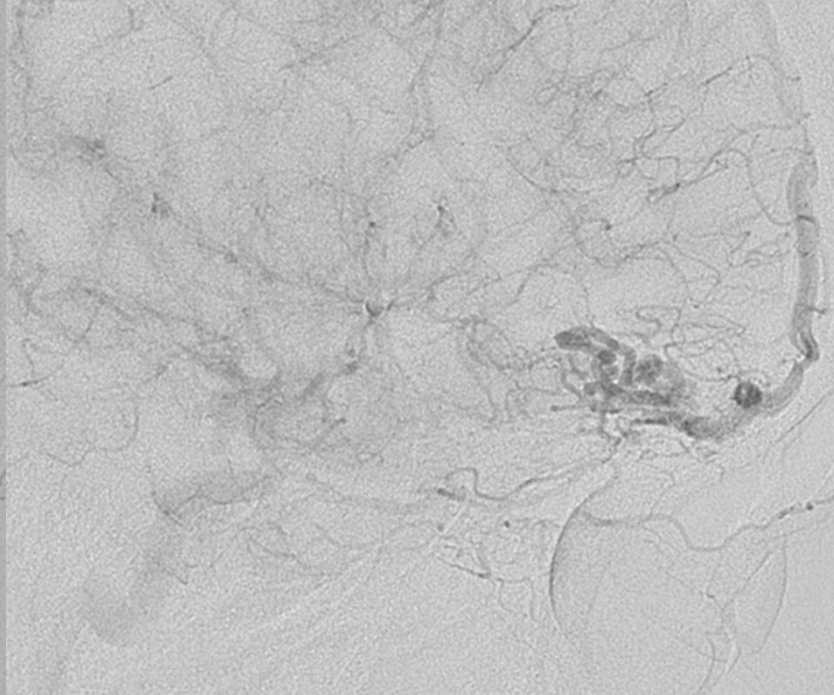
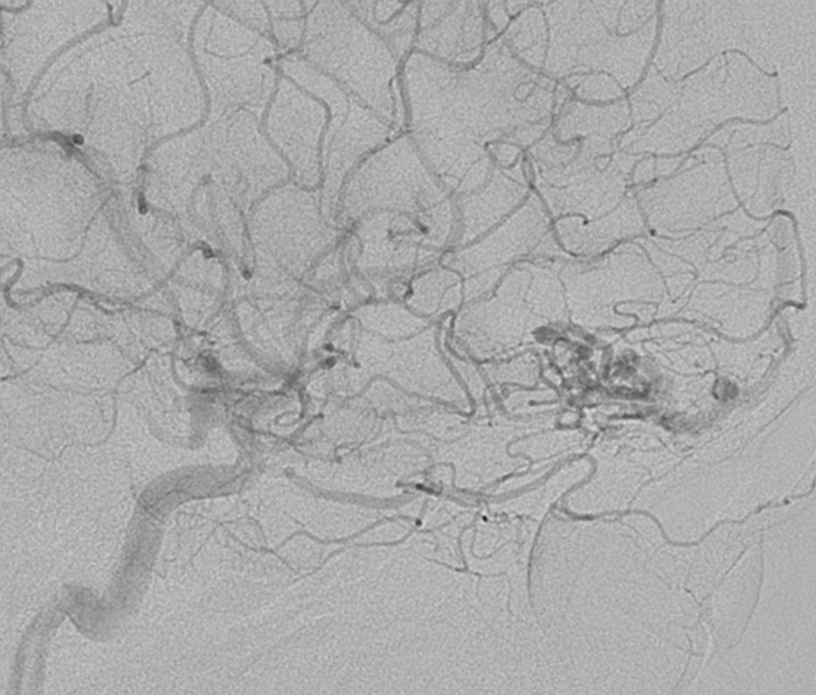
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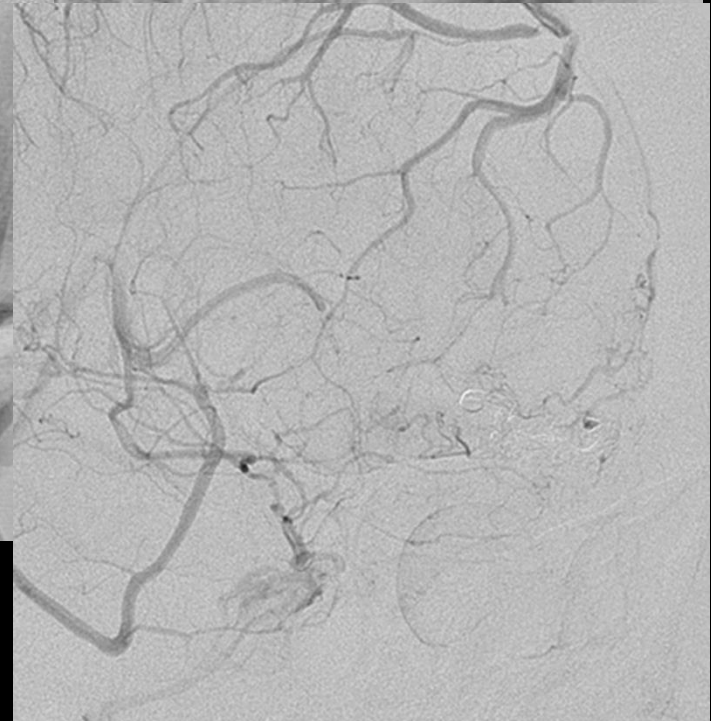
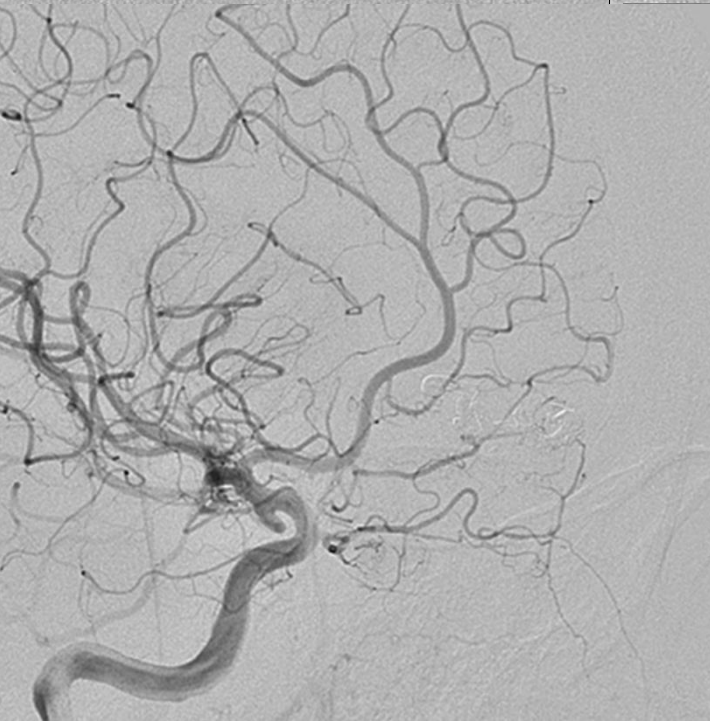
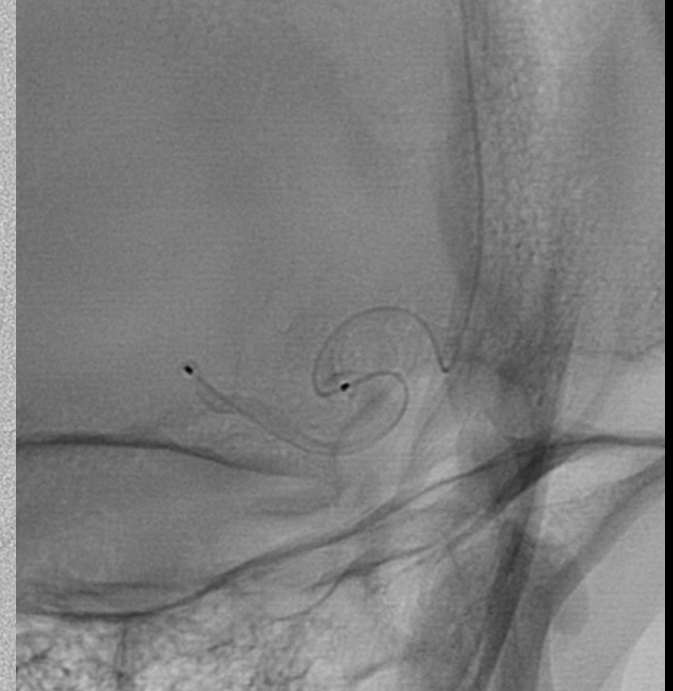
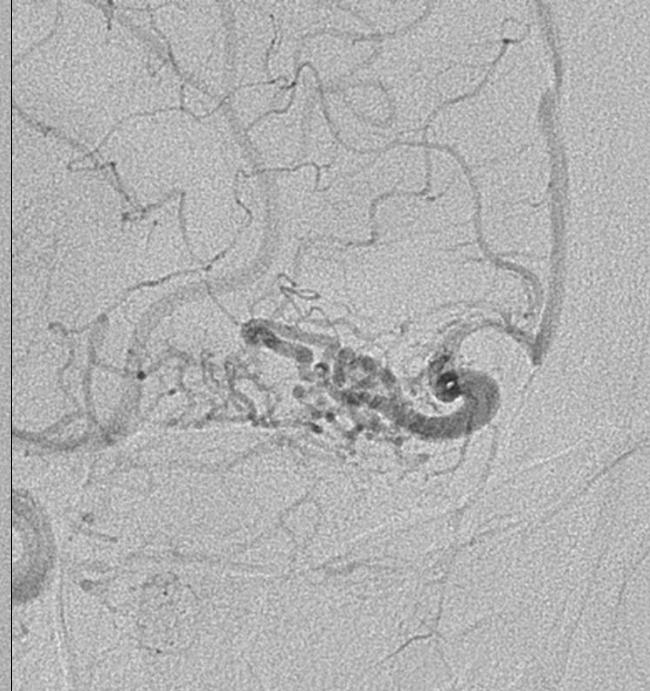
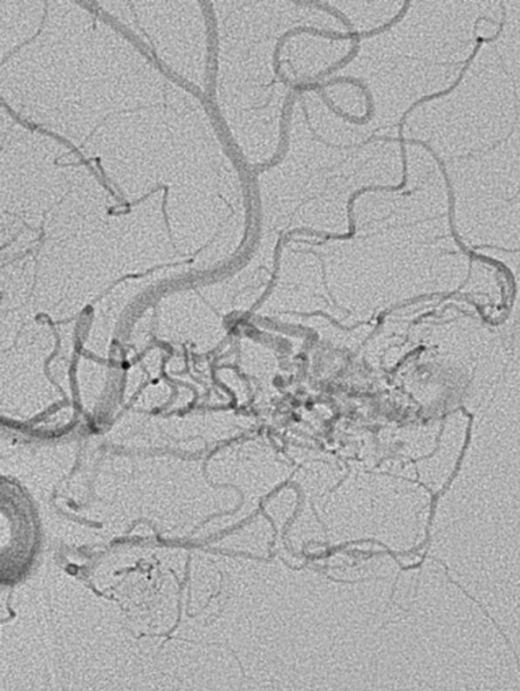


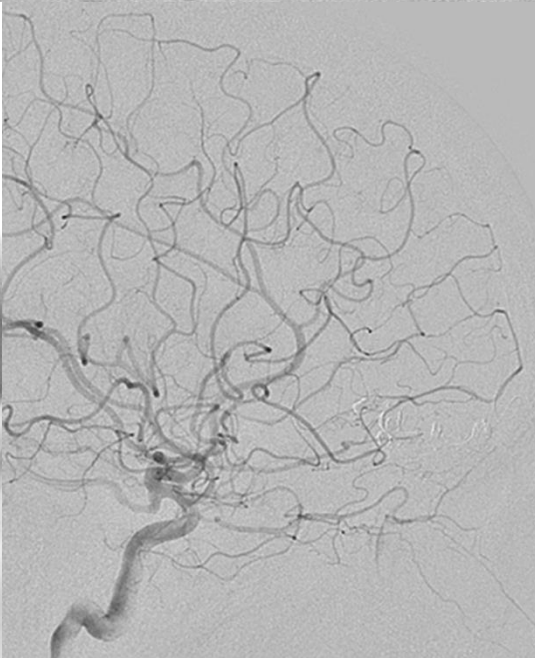
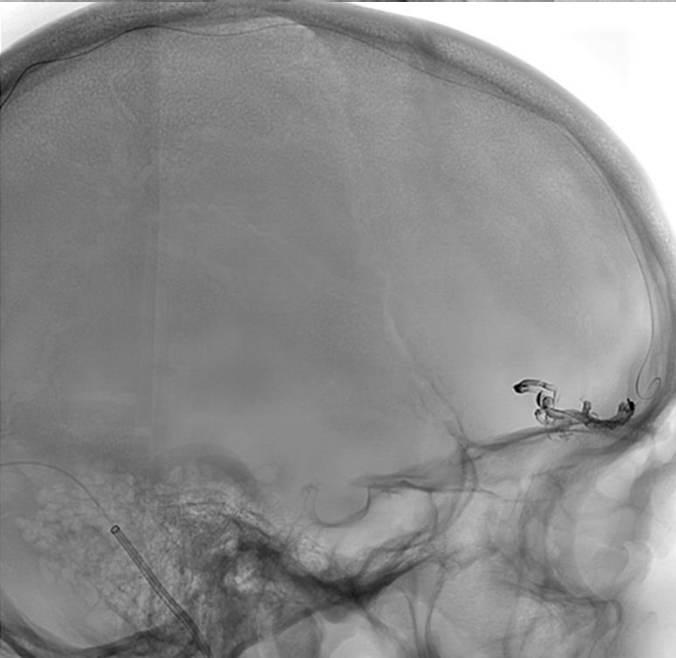
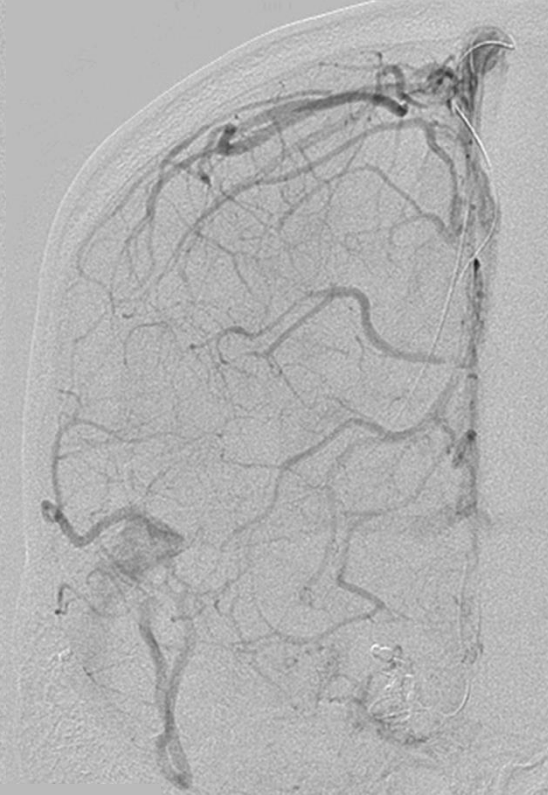
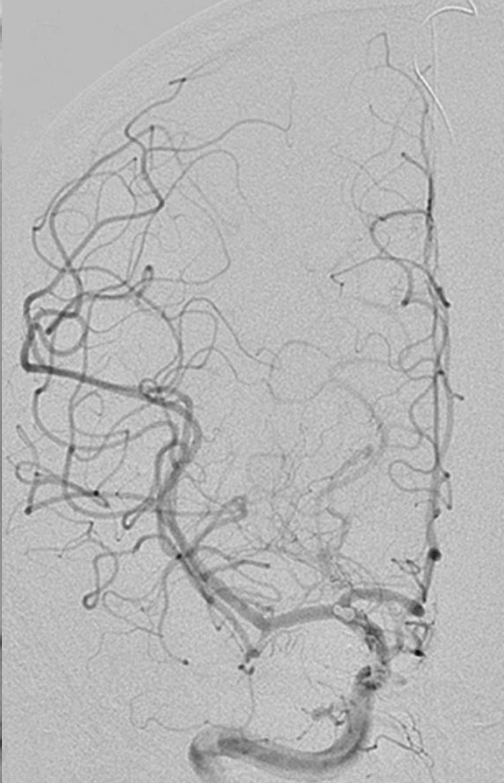
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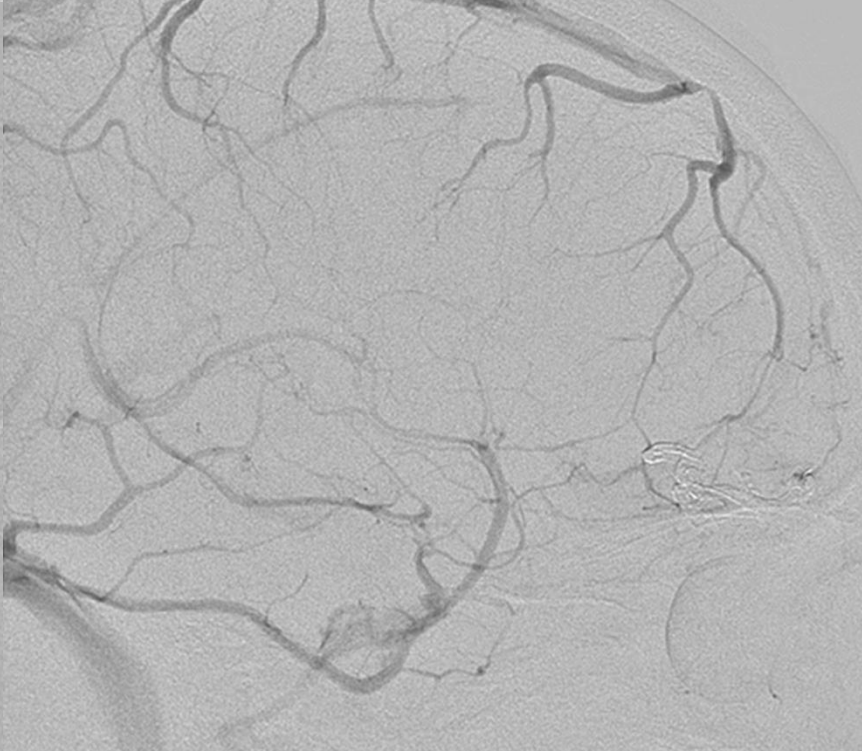
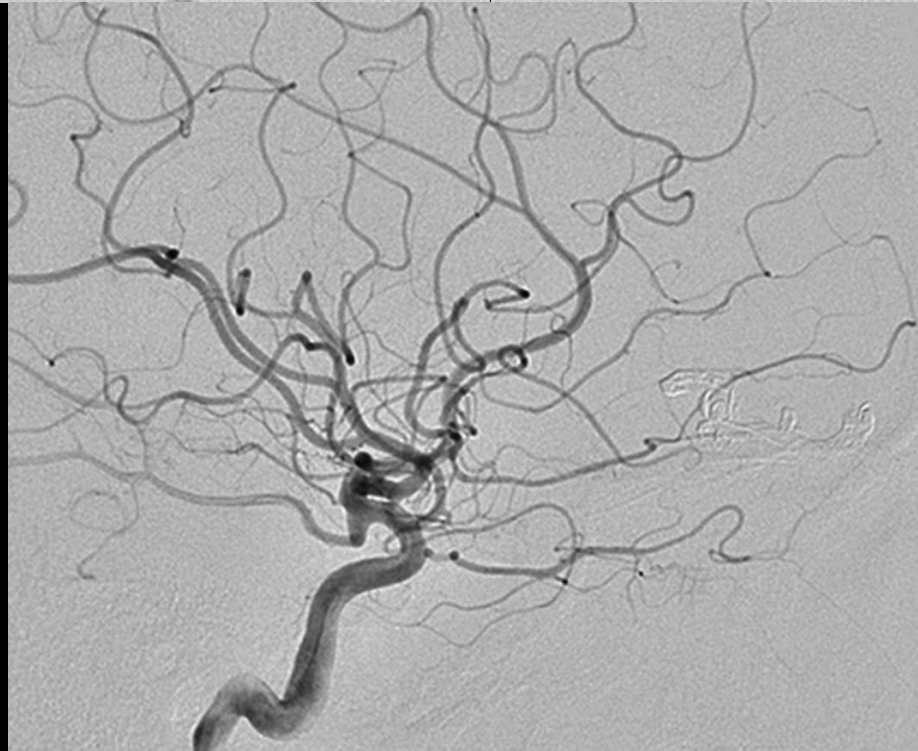
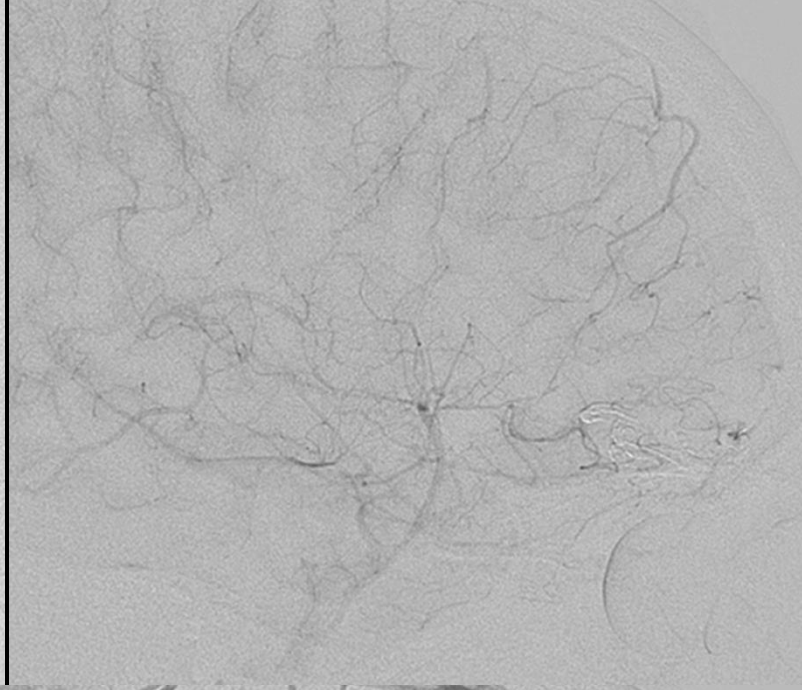
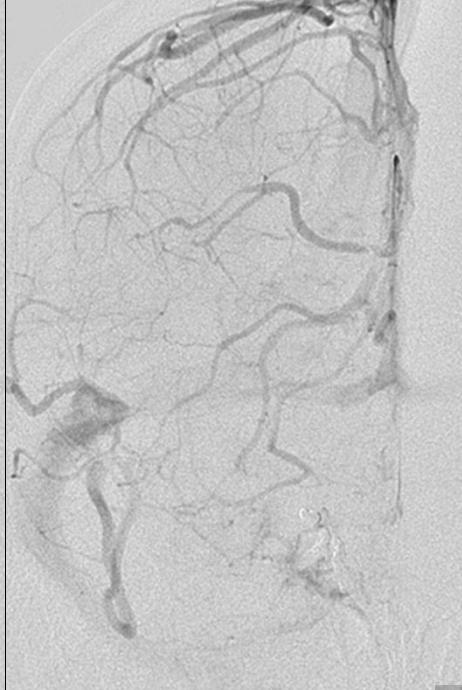
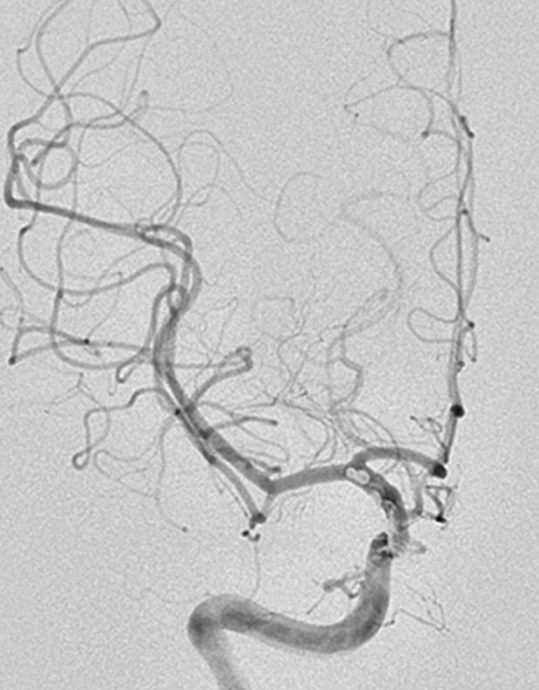
51°
12°
cm

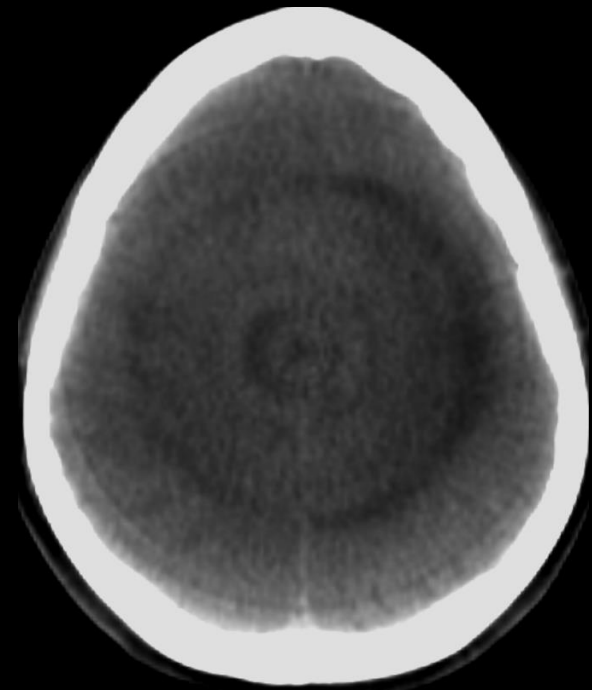
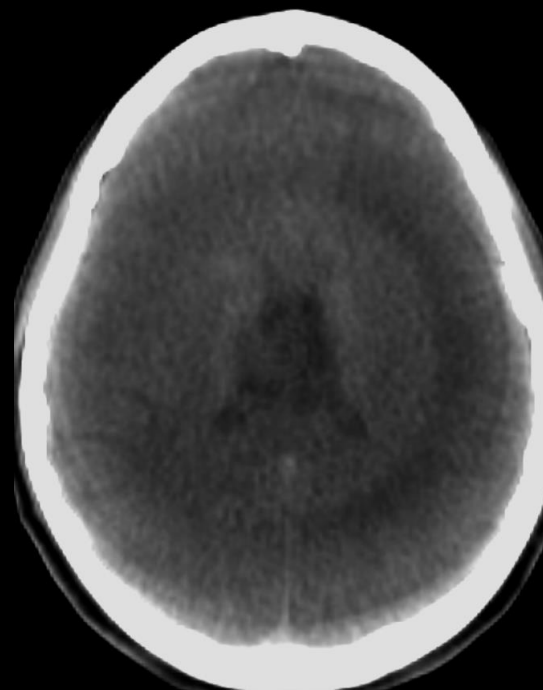
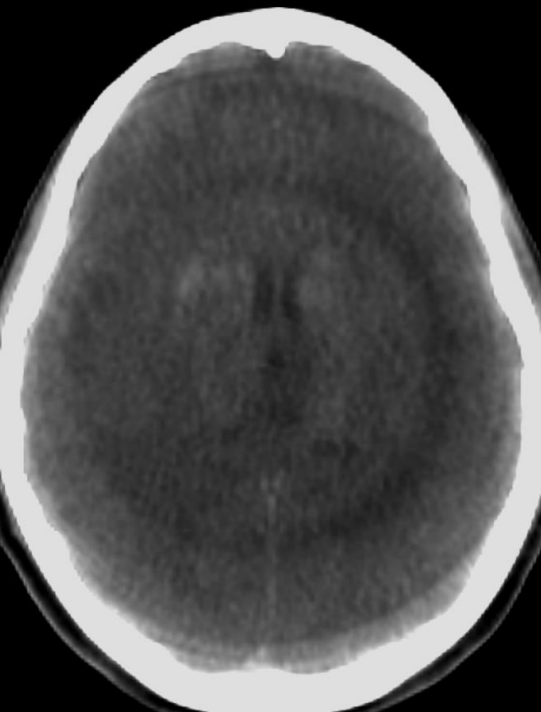
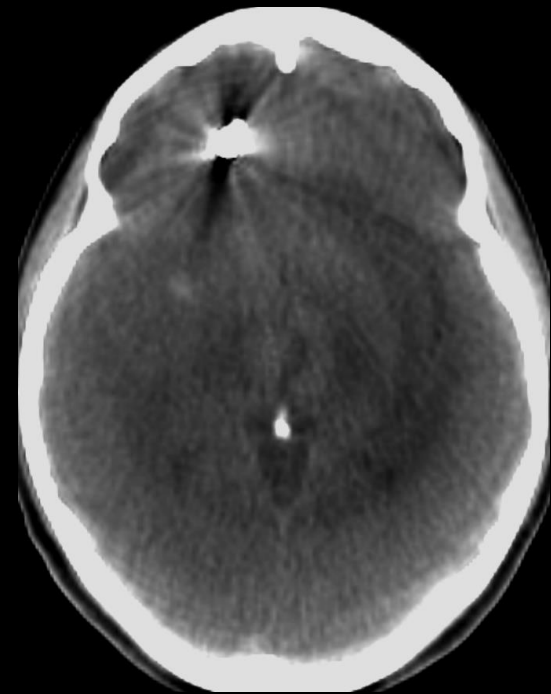
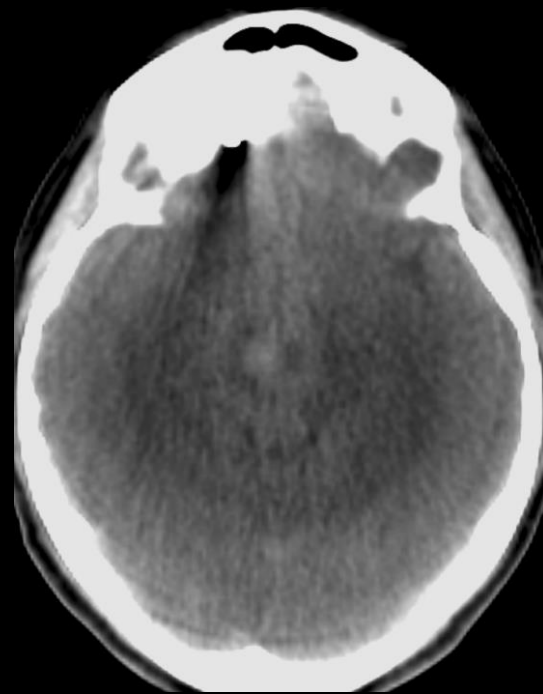
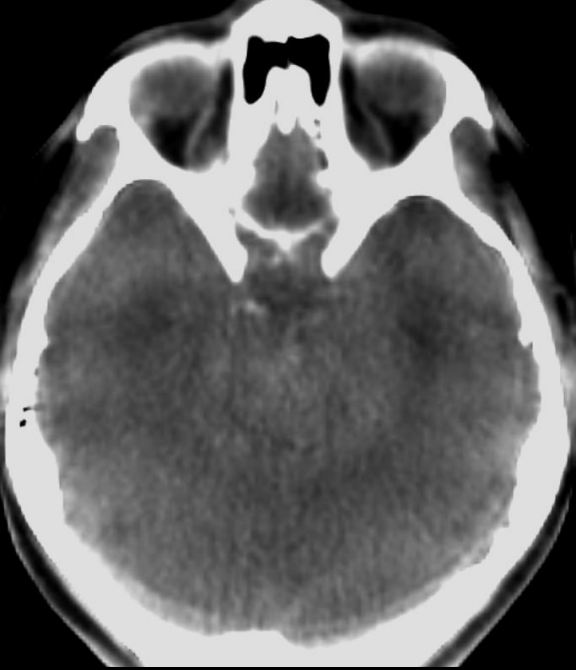




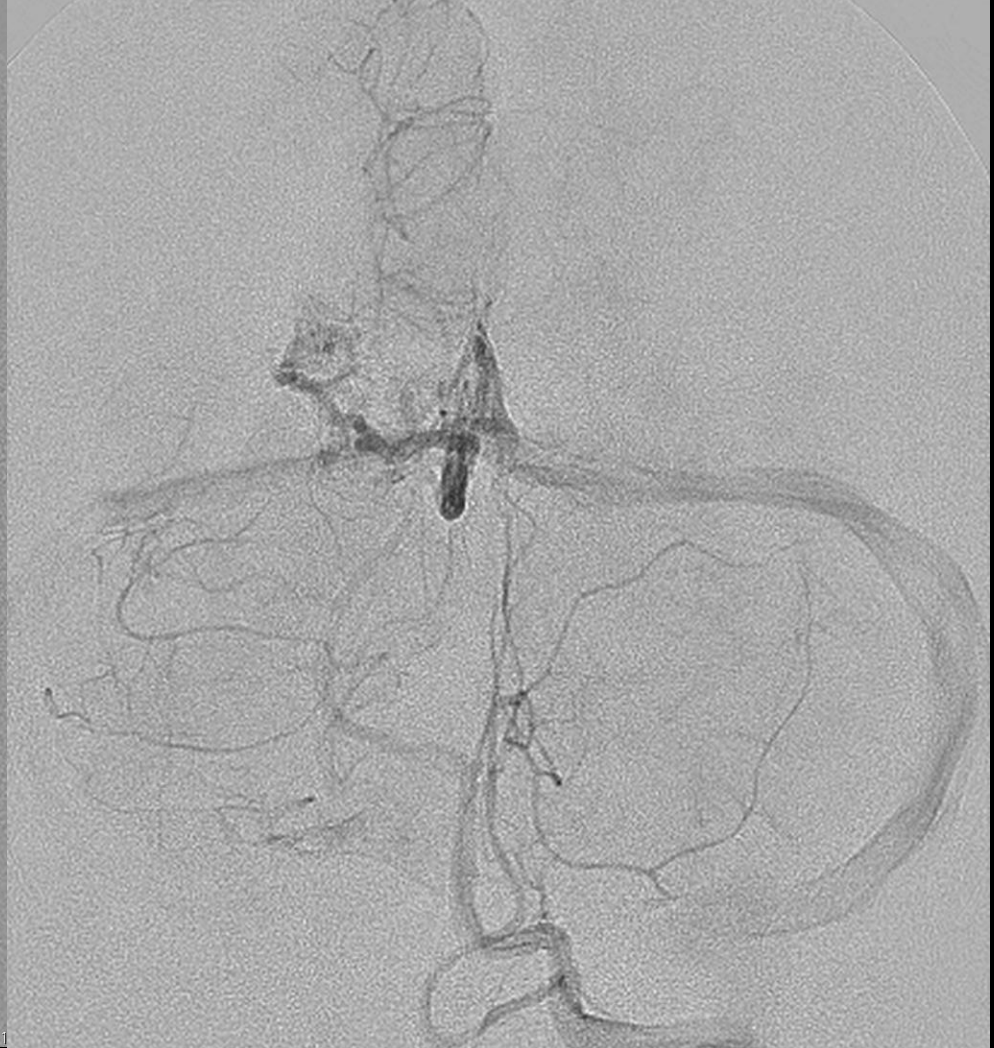








AD Pre Embol I 15.7.14





Angle: 0



5.196 Angle: 0

Image size: 904 x 904
View size: 1358 x 1287
WL: 133 WW: 178

ROMERO MARIA GISELA Sra. 4091333 (28 y , 26 y)
-- unnamed
258009
8034

Image size: 904 x 904
View size: 1207 x 1204
WL: 133 WW: 178

ROMERO MARIA GISELA Sra. 4091333 (28 y , 26 y)
-- unnamed
258009
8034

Zoom: 150% Angle: 0
Itr: 2/6
Uncompressed

15/07/14 15:35:55
Made in OsiriX

Zoom: 134% Angle: 0
Itr: 3/6
Uncompressed

Image size: 904 x 904
View size: 1073 x 1073
WL: 90 WW: 176

ROMERO MARIA GISELA Sra. 4091333 (28 y , 26 y)
-- unnamed
258009
8035

15/07/14 15:35:55
Made in OsiriX

Image size: 904 x 904
View size: 1073 x 1073
WL: 90 WW: 211

ROMERO MARIA GISELA Sra. 4091333 (28 y , 26 y)
-- unnamed
258009
8035

Zoom: 159% Angle: 0
Itr: 3/4
Uncompressed

15/07/14 15:38:27
Made in OsiriX

Zoom: 119% Angle: 0
Itr: 4/4
Uncompressed

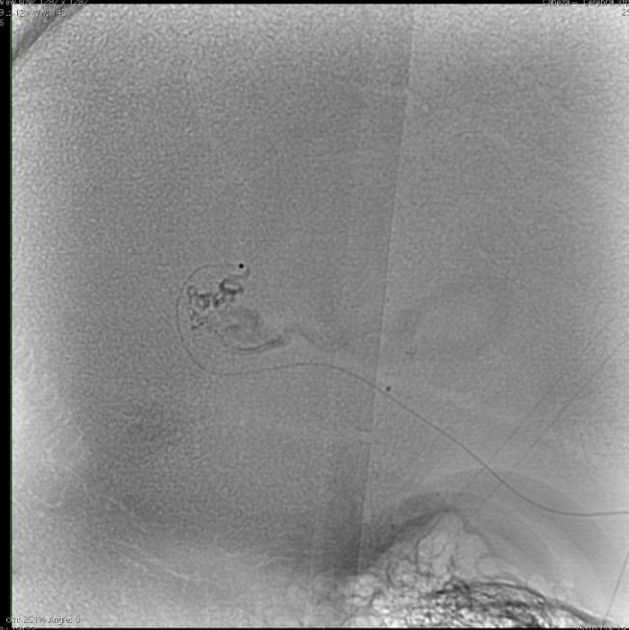
15/07/14 15:38:27
Made in OsiriX

Pre I

Image size: 512 x 512
View size: 1287 x 1287
W: 122 H: 133

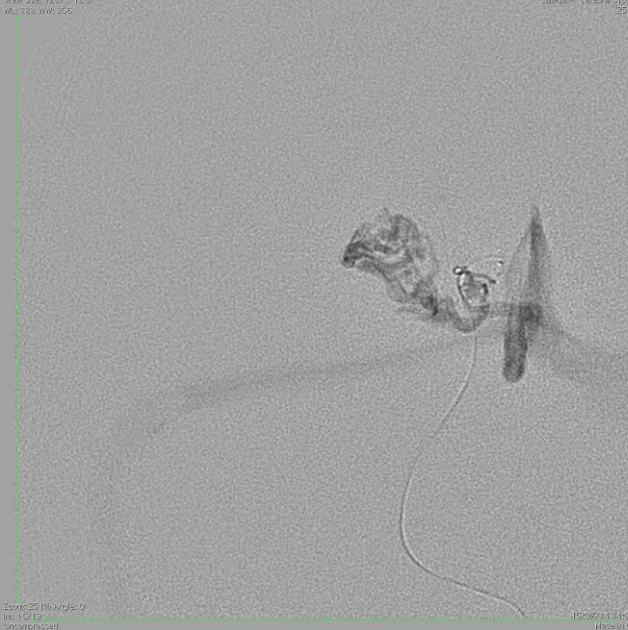


ROMERO MARIA GISELA Sra. 4091333 (28 y., 26 y) age size: 512 x 512
View size: 1287 x 1287
W: 122 H: 133

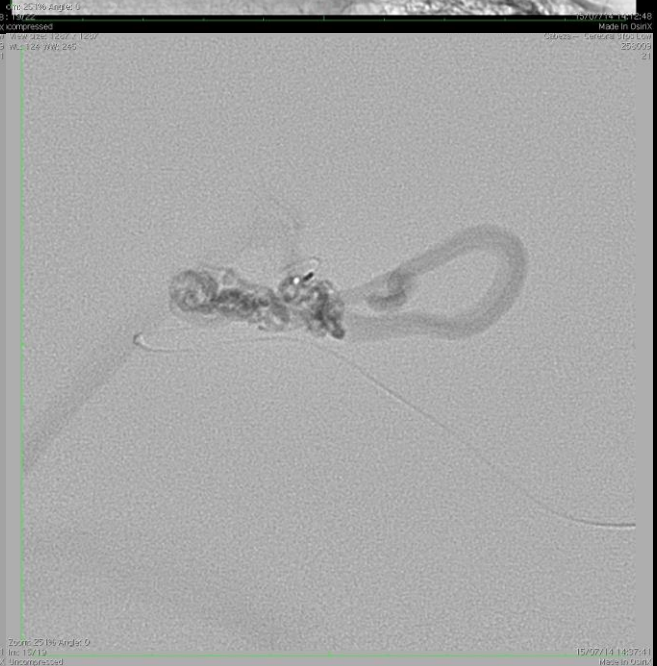


ROMERO MARIA GISELA Sra. 4091333 (28 y., 26 y)
View size: 1287 x 1287
W: 122 H: 133

Zoom: 25.1% Angle: 0
W: 122 H: 133
Uncompressed

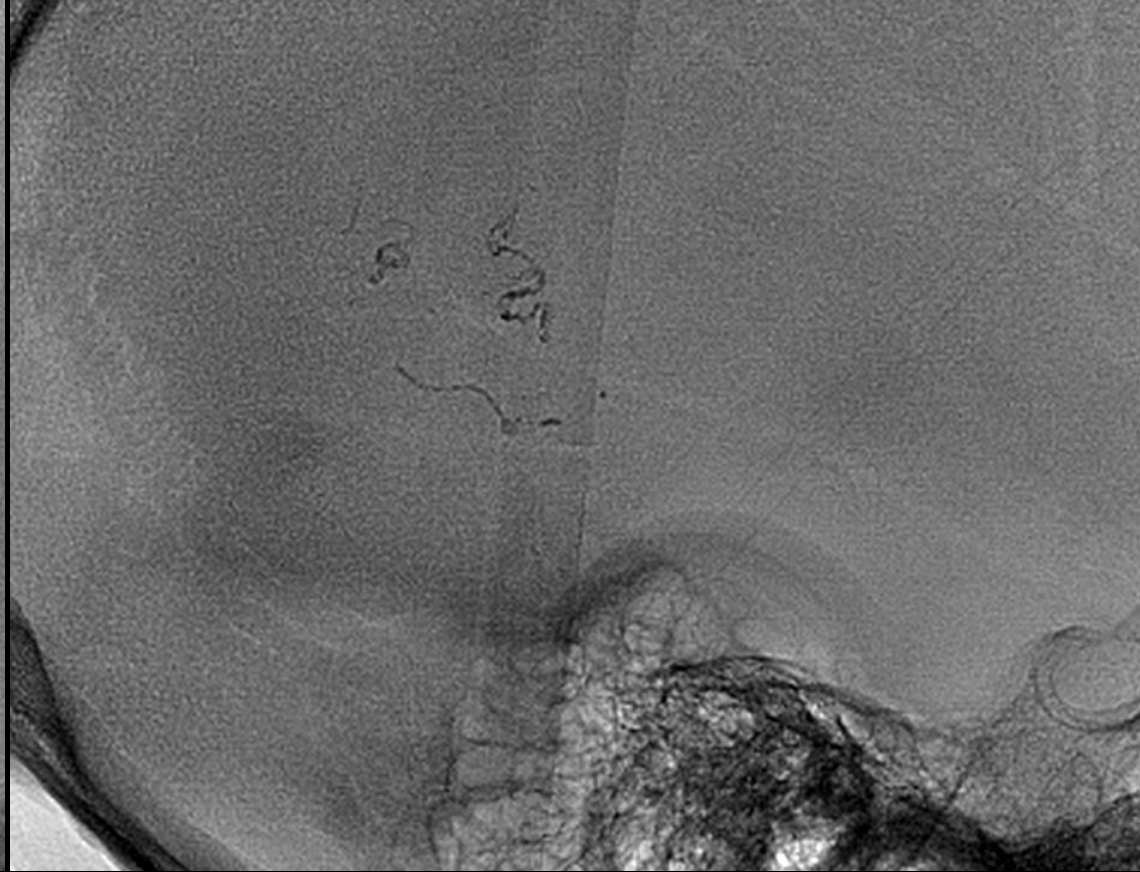
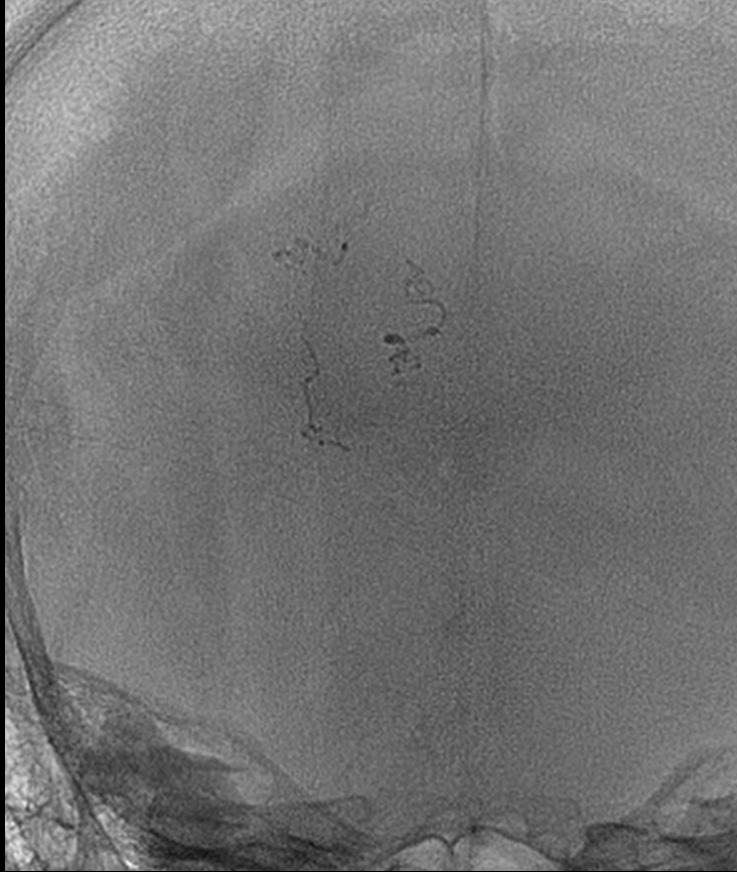


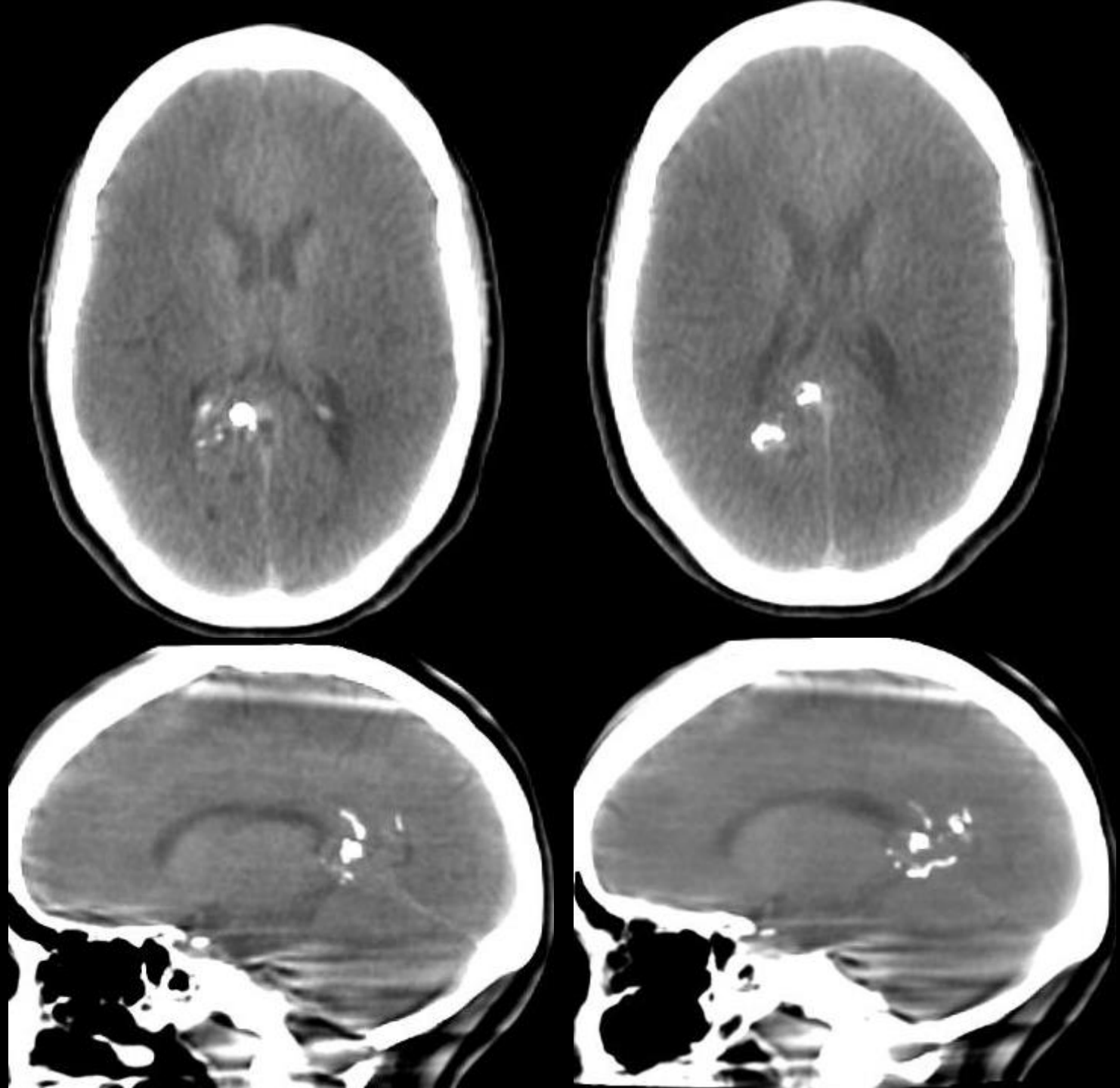
Zoom: 25.1% Angle: 0
W: 122 H: 133
Uncompressed



Zoom: 25.1% Angle: 0
W: 122 H: 133
Uncompressed

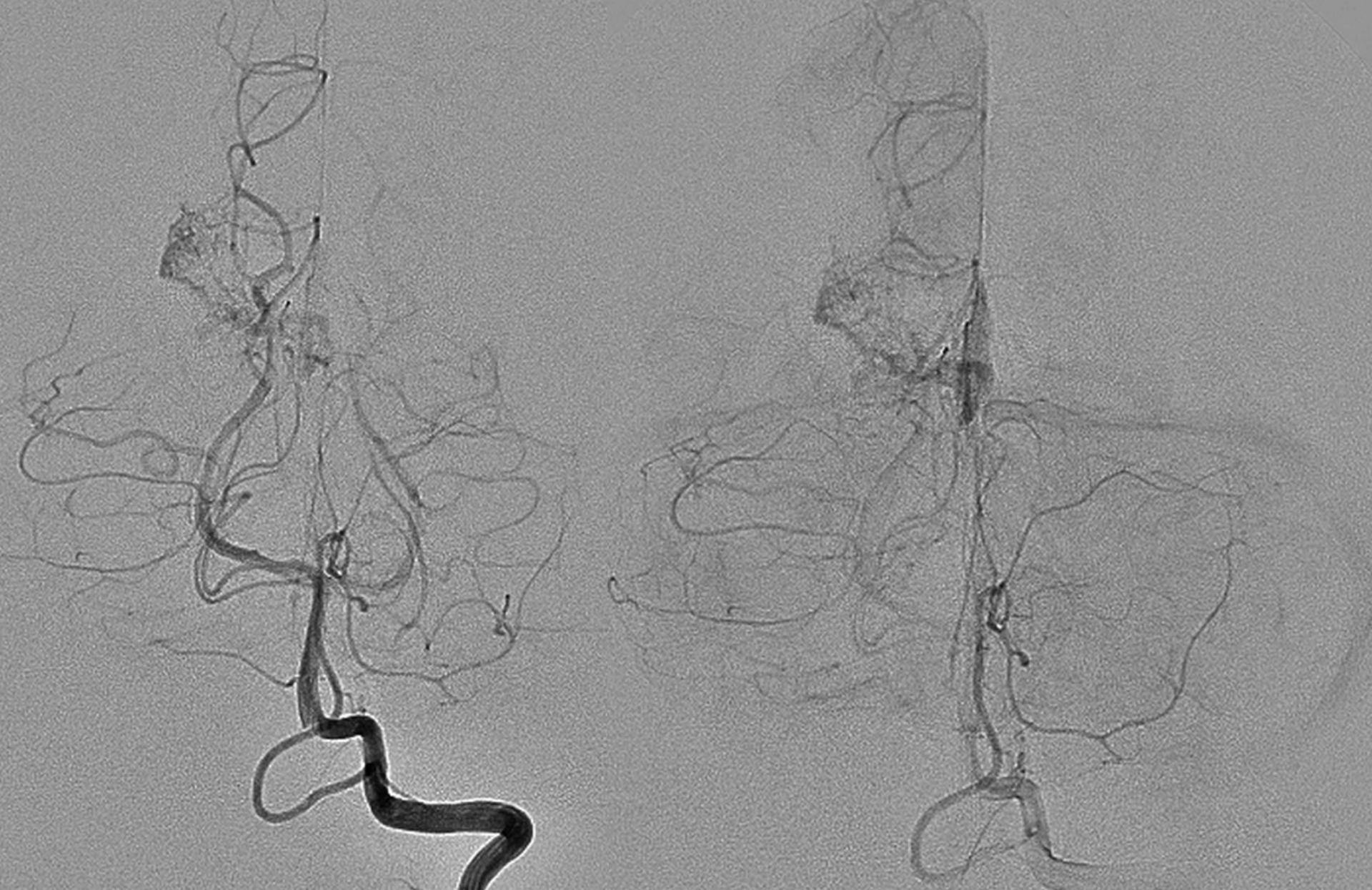
Post Intraart.



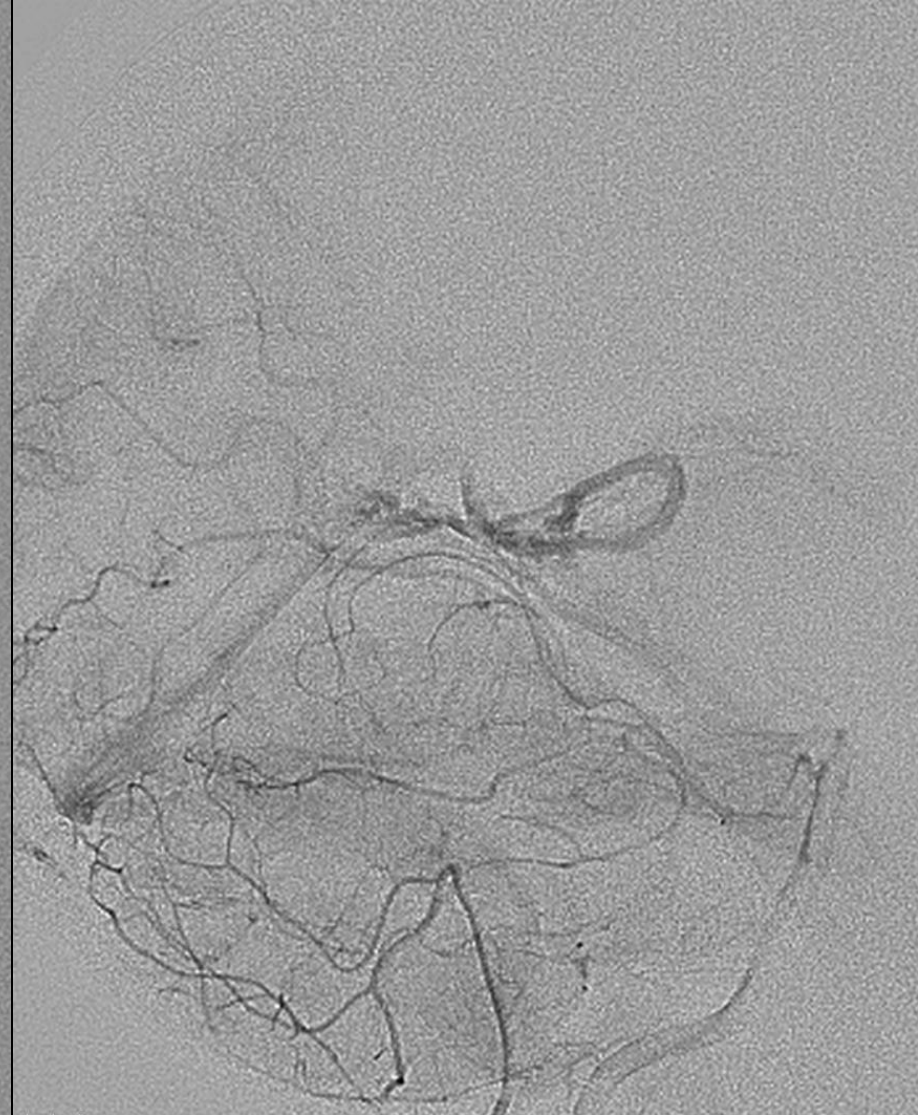
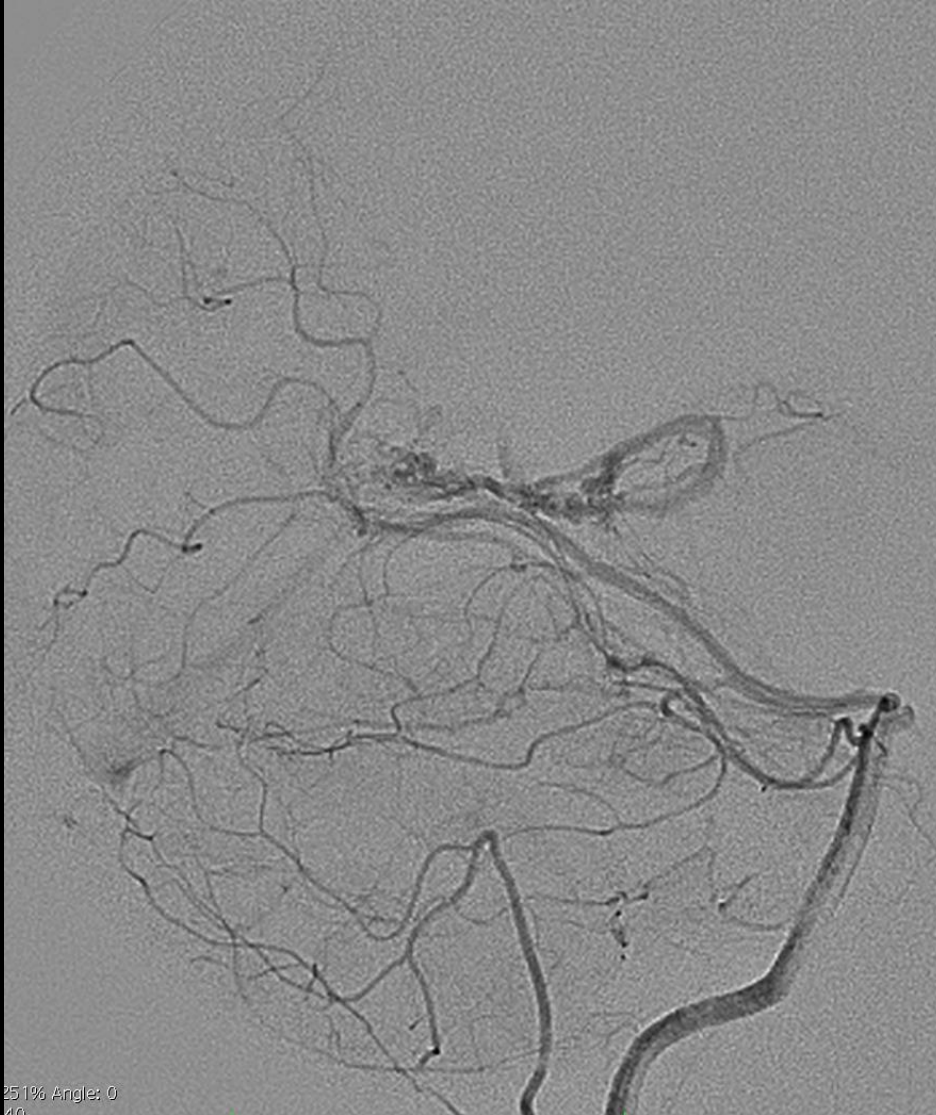




Post Embol Intraart.



Post embol Intraart.



251% Angle: 0
40

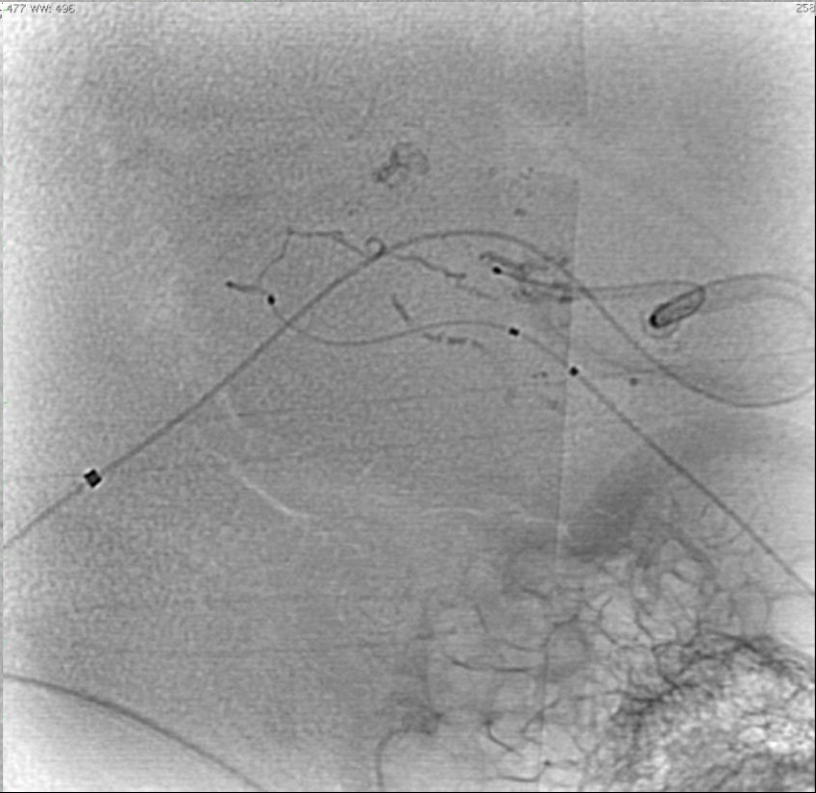
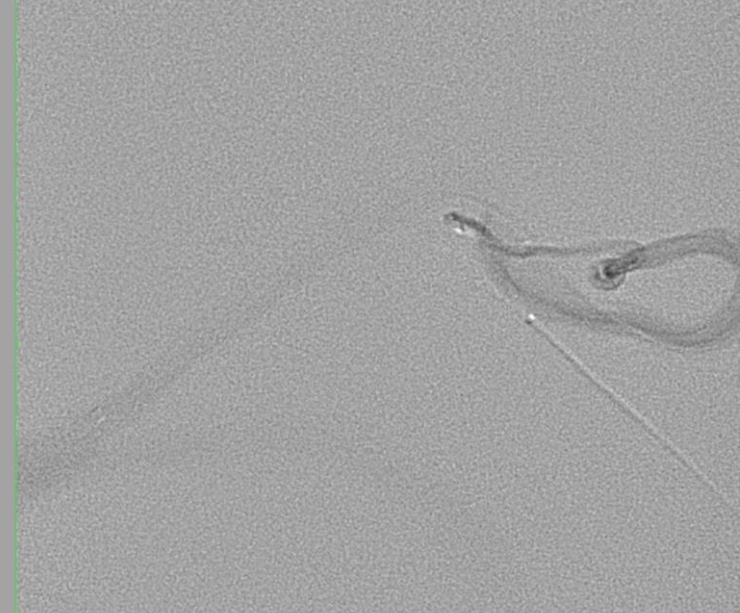
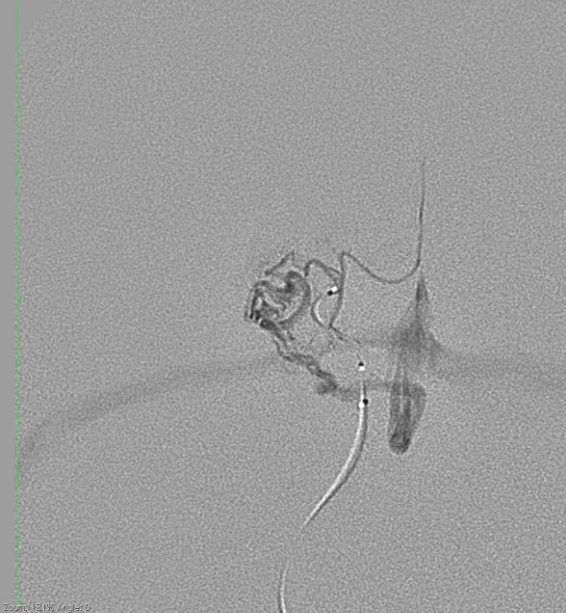


Image size: 1024 x 1024
View size: 1287 x 1287
WL: 485 WW: 607

ROMERO MARIA GISELA Sra. 4091333 (28 y , 26 y)
Cabeza - Cerebral 3 (ps) Low
25/07/14 17:02:27 WL: 472 WW: 572

ROMERO MARIA GISELA Sra. 4091333 (28 y , 26 y)
Cabeza - Cerebral 3 (ps) Low
25/07/14 17:02:28 WL: 472 WW: 572

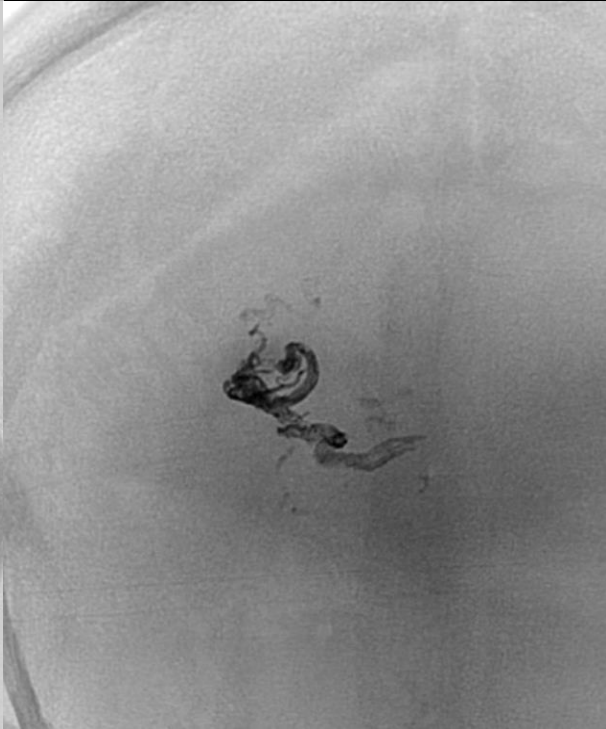


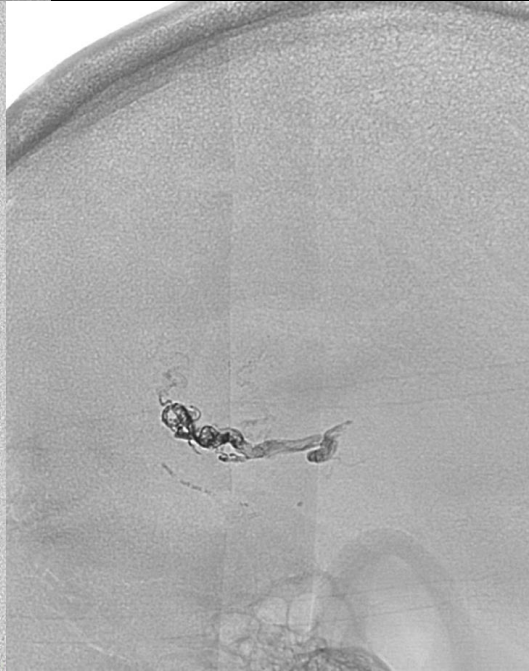
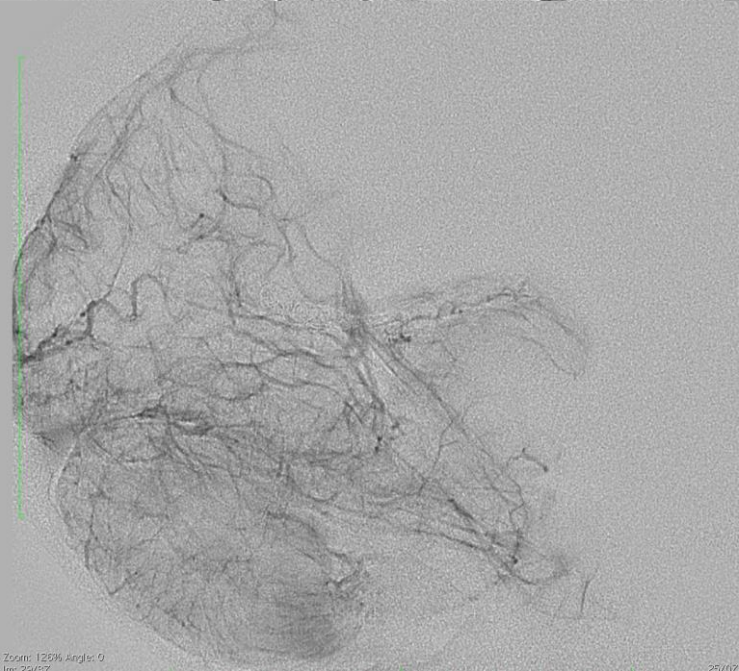
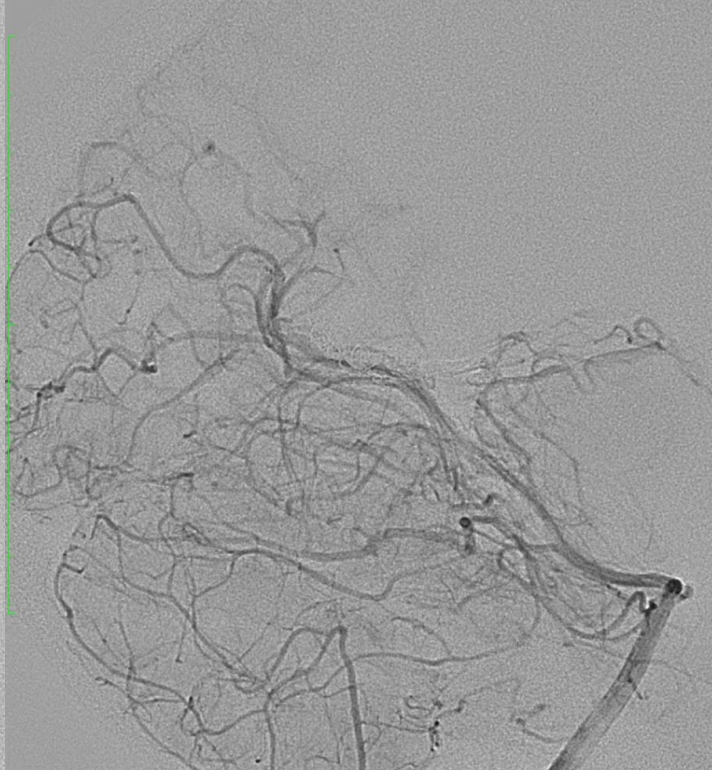
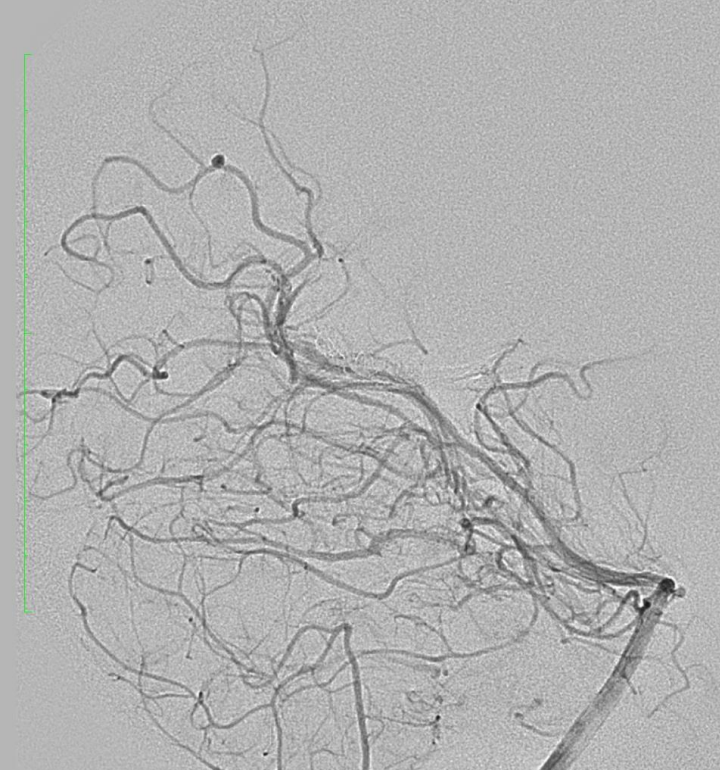
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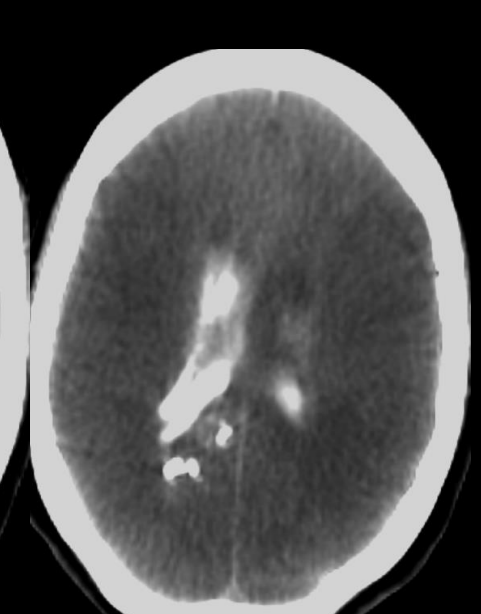
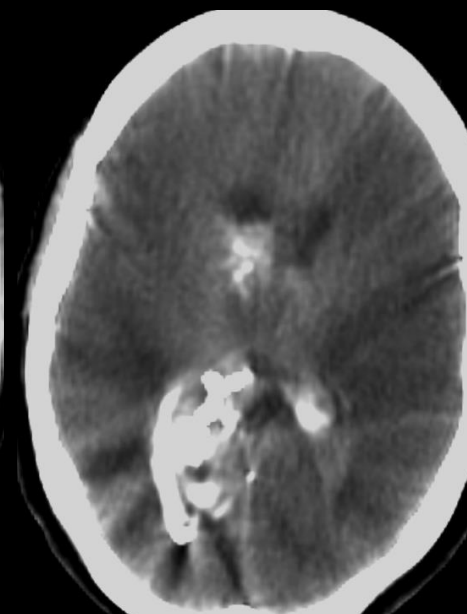
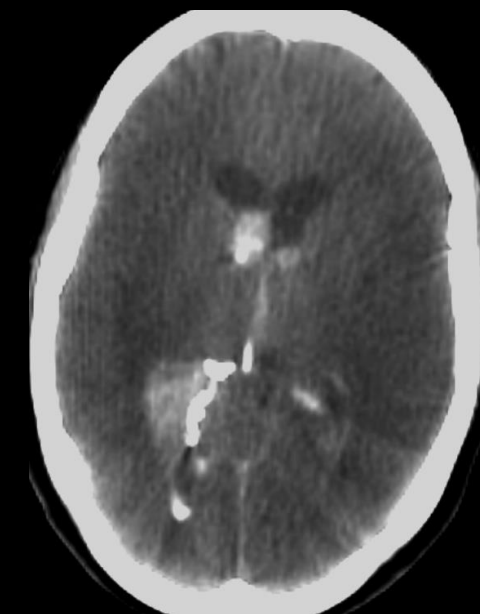
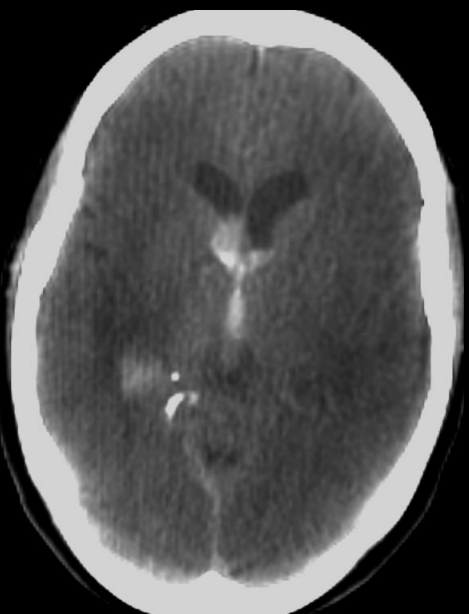
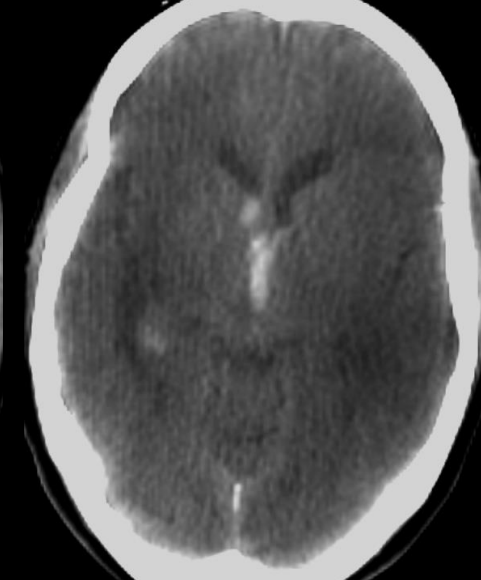
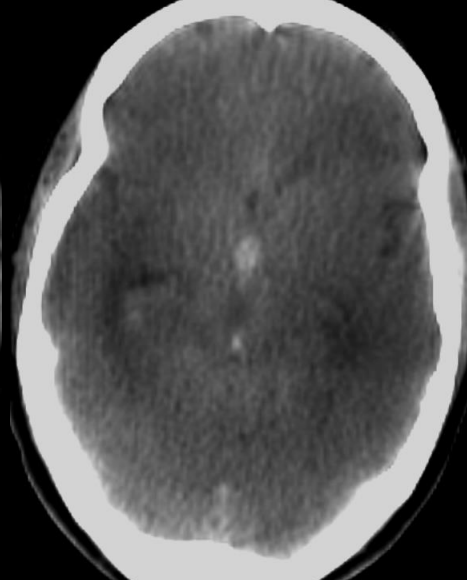
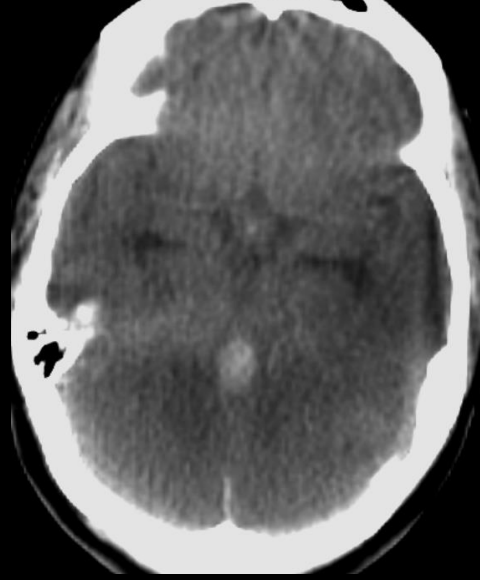


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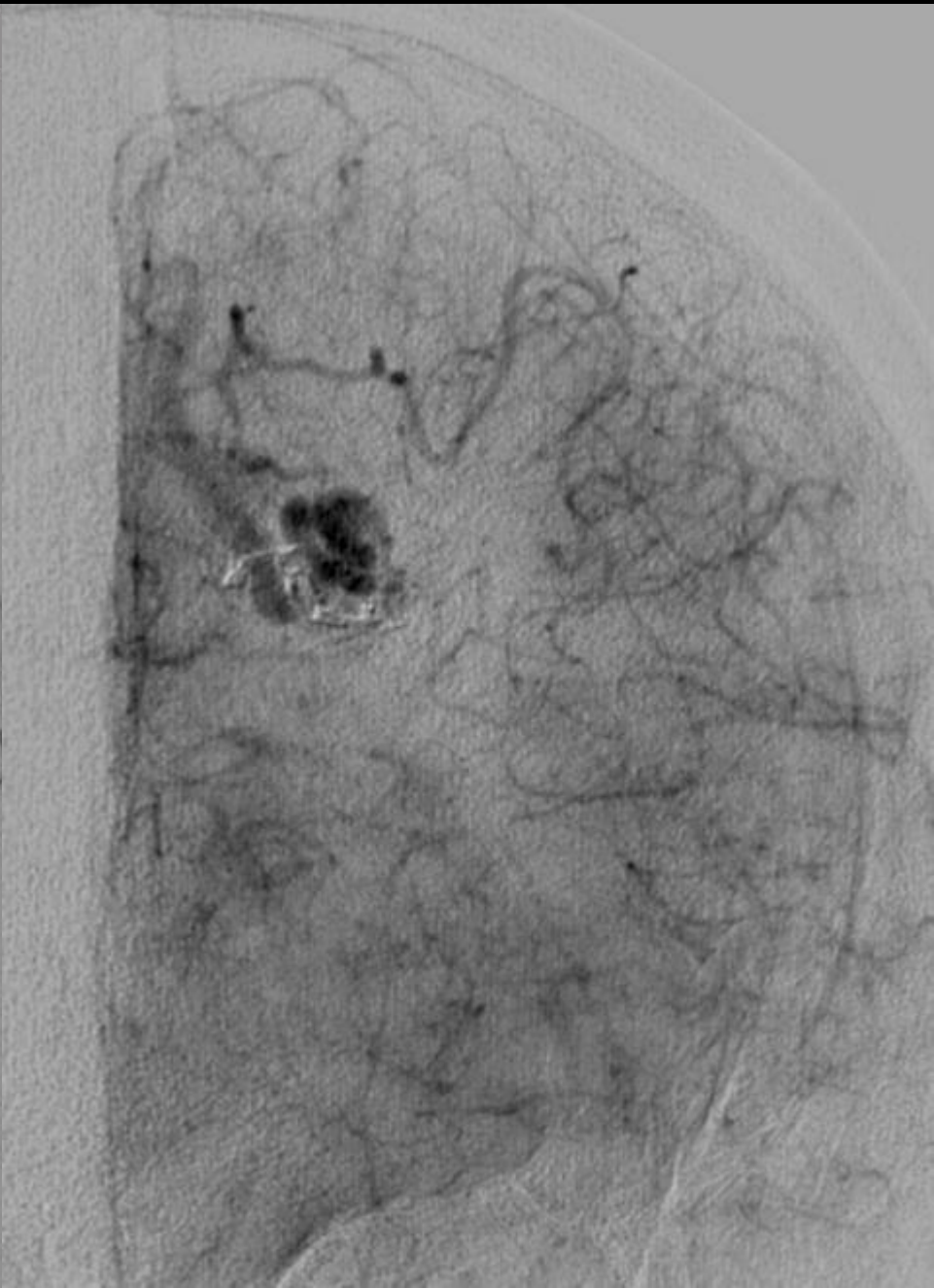
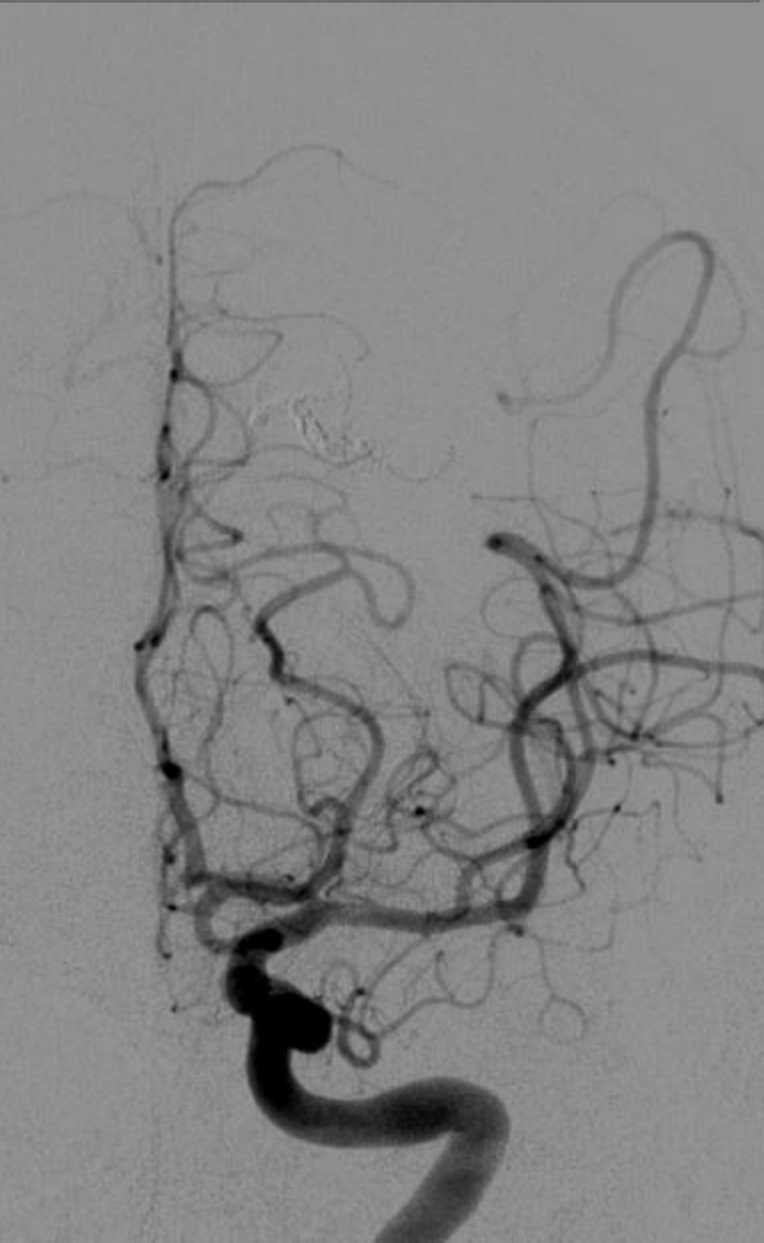
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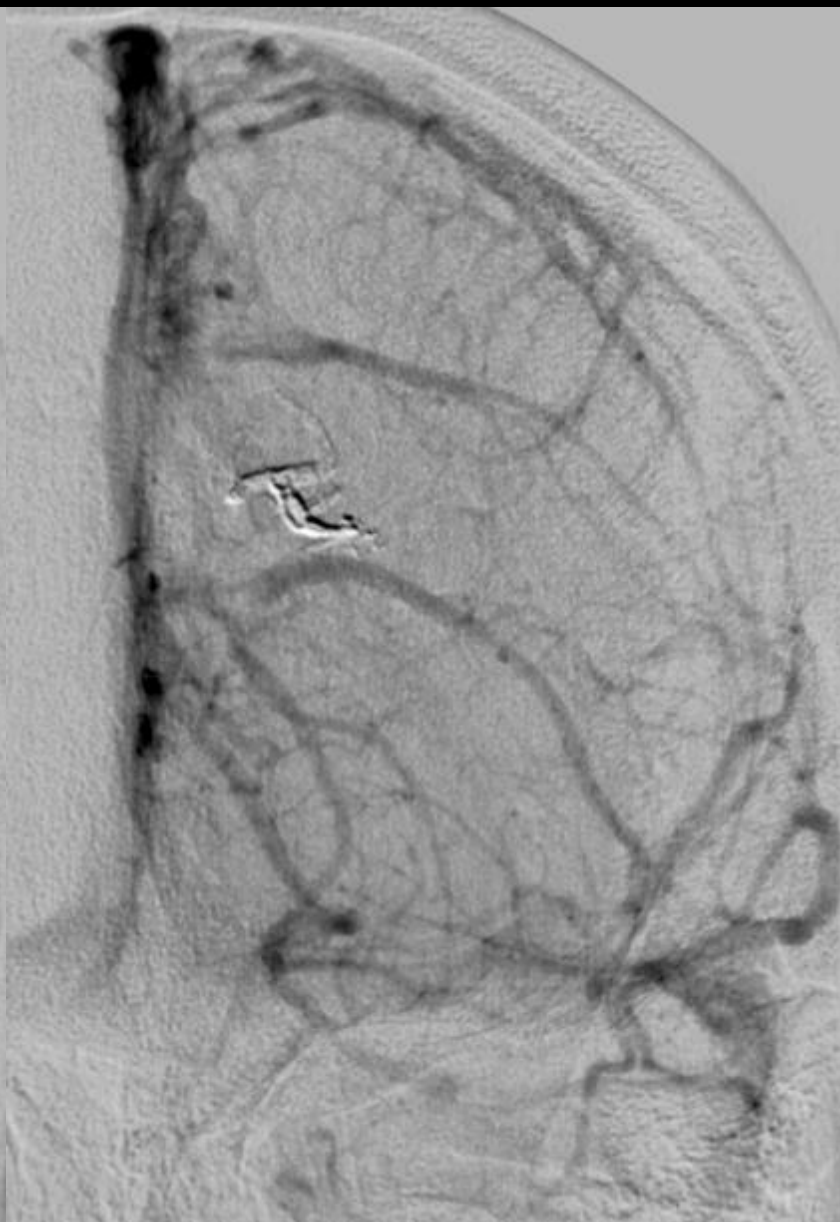
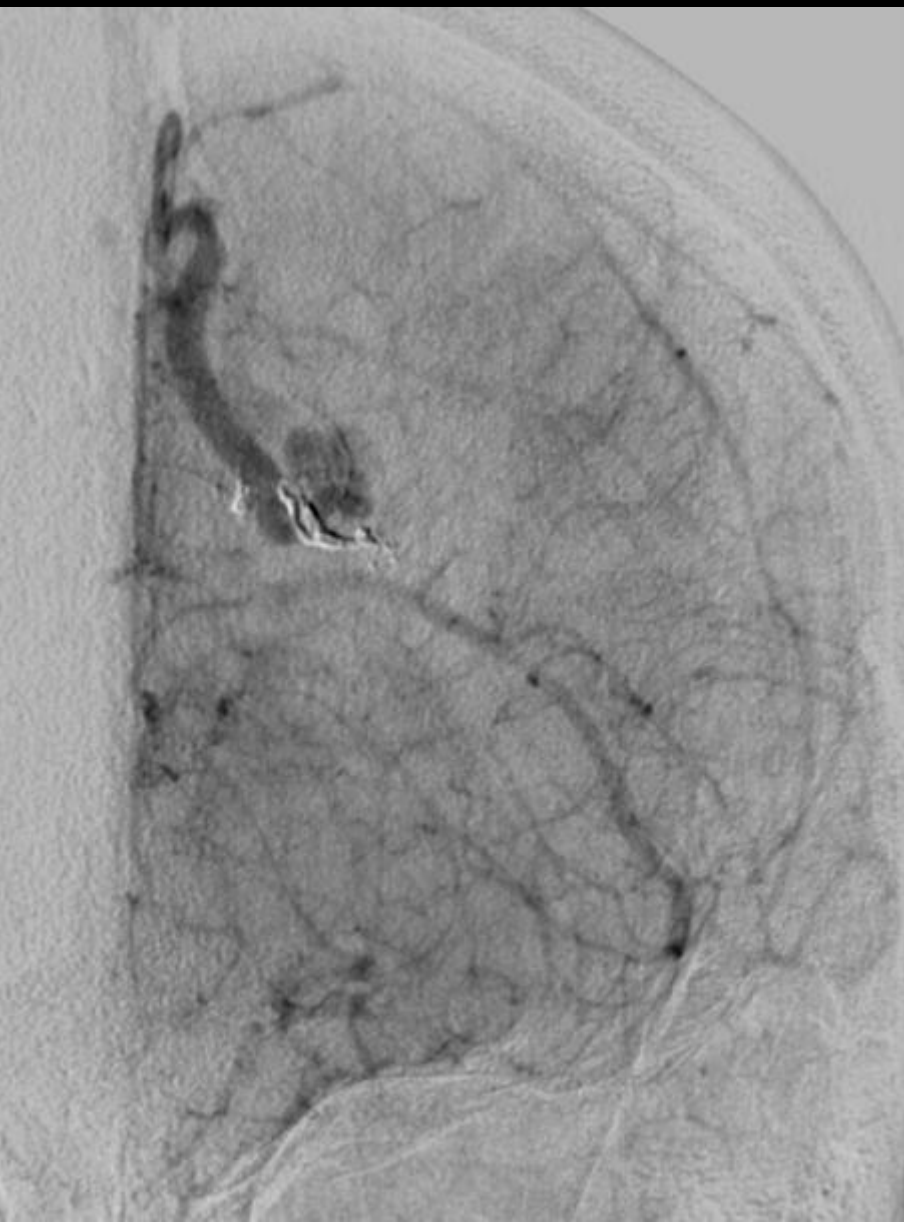




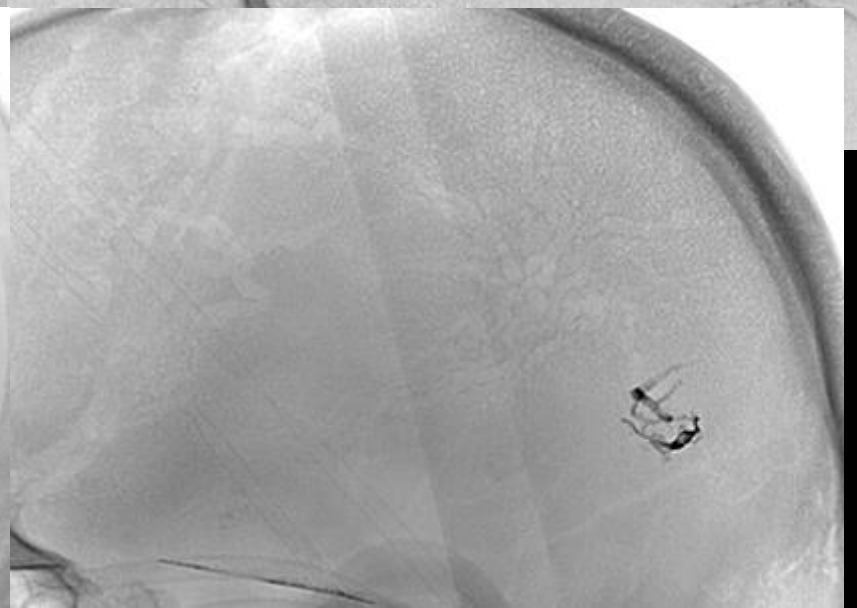
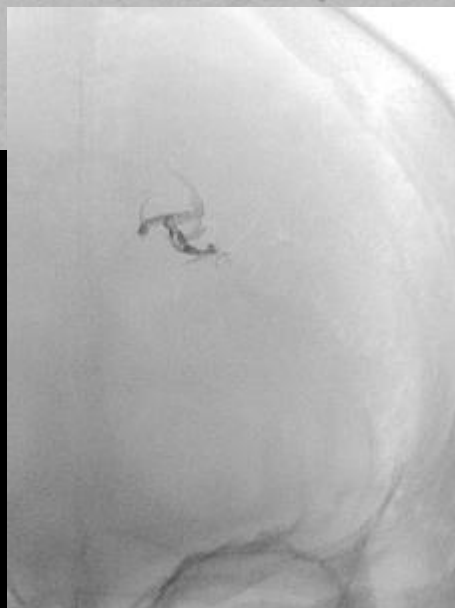
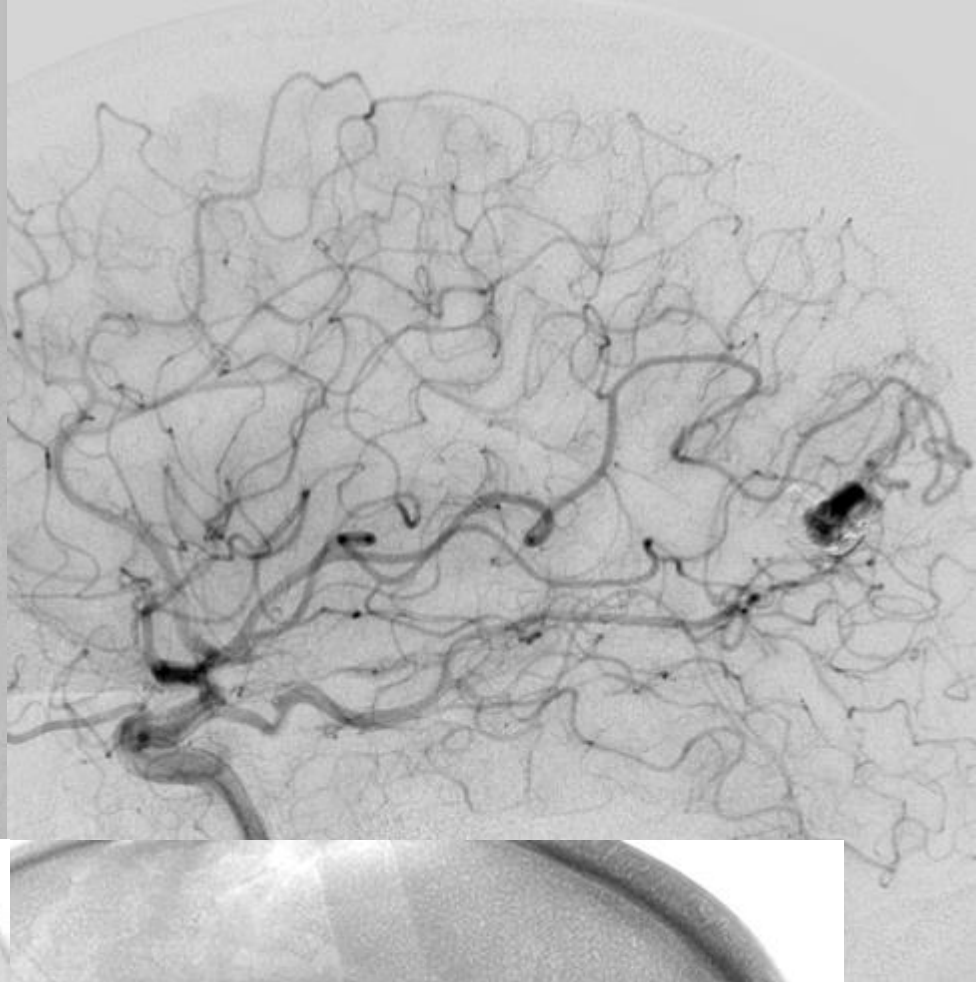
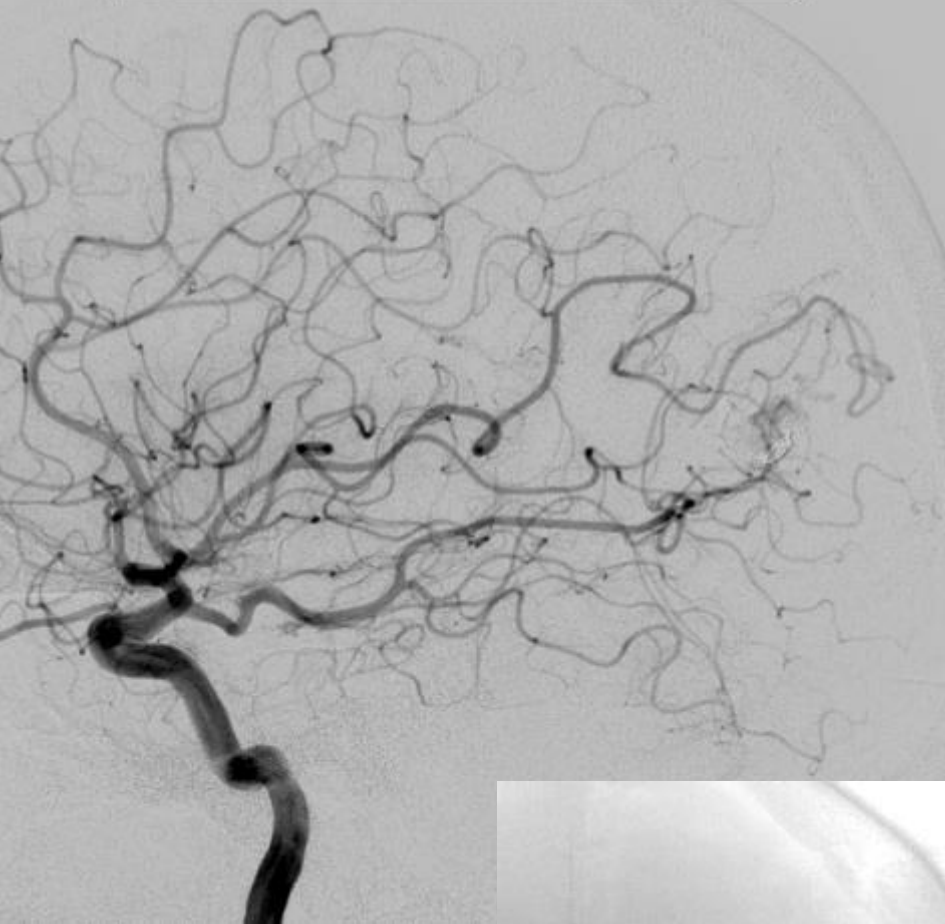


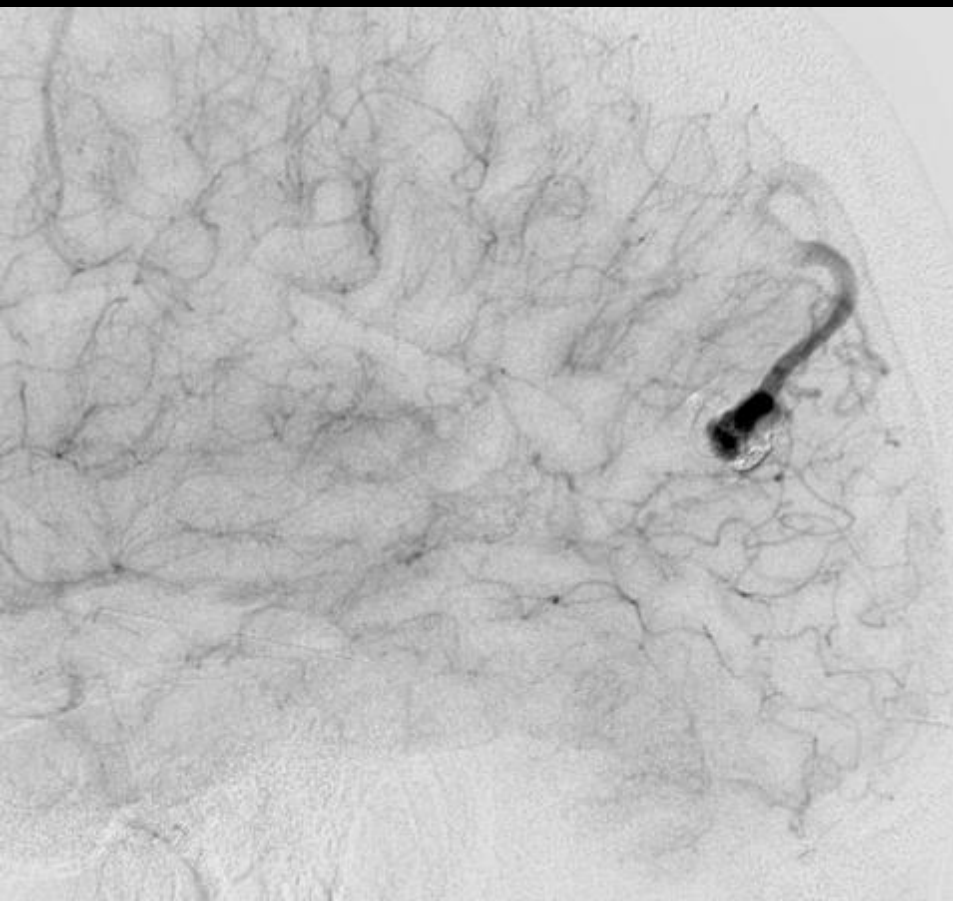
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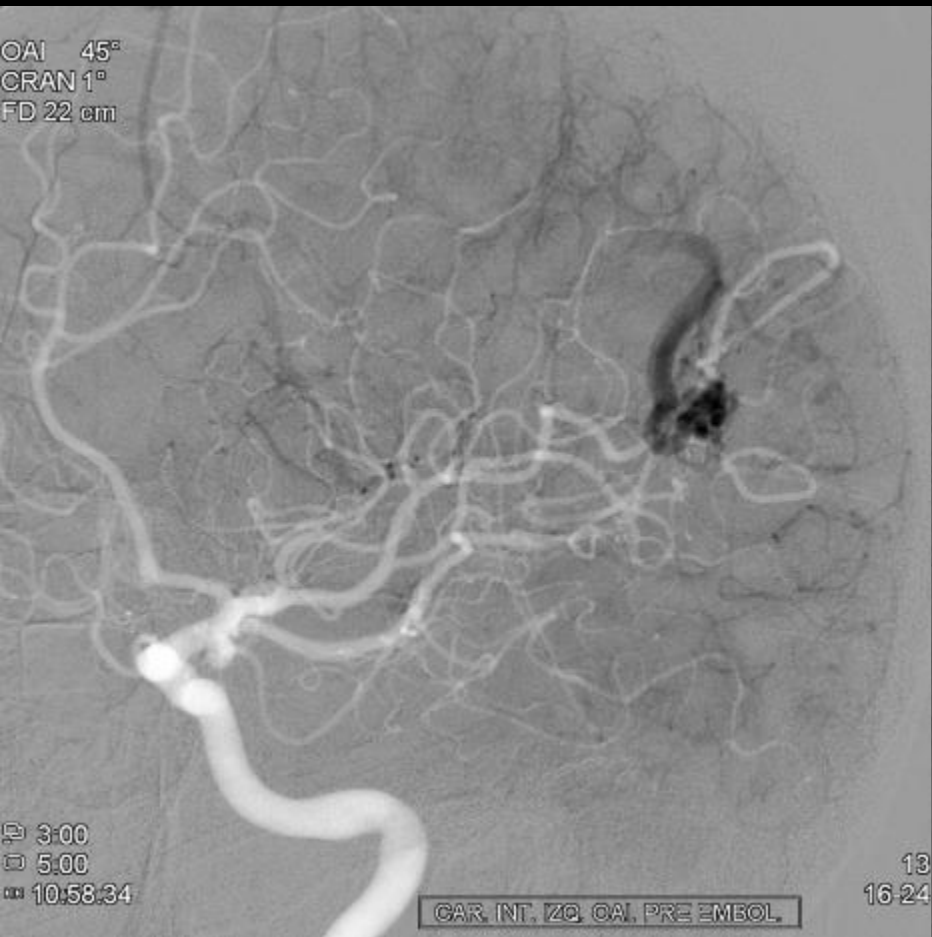


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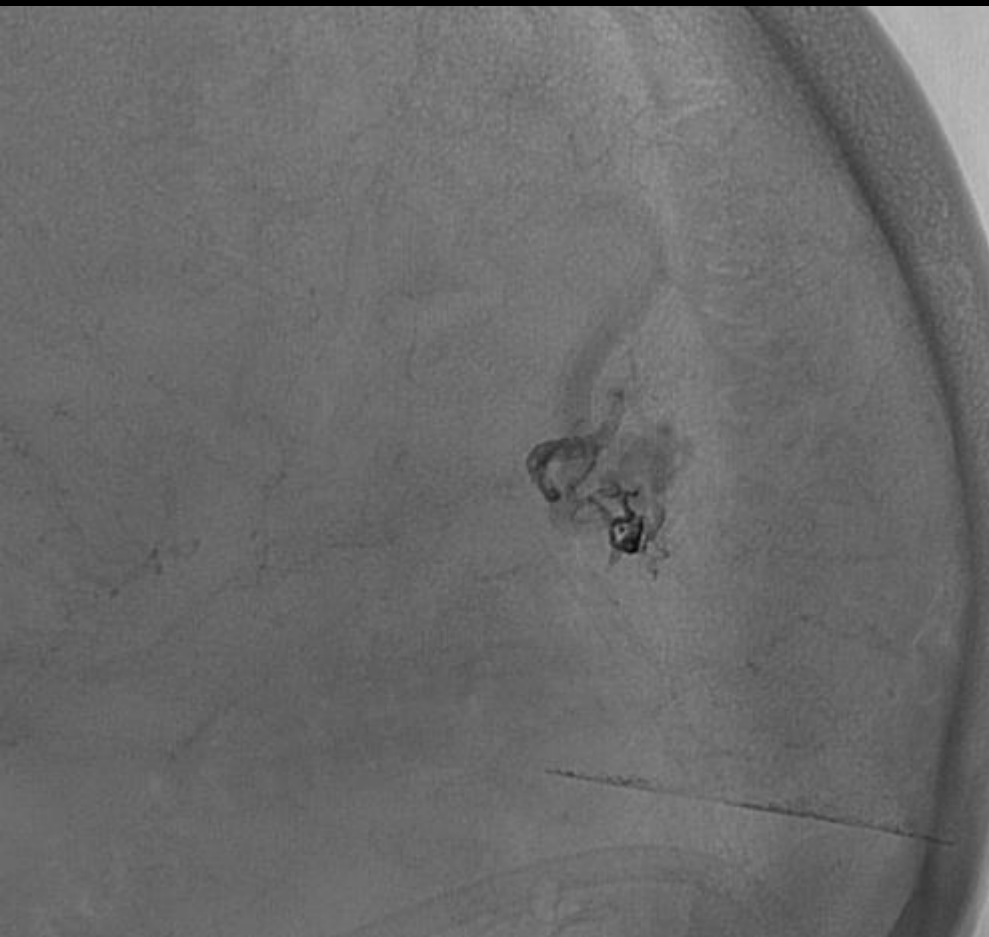


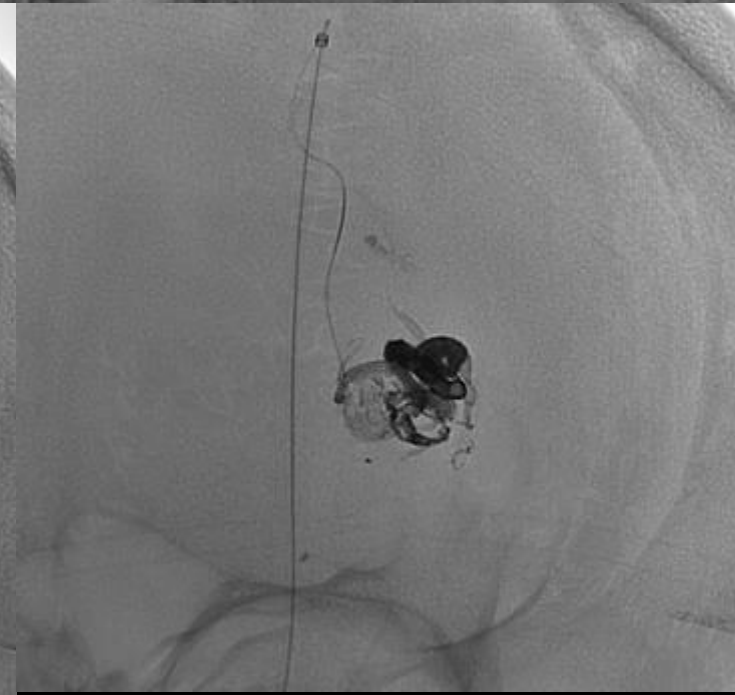
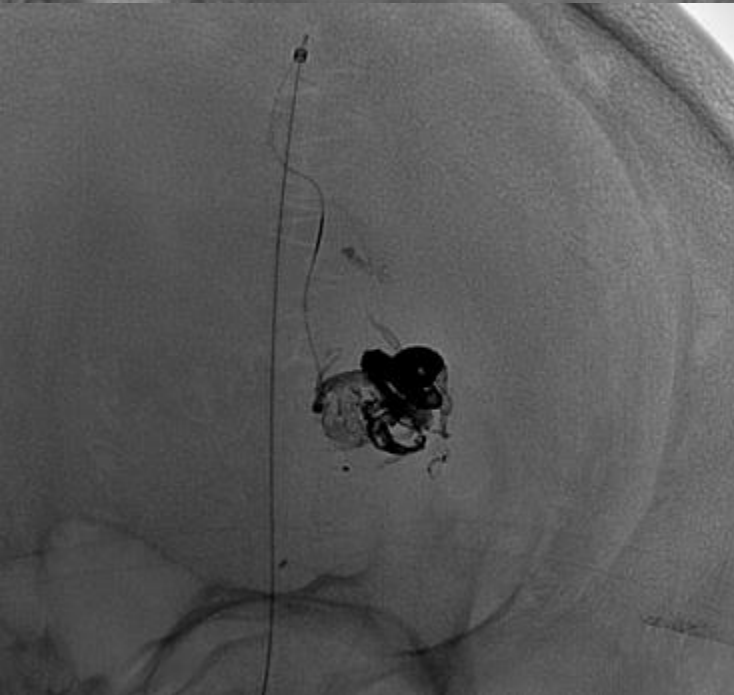
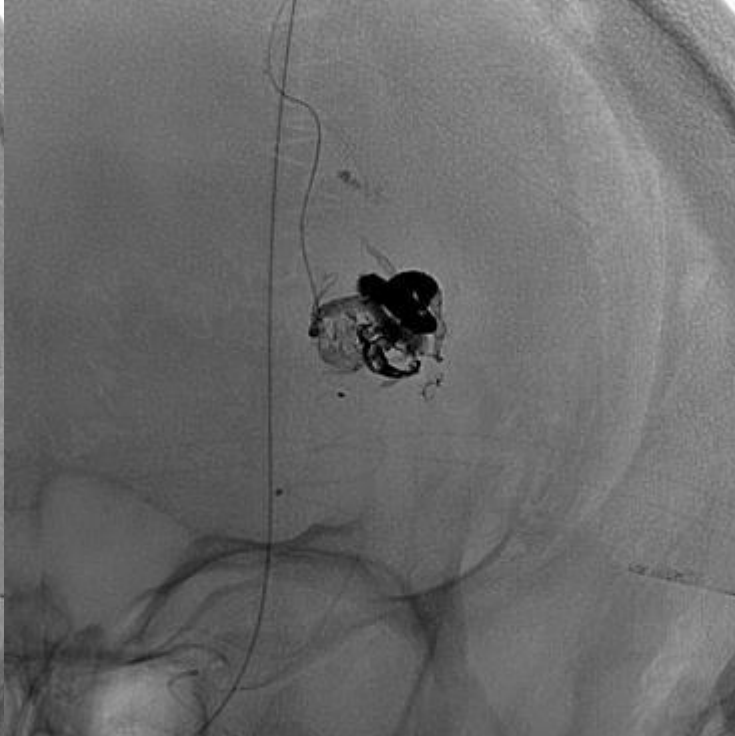
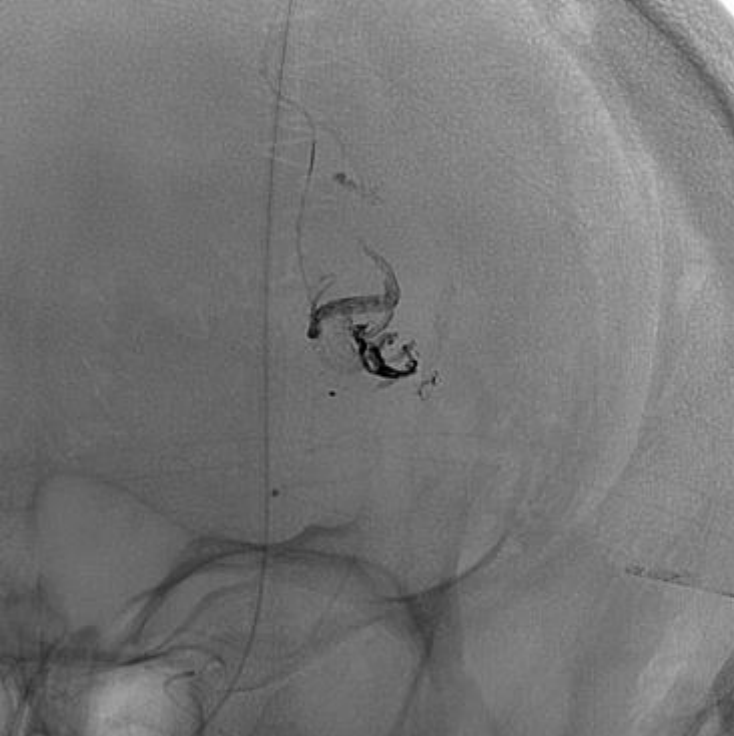


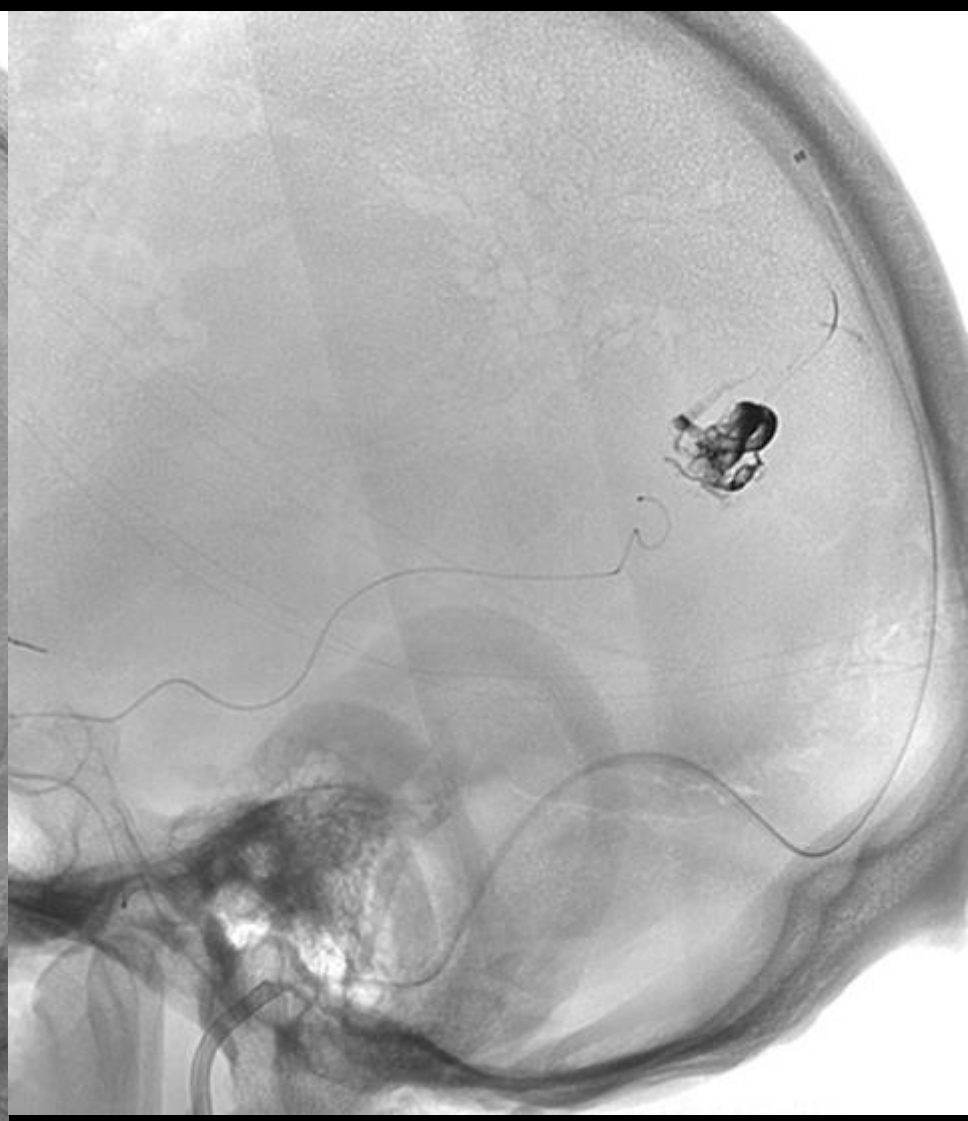
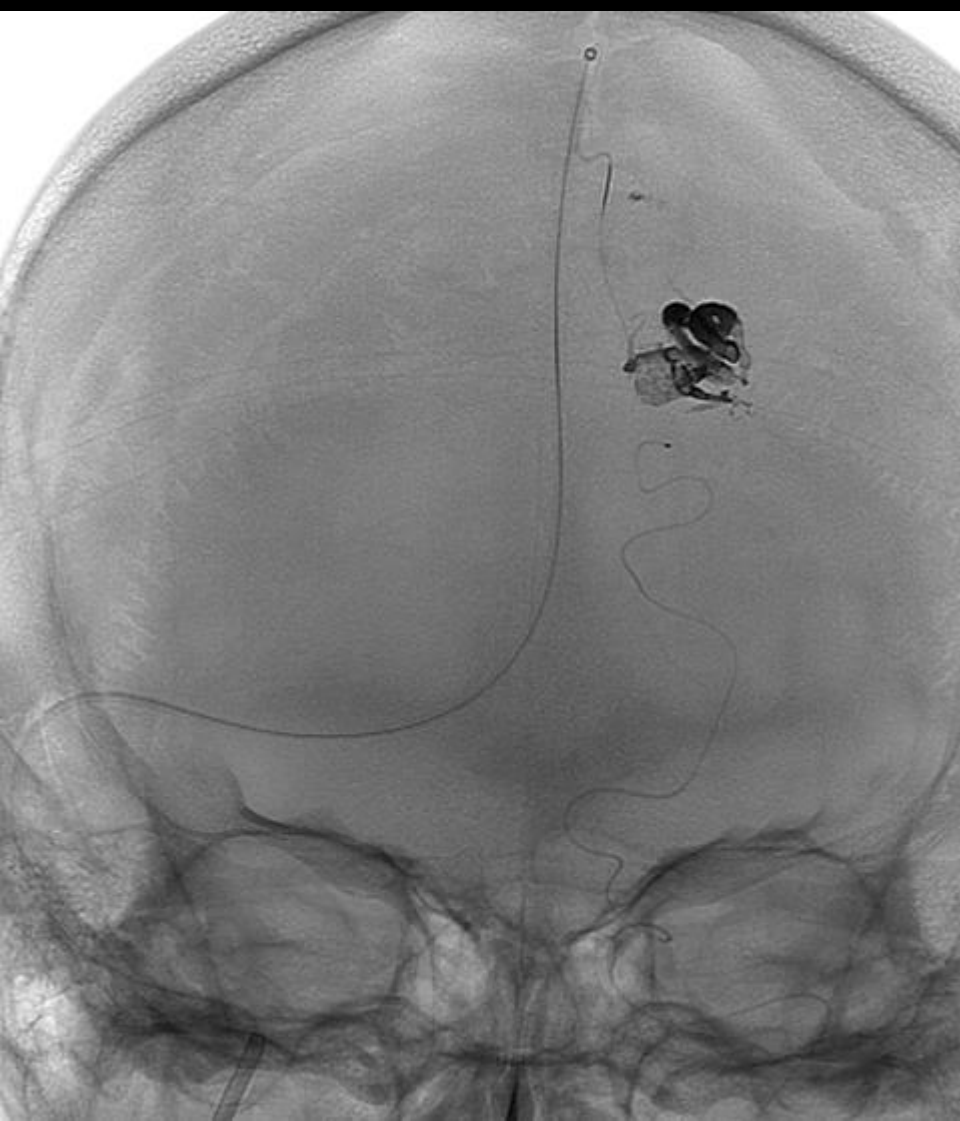
OAI 45°
CRAN 1°
FD 22 cm



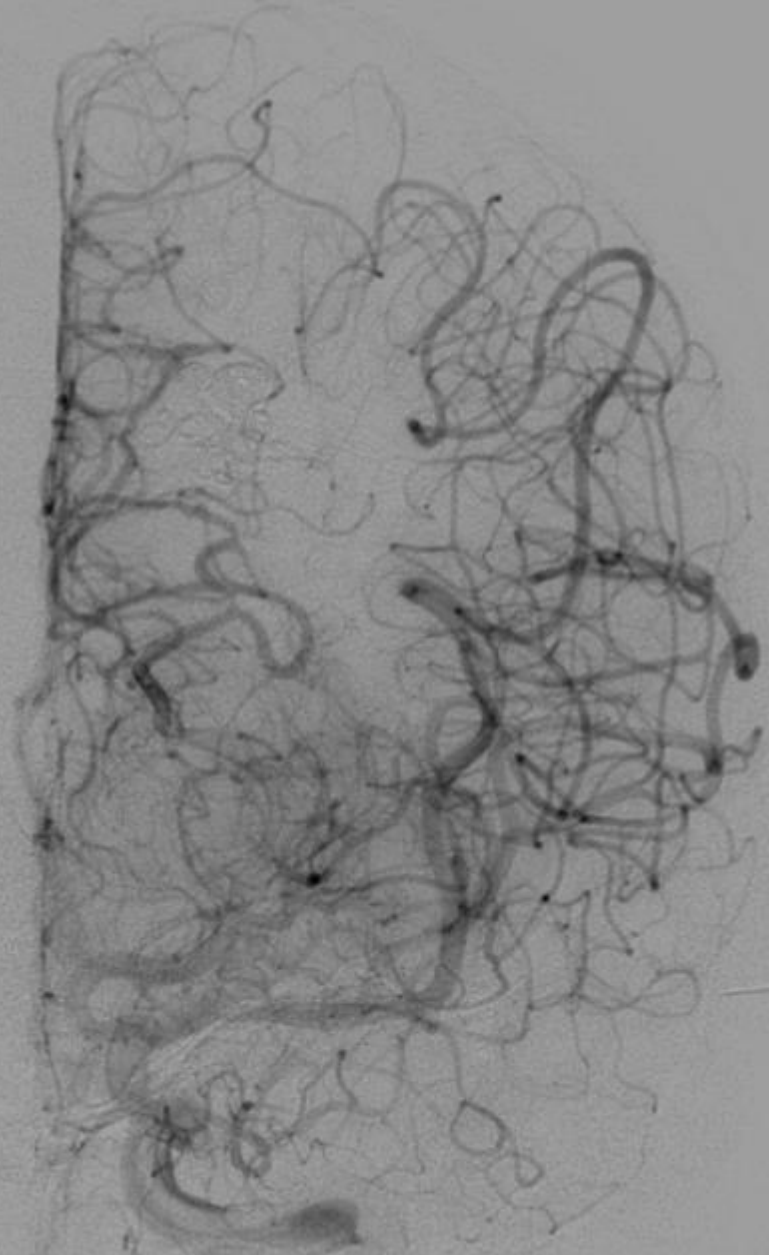
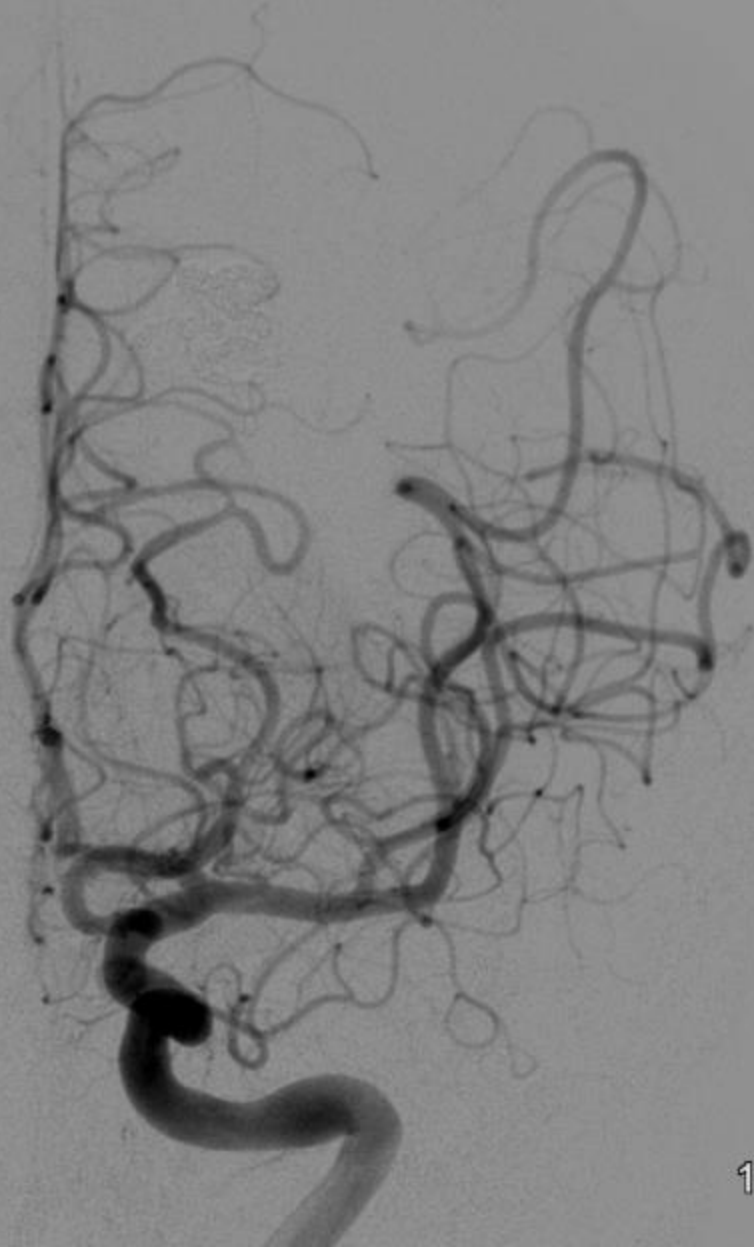
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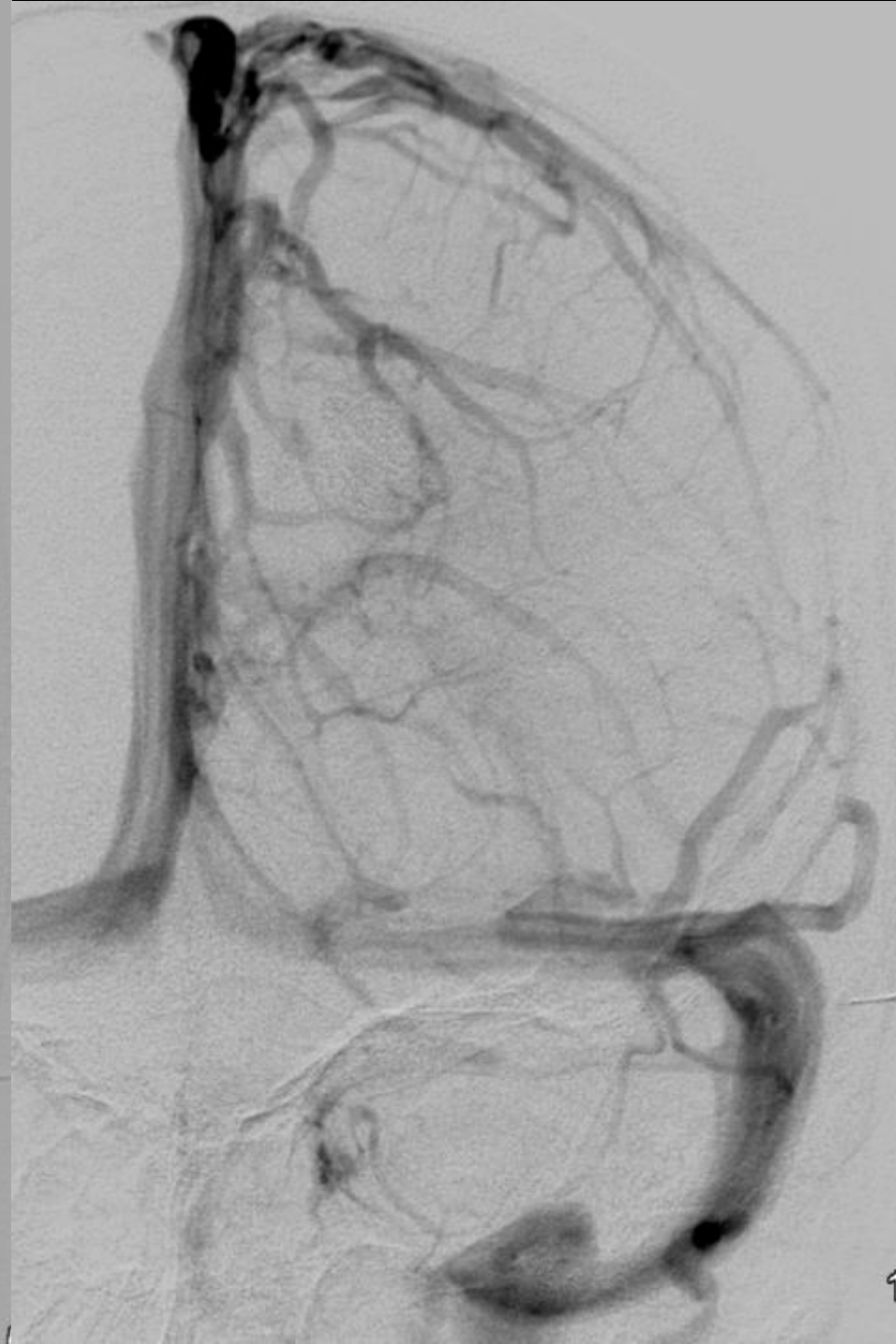




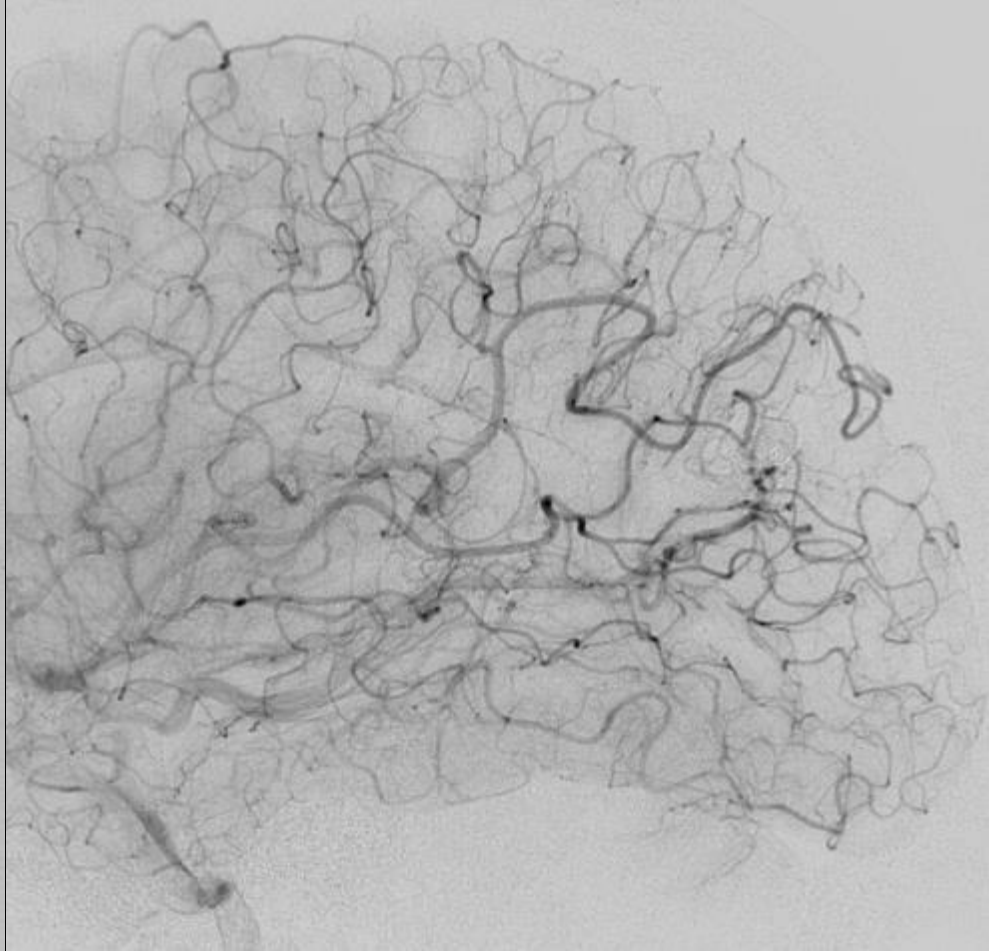
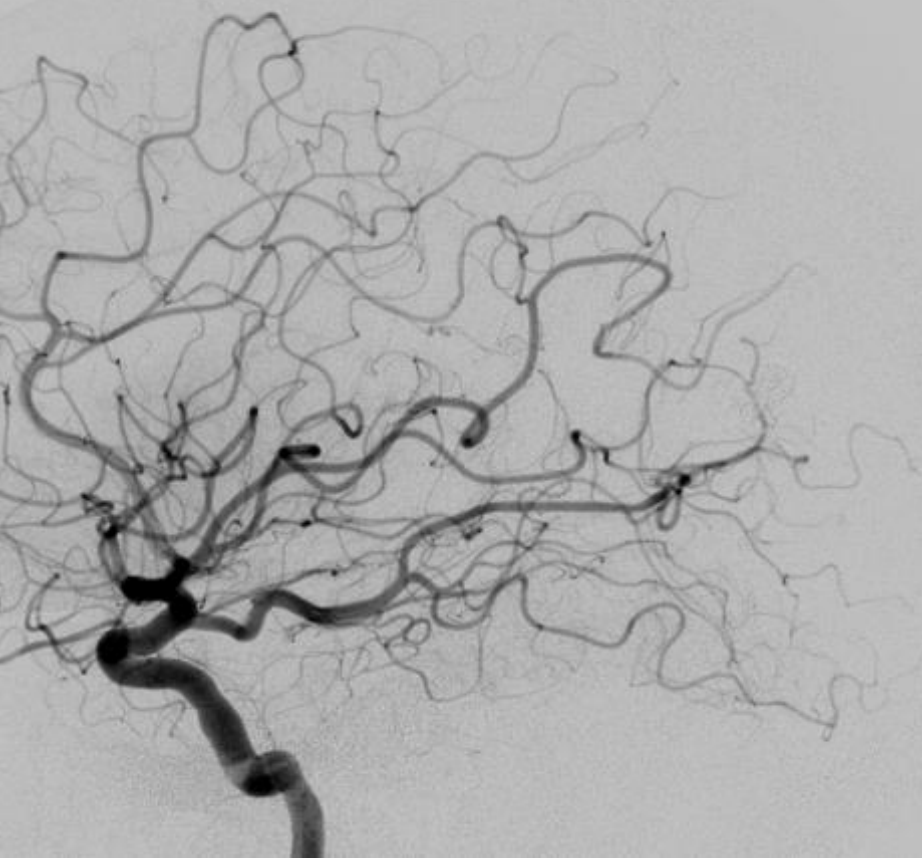


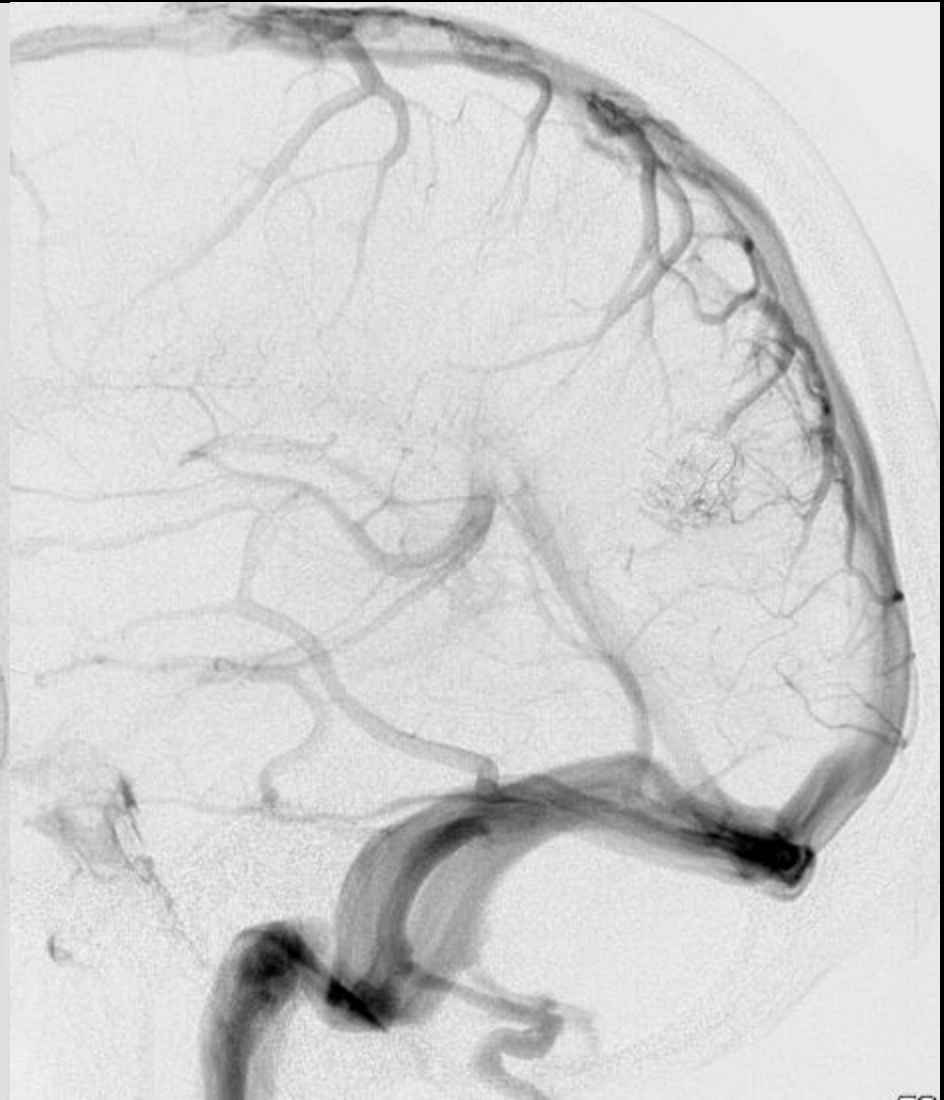
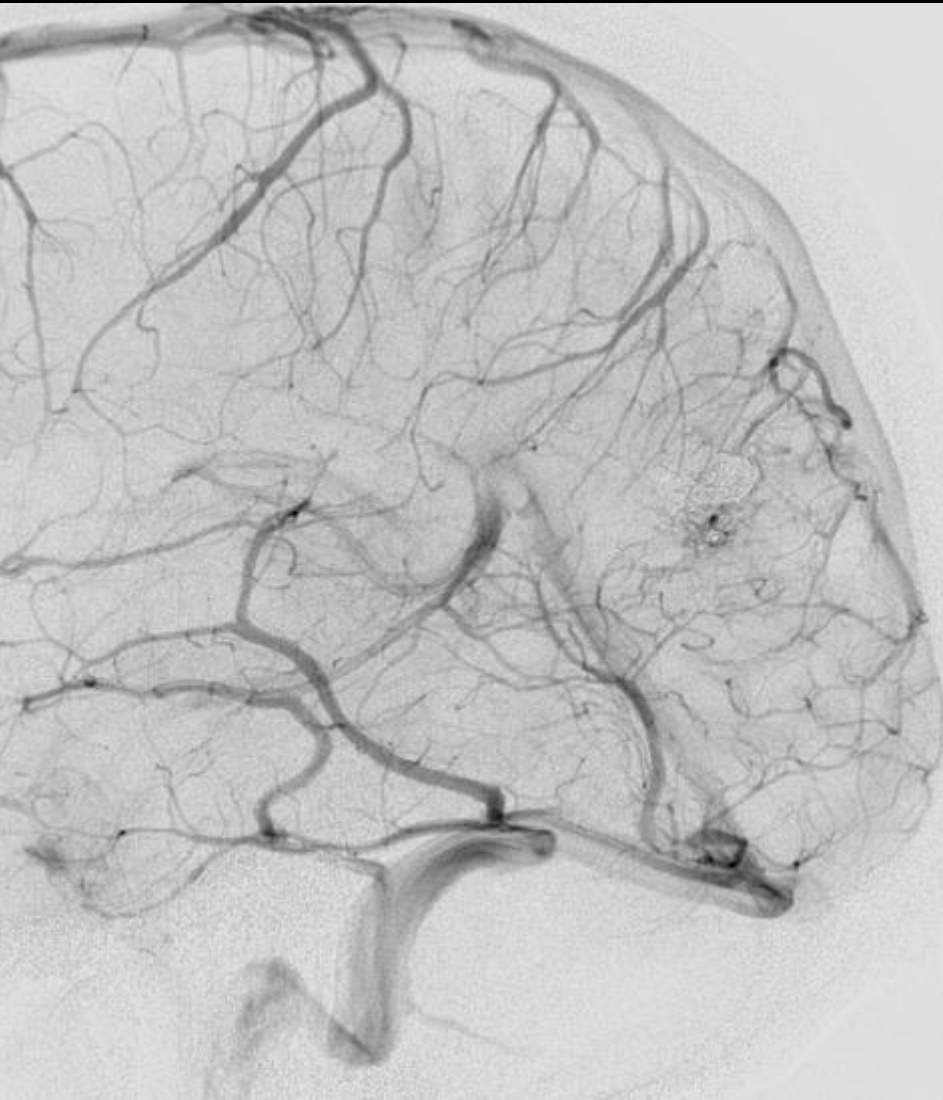
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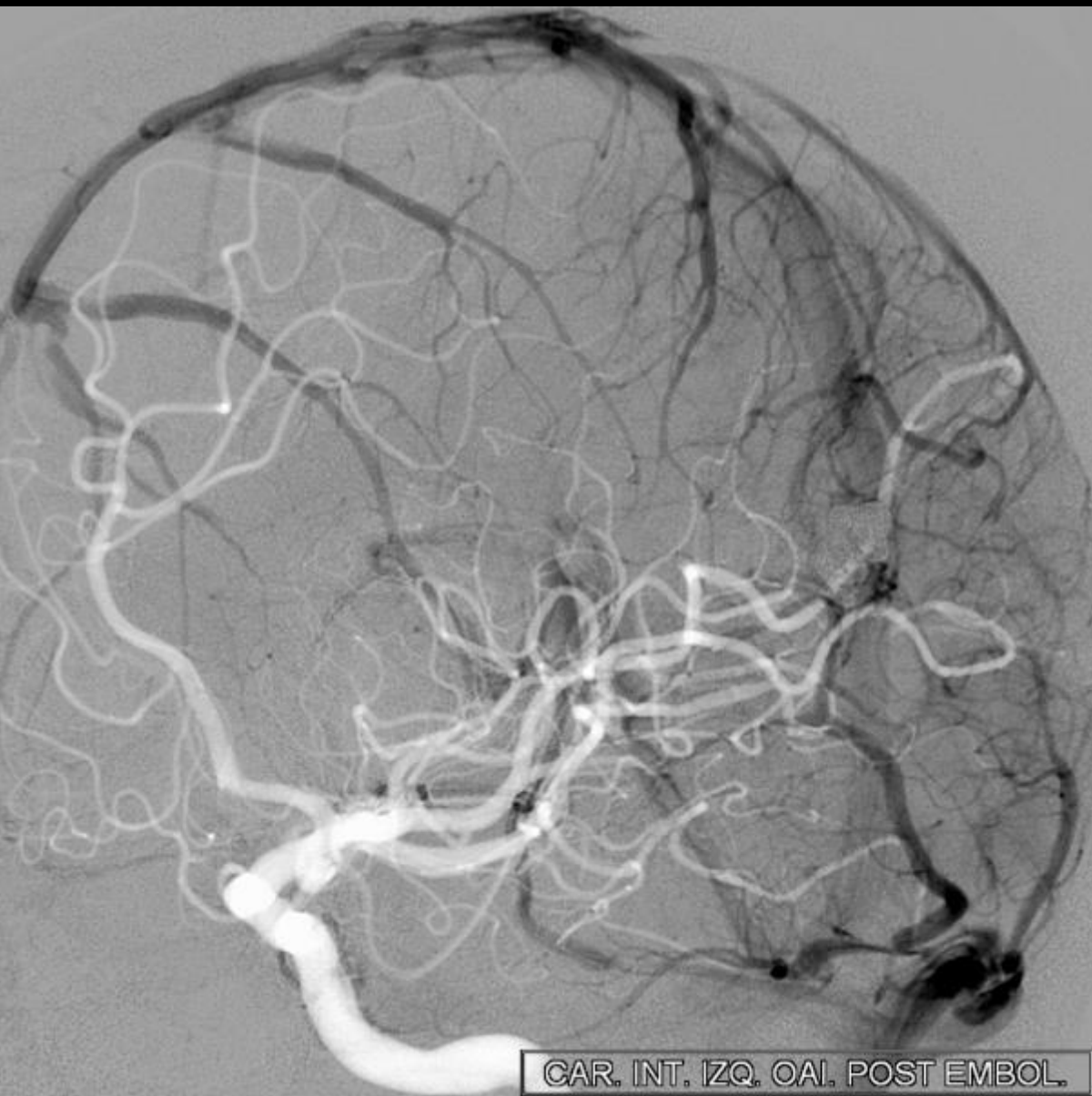




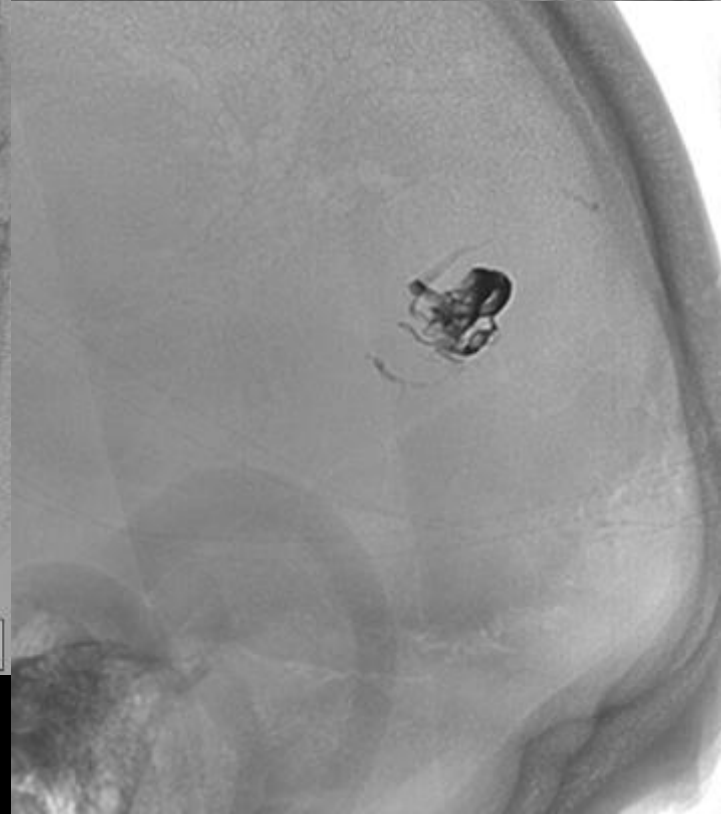
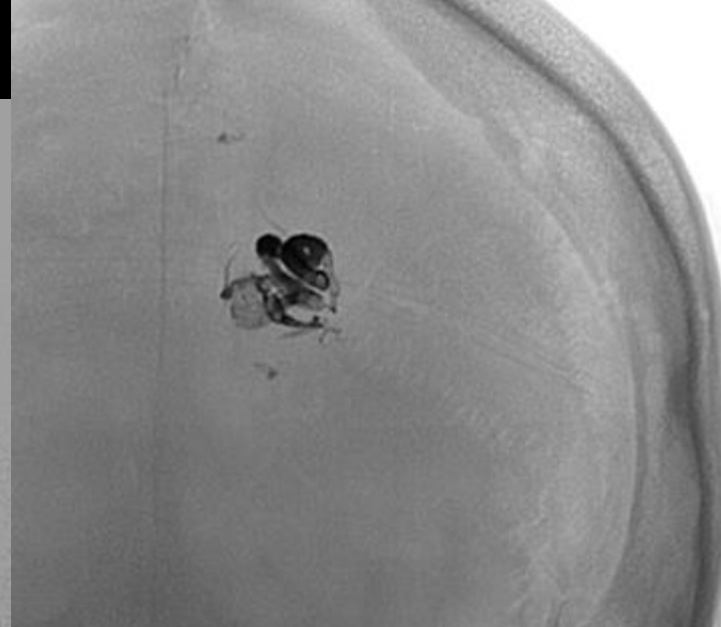
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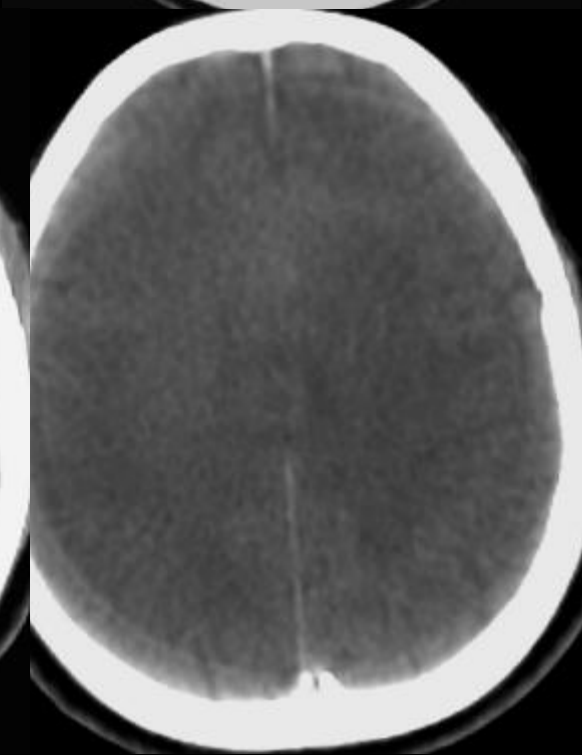
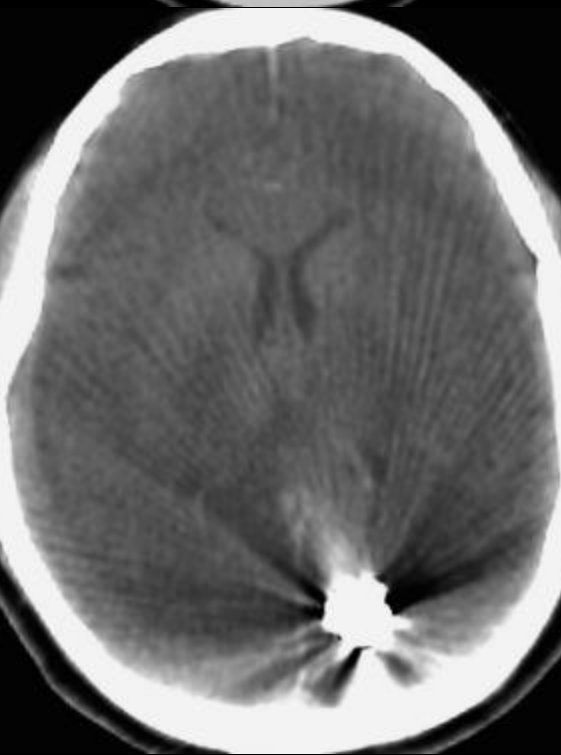
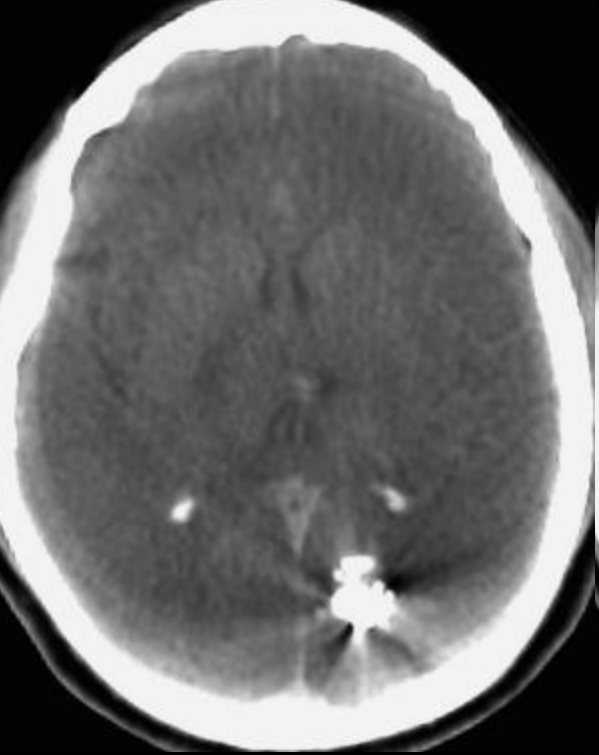
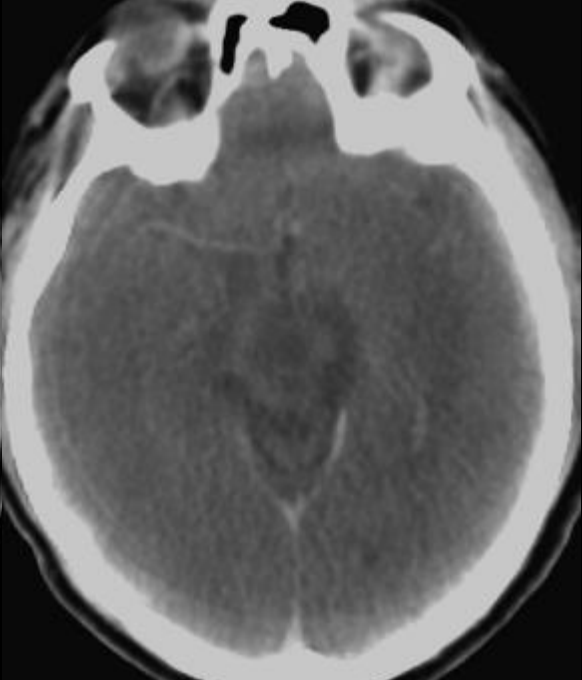




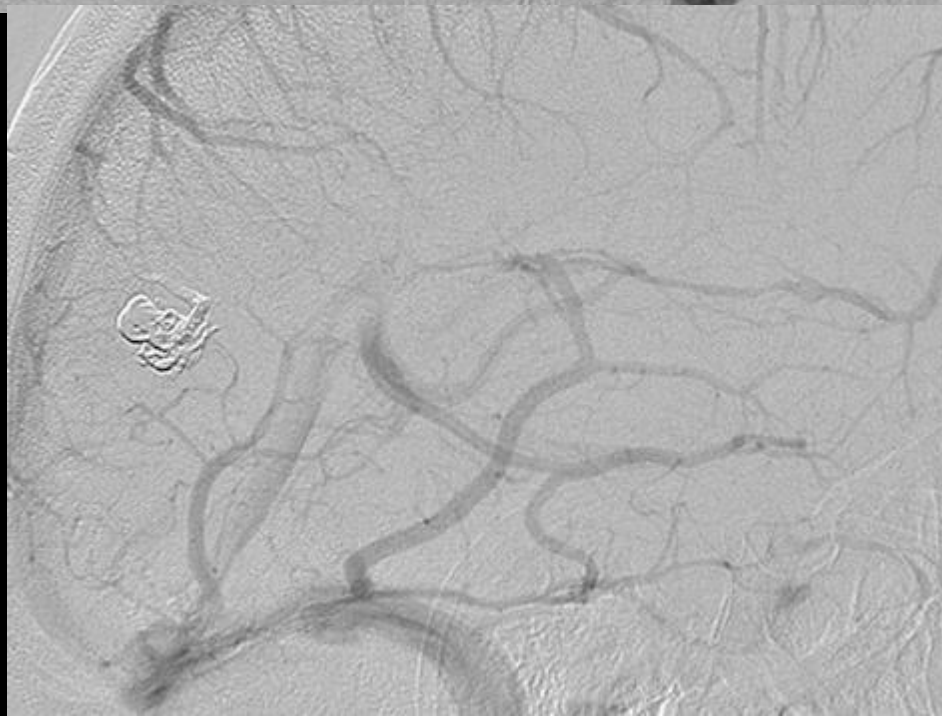
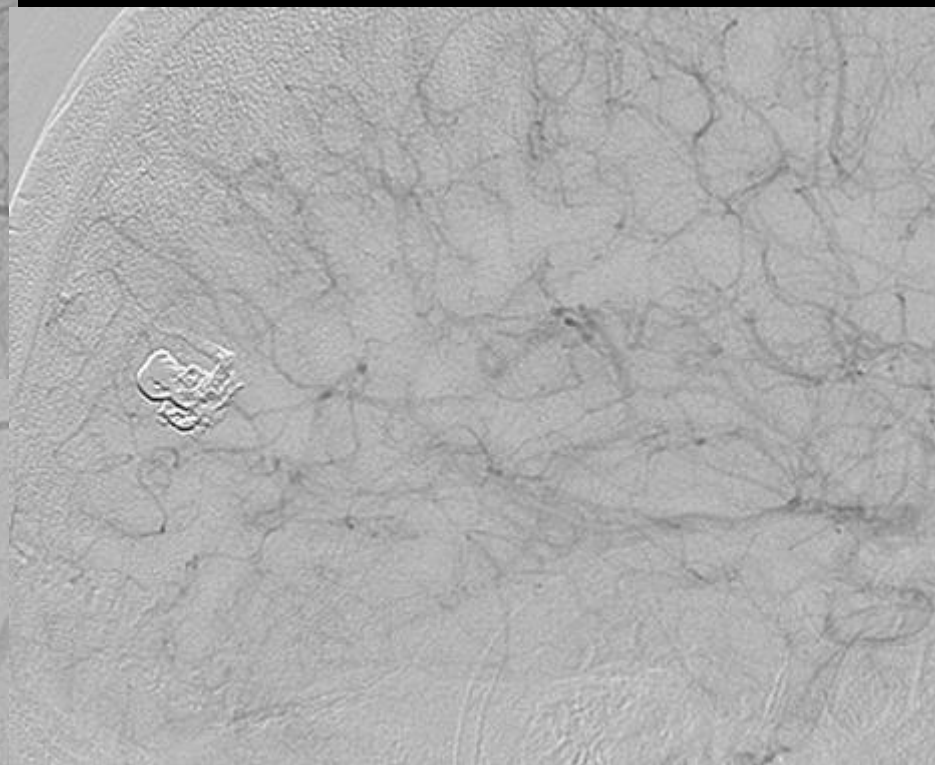
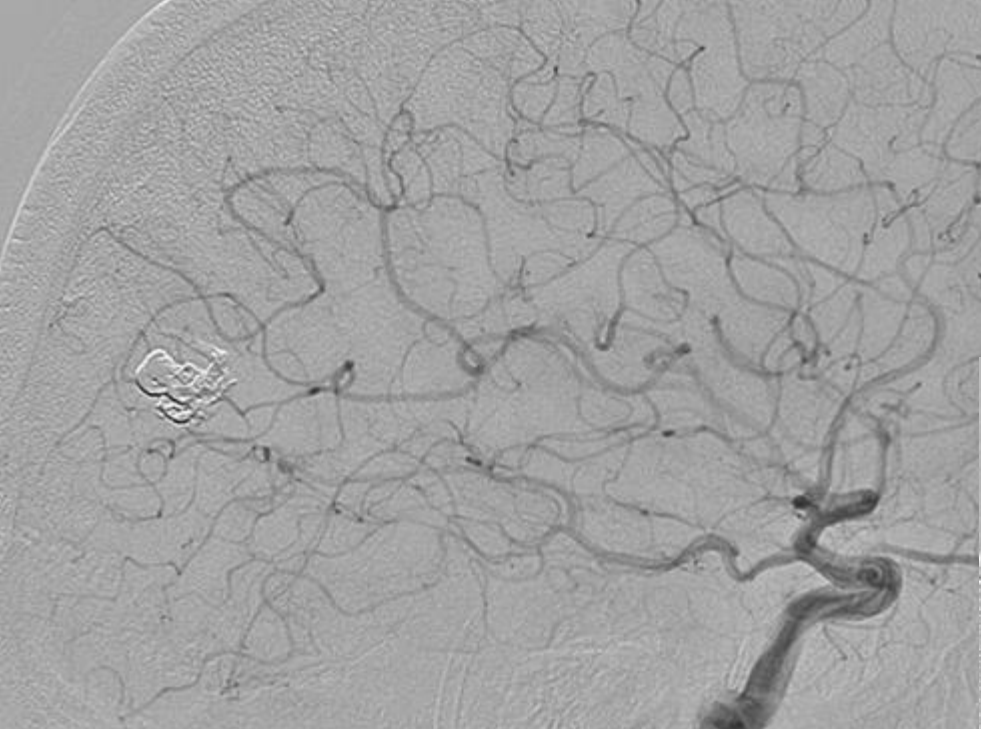


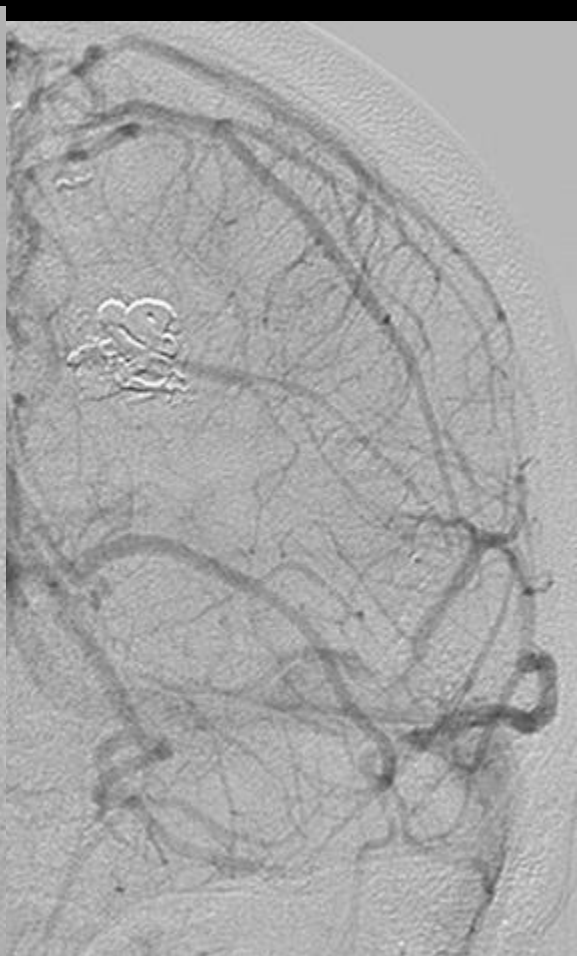
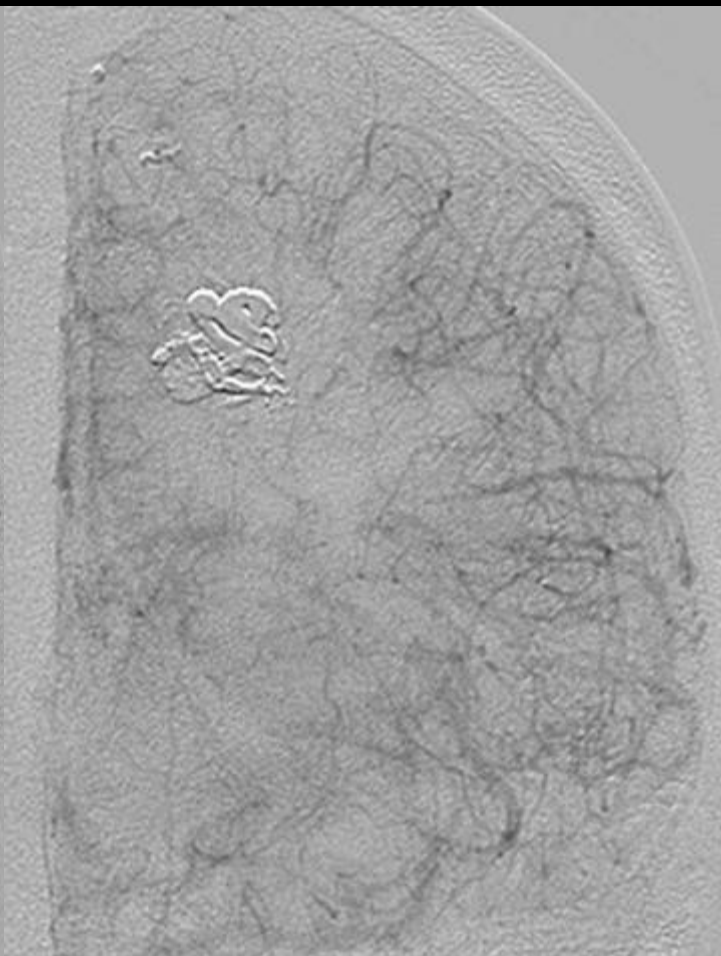
CAR. INT. IZQ. OAI. POST EMBOL.





F/up 6 m





VENOUS OCCLUSION CONCEPT TO TREAT BRAIN AVM'S

- «Venous approach» is just the ability to treat a brain AVM by achieving necessarily an occlusion of the vein when it is impossible or unlikely through the artery
- Occlusion of the nidus by retrograde filling from the vein
- Stability over time of nidal occlusion, requires occlusion of the veins
- Technically more difficult
- Not more dangerous than arterial approach when indications are strictly selected

VENOUS APPROACH

- Ruptured AVM (ARUBA)
- No or too tiny or dangerous arterial access (perforators, eloquent branches...)
- Eloquent area / deep location = no Surgery
- Ruptured AVM = no Radiosurgery



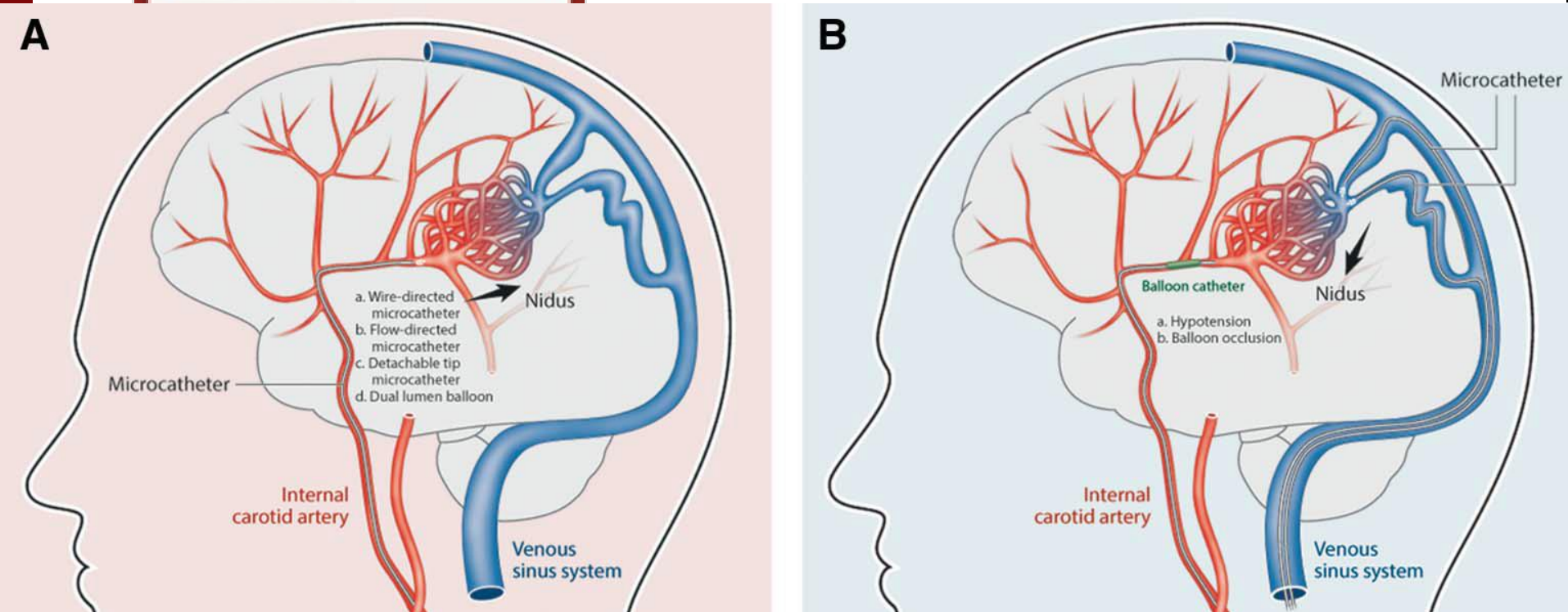
IF THE VEIN IS SINGLE
and EXCLUSIVE

A SMALL AVM REMNANT WITH A DRAINING VEIN
RARELY DISAPPEARS !!!

On the contrary THERE IS A HIGH
RISK OF BLEEDING IF THE VEINS ARE OCCLUDED
BUT NOT THE NIDUS !!!

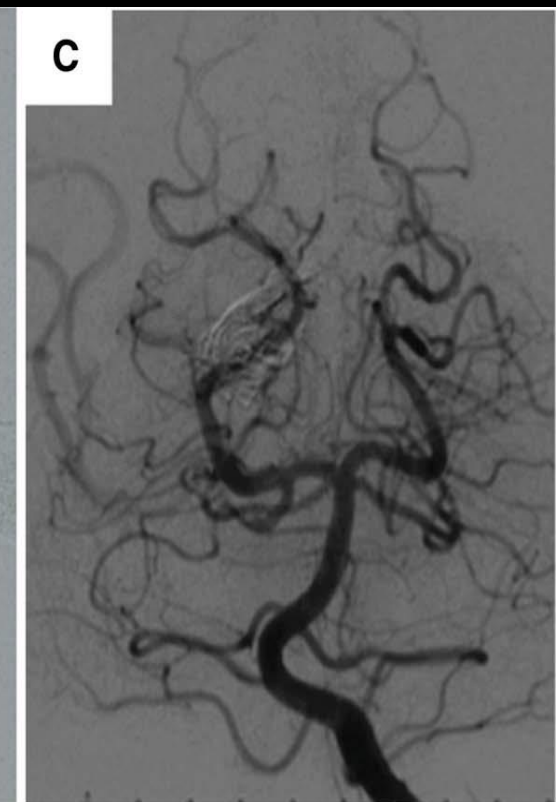
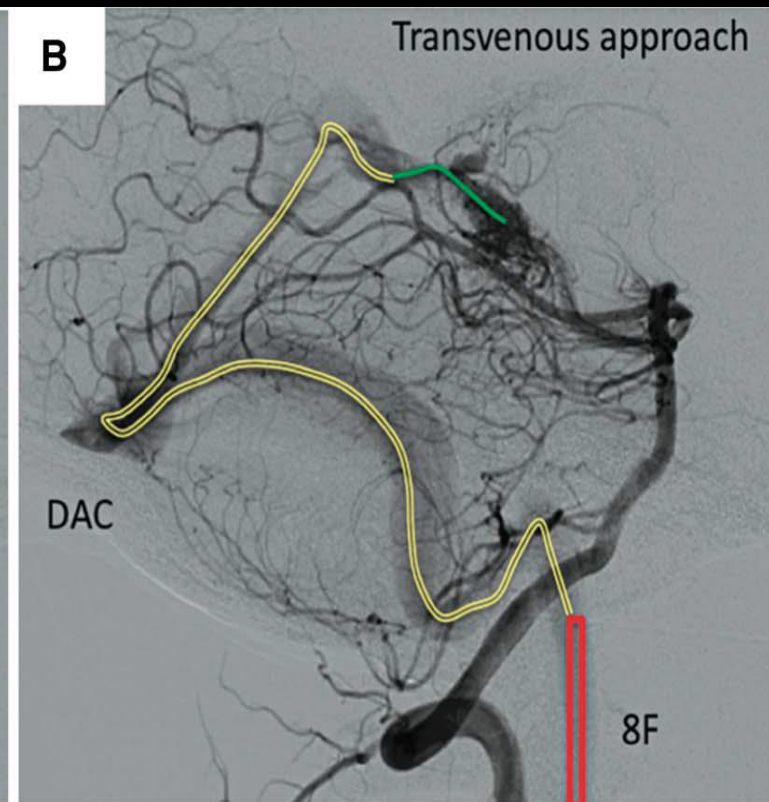
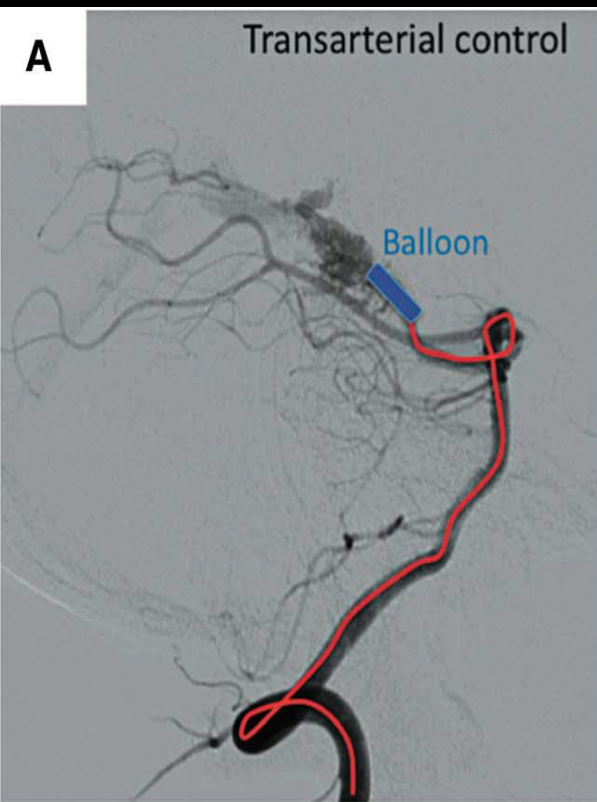
THERE IS NEVER ANY RECURRENCE
IF THE VEINS ARE OCCLUDED

THE VEINS SHOULD BE OCCLUDED... AT THE
VERY END OF THE EVT



**Transvenous Approach to Intracranial Arteriovenous Malformations:
Challenging the Axioms of Arteriovenous Malformation Therapy?**

Choudhri, Omar MD^{*}; Ivan, Michael E. MD[‡]; Lawton, Michael T. MD[‡]



Adapted with permission from Pereira VM, et al. Transvenous embolization of a ruptured deep cerebral arteriovenous malformation. A technical note. *Interv Neuroradiol.* 2013;19(1):27-34).

TABLE. Reported Cases of Transvenous Endovascular Treatment of Intracranial Arteriovenous Malformations^a

Case#	Author & Year	Patient Age/Sex	Location of AVM, Nidus Size	Transvenous Embolic Agent	Feeding Artery
1	Benabu et al 2010 ⁶¹	13 M	Basal ganglia, thalamic	Coils	Insular perforators, lenticulostriate
2	Nguyen et al 2010 ³⁹	50 M	Sylvian AVM <1 cm	Onyx	En passage AVM supply
3	Kessler et al 2011 ⁶²	57 M	Right CP angle 1 cm	Onyx	SCA
4		32 M	Basal ganglia 2 cm	Onyx	Lenticulostriate
5		19 F	Right lateral ventricle 2 cm	Onyx	Anterior and posterior choroidal artery
6		48 M	Frontal 5 cm	Onyx	MCA temporal branches
7		53 F	Temporal 3.5 cm	Onyx	MCA temporal branches
8	Consoli et al 2013 ⁶³	36 F	Paraventricular <3 cm	Onyx	AchoA, insular perforators, artery of splenium of CC
9		23 F	Thalamomesencephalic <3 cm	Onyx	AchoA, thalamogeniculate perforators
10		11 F	Pontocerebellar angle <3 cm	Onyx	AICA
11		36 M	Paraventricular <3 cm	Onyx	Posterior choroidal
12		61 M	Medial temporopolar <3 cm	Onyx	AchoA, PCA and temporal branches, MCA perforators, Acc. meningeal artery
13	Pereira et al 2013 ³⁸	31 M	Paraventricular 2 cm	Squid 18	Posterior choroidal feeders
14	Martinez-Galdamez et al 2013 ⁶⁴	45 F	Subependymal 9 mm	Onyx	Anterior and posterior pericallosal arteries

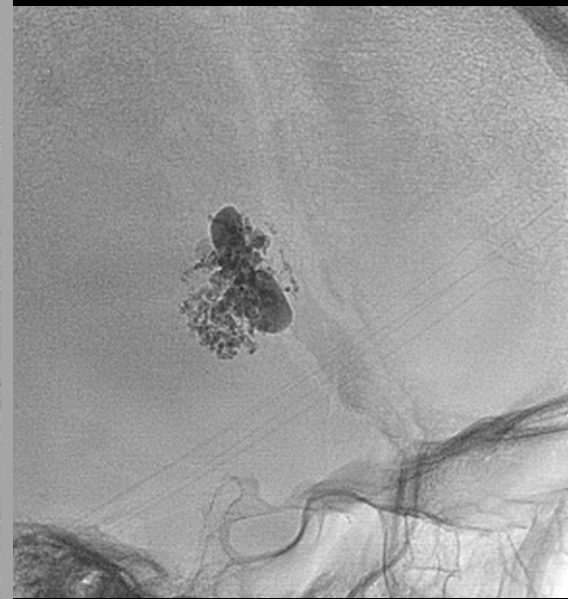
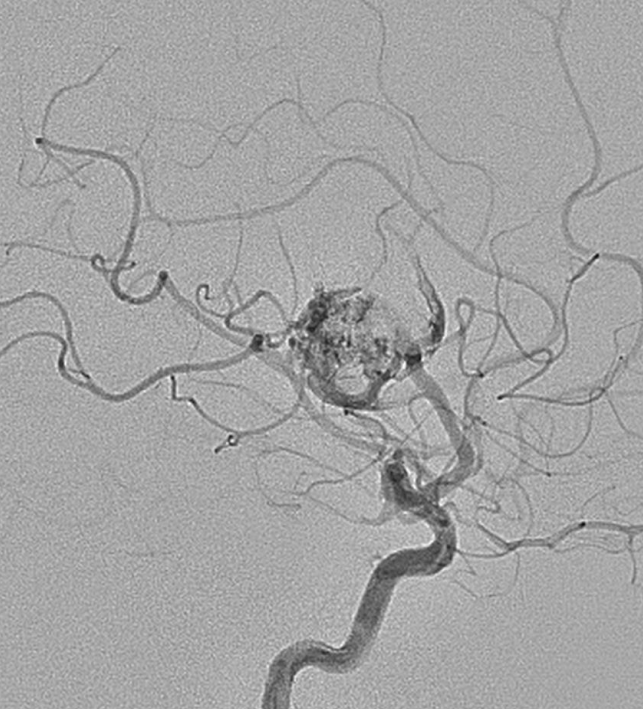
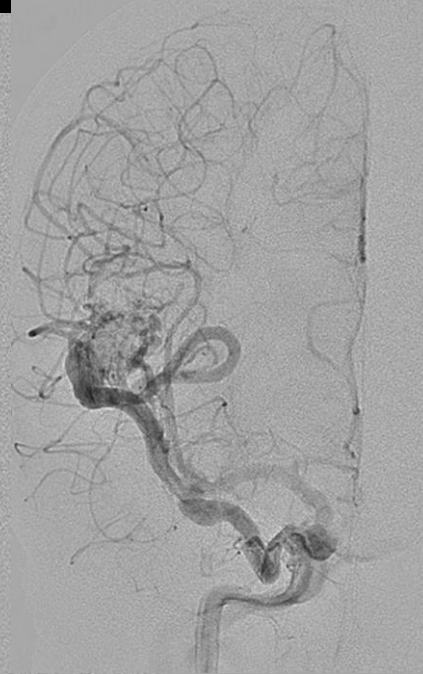
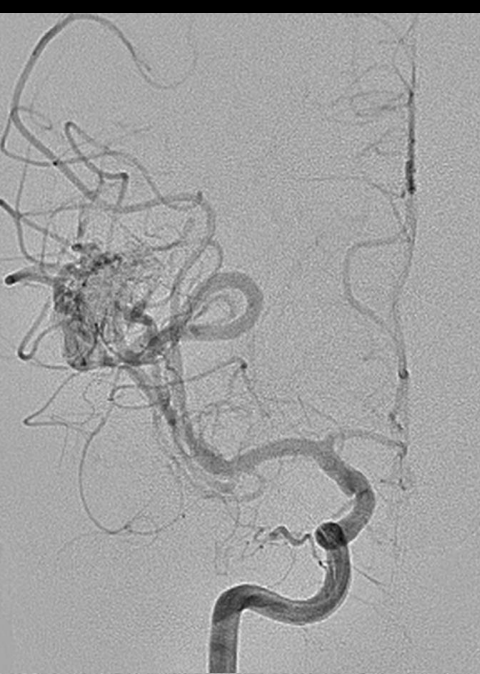
Case#	Draining Vein	Prior Hemorrhage	Prior Treatment	Outcome	Complications
1	Internal cerebral vein	No	Partial TA embo histoacryl	Only venous aneurysm coiled, obliterated	None
2	Vein of Labbé, transverse sinus	Yes	Failed arterial pedicle access	Angiographic cure	Arterial branch occlusion
3	Pontine vein, SPS	Yes	No	Angiographic cure	None
4	ICV	Yes	No	Angiographic cure	None
5	ICV, VOG, SS	Yes	No	Ongoing	None
6	VOL	No	TA embo	Angiographic cure	None
7	Lateral thalamic vein, ICV, SS	Yes	XRT and transarterial embo.	Angiographic cure	None
8	Deep, single ICV	Yes	No	Angiographic cure	None
9	Deep, single BVOR	Yes	No	Angiographic cure	None
10	Deep, single cortical ectatic cerebellar vein	Yes	Combined, Glubran used TA	Angiographic cure	None
11	Deep, single BVOR	Yes	Combined, Onyx used TA and TV	Angiographic cure	None
12	Deep (single) BVOR and superficial (single)VOL	Yes	Combined Onyx used TA and TV; prior subtotal TA embo & XRT	Angiographic cure	None
13	ICV, VOG, SS	Yes	No	Angiographic cure	None
14	Single deep	Yes × 2	XRT after initial hemorrhage	Angiographic cure	None

^aAchoA, anterior choroidal artery; AICA, anterior-inferior cerebellar artery; AVM, arteriovenous malformation; BVOR, basal vein of Rosenthal; CC, corpus callosum; CP, cerebellopontine; ICV, internal cerebral vein; MCA, middle cerebral artery; PCA, posterior cerebral artery; SCA, superior cerebellar artery; SPS, superior petrosal sinus; SS, straight sinus; TA, transarterial; TV, transvenous; VOG, vein of Galen; VOL, vein of Labbé; XRT, radiation.

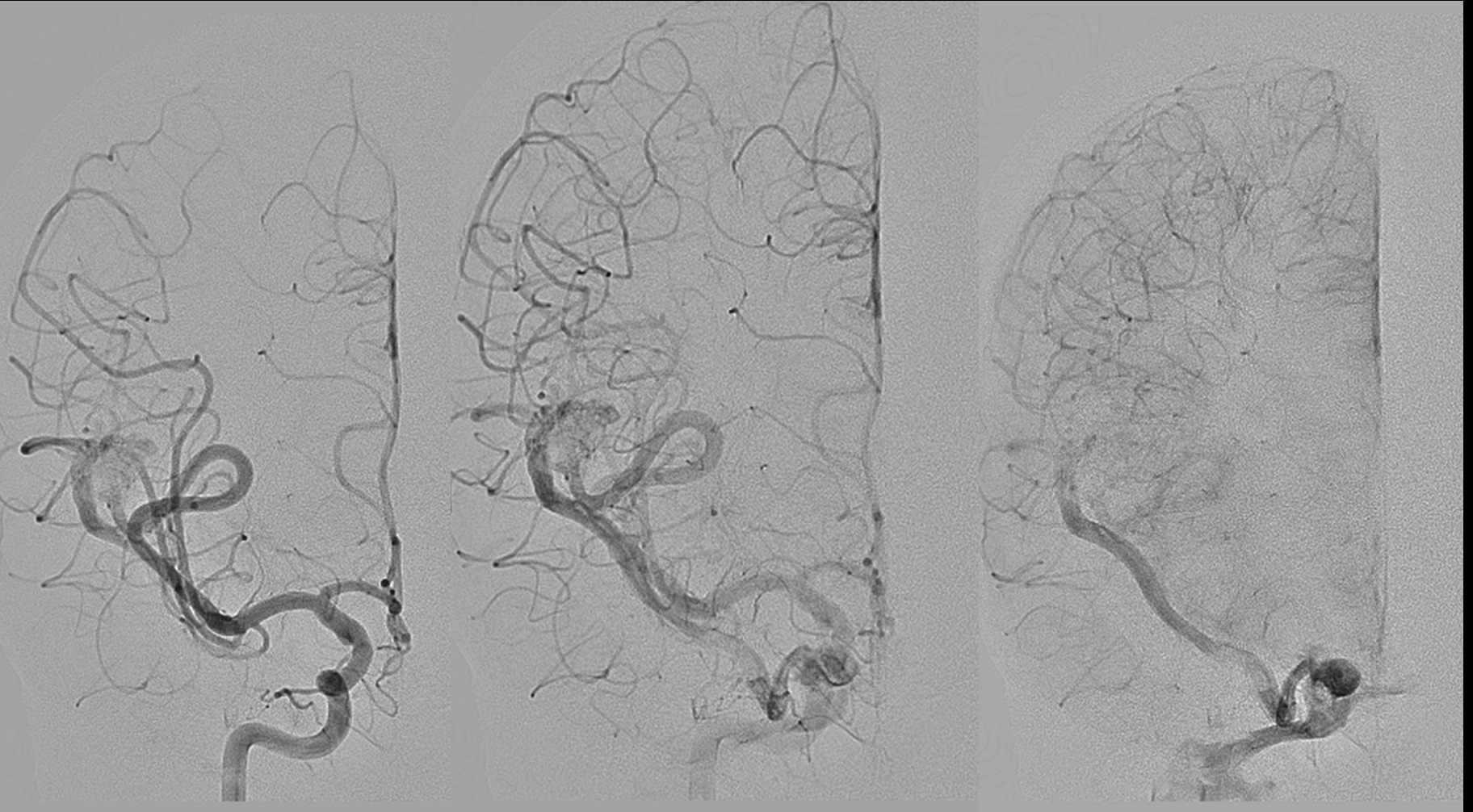
VENOUS OCCLUSION CONCEPT
TO TREAT BRAIN AVM'S

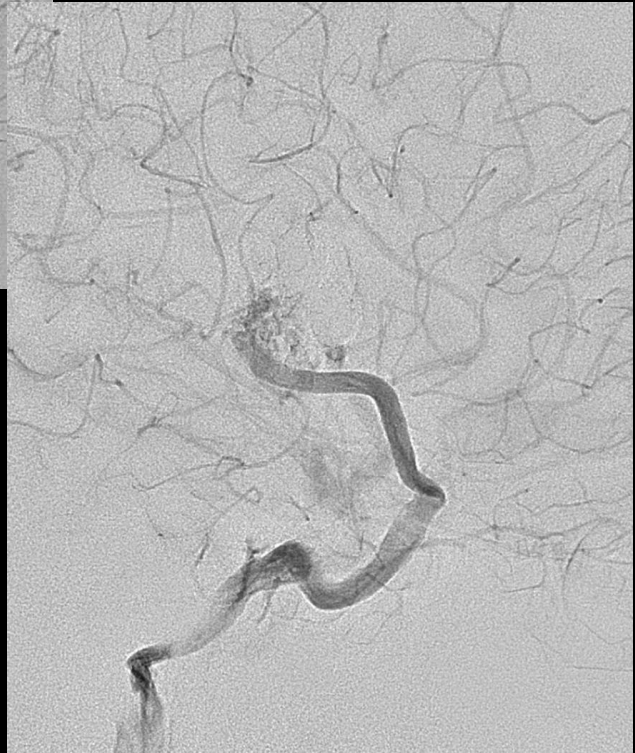
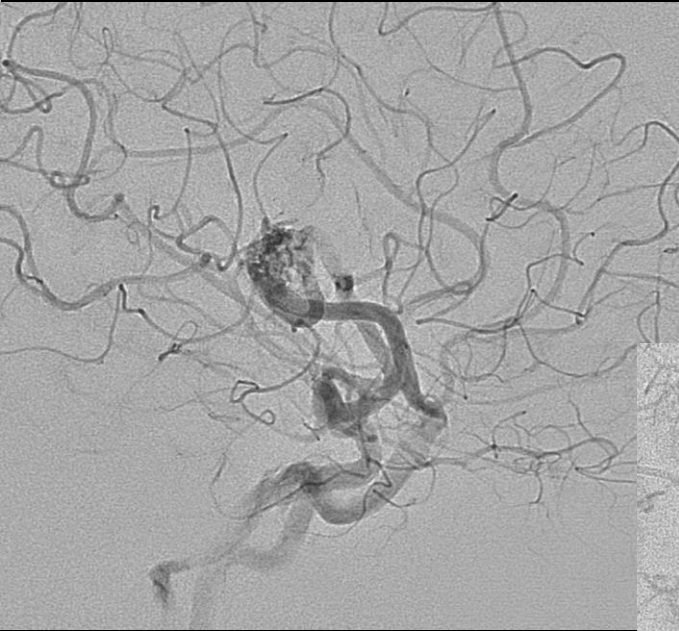
CAN WE EXPECT MORE
INDICATIONS IN THE FUTURE ?





Post Embol







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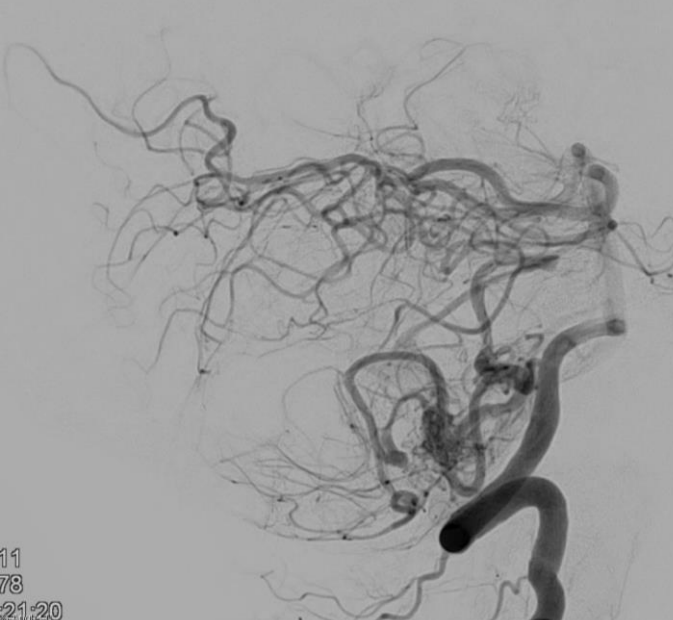
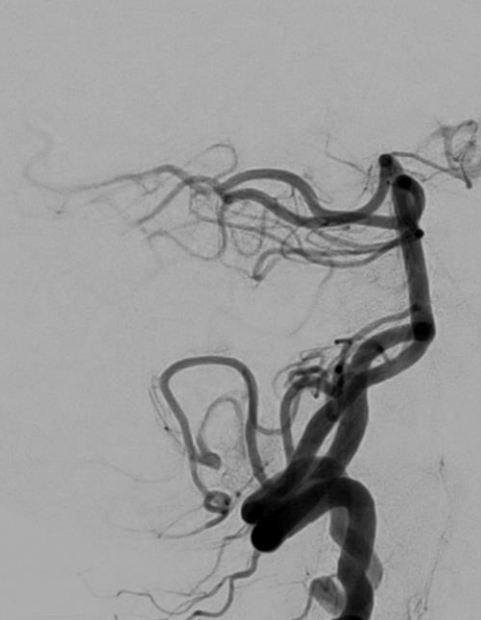
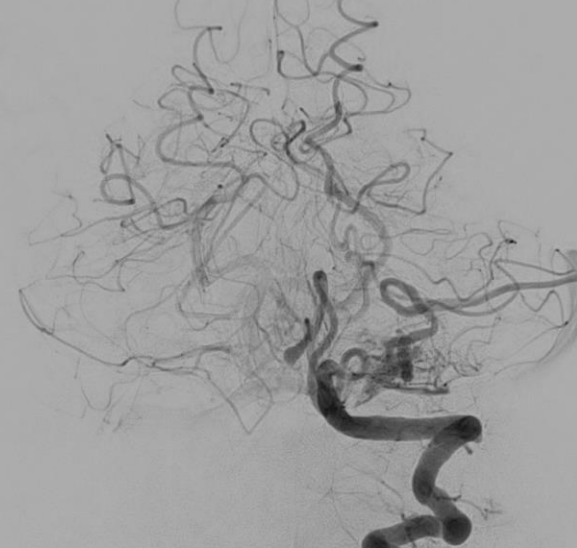


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View size: 1237 x 1237

Rot -89°
Ang -2°
FD 25 cm



PARODI DE ARMESTO MARTHA ESTER 4096370 (76 y., 76 y)
Cabeza - Cerebr. 6fps 116mm

Image size: 1024 x 1024
View size: 1237 x 1237

Rot -89°
Ang -2°
FD 25 cm



PARODI DE ARMESTO MARTHA ESTER 4096370 (76 y., 76 y)
Cabeza - Cerebr. 6fps 116mm

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16:21:20

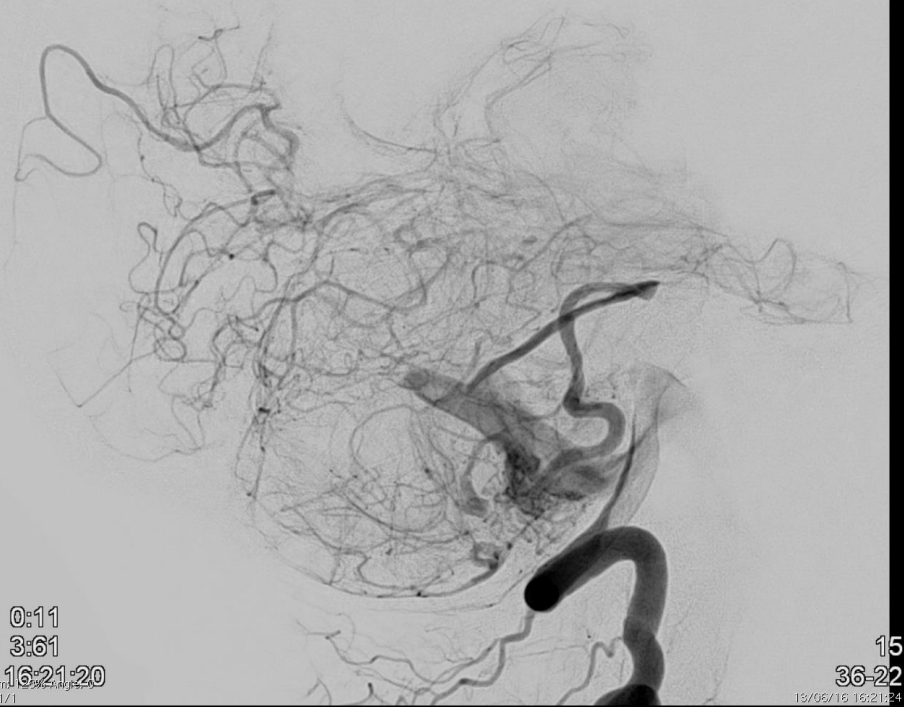
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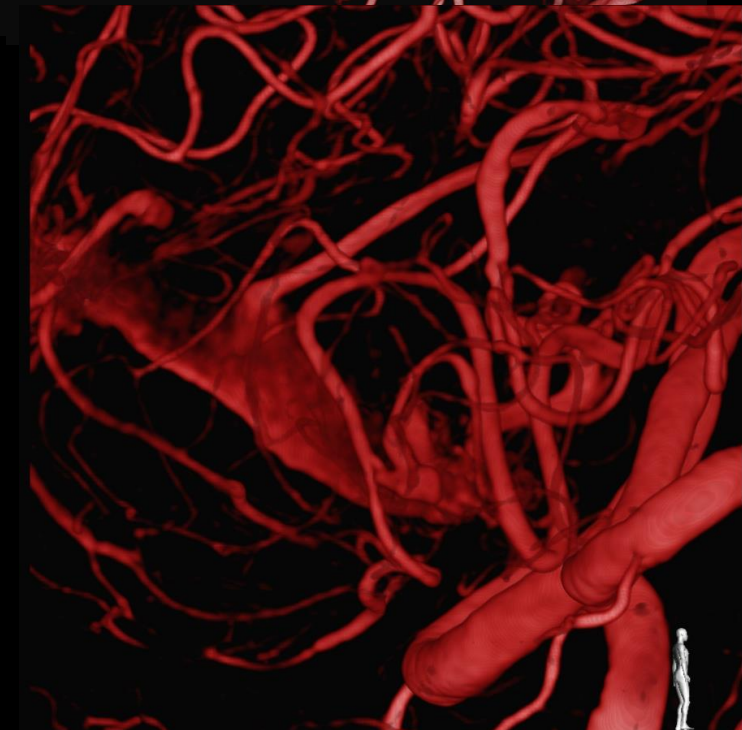
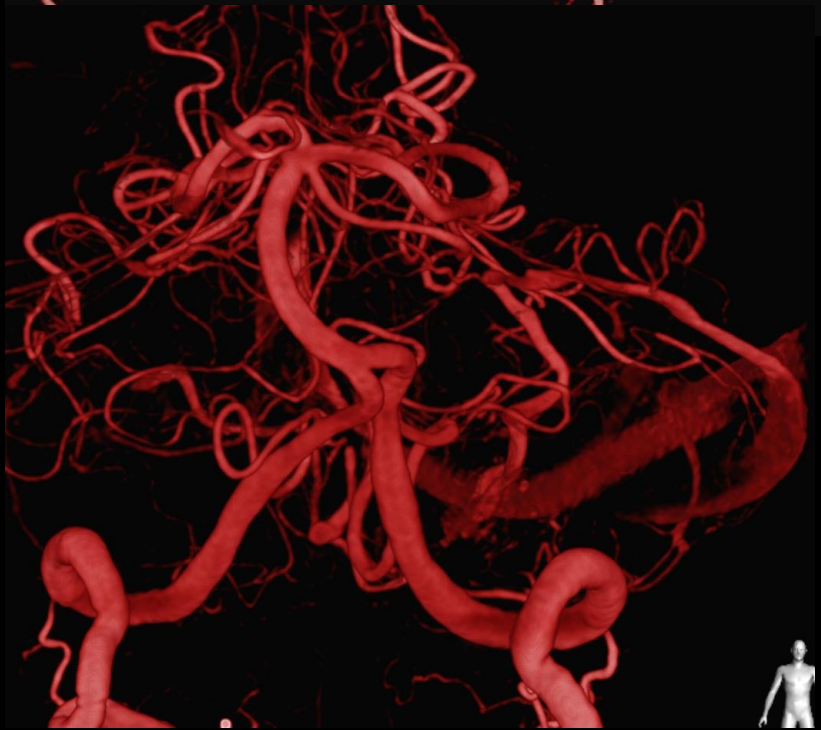
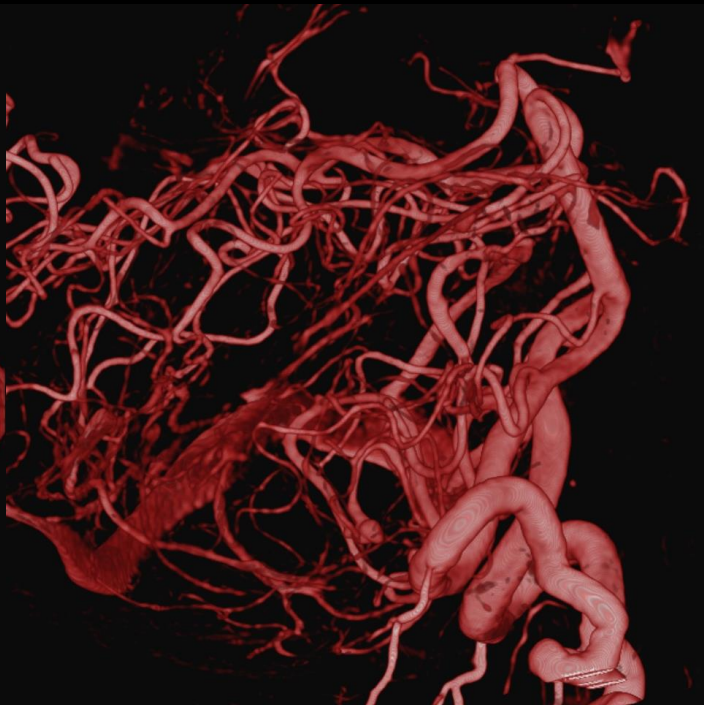
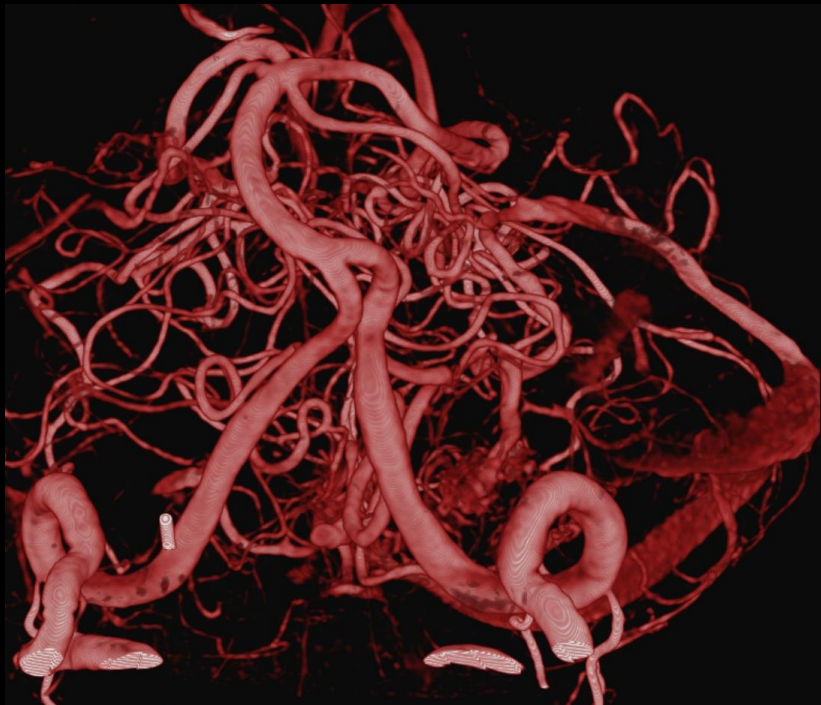
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15
36-22
16:21:24

Made In OsiriX





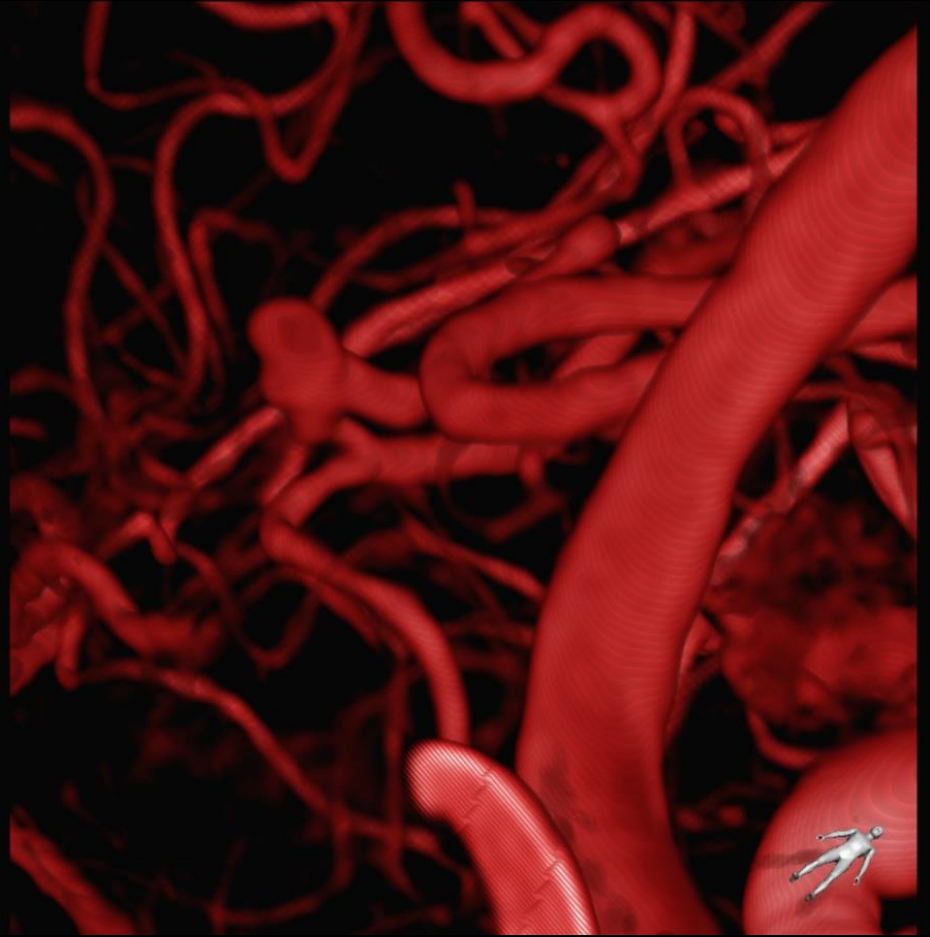
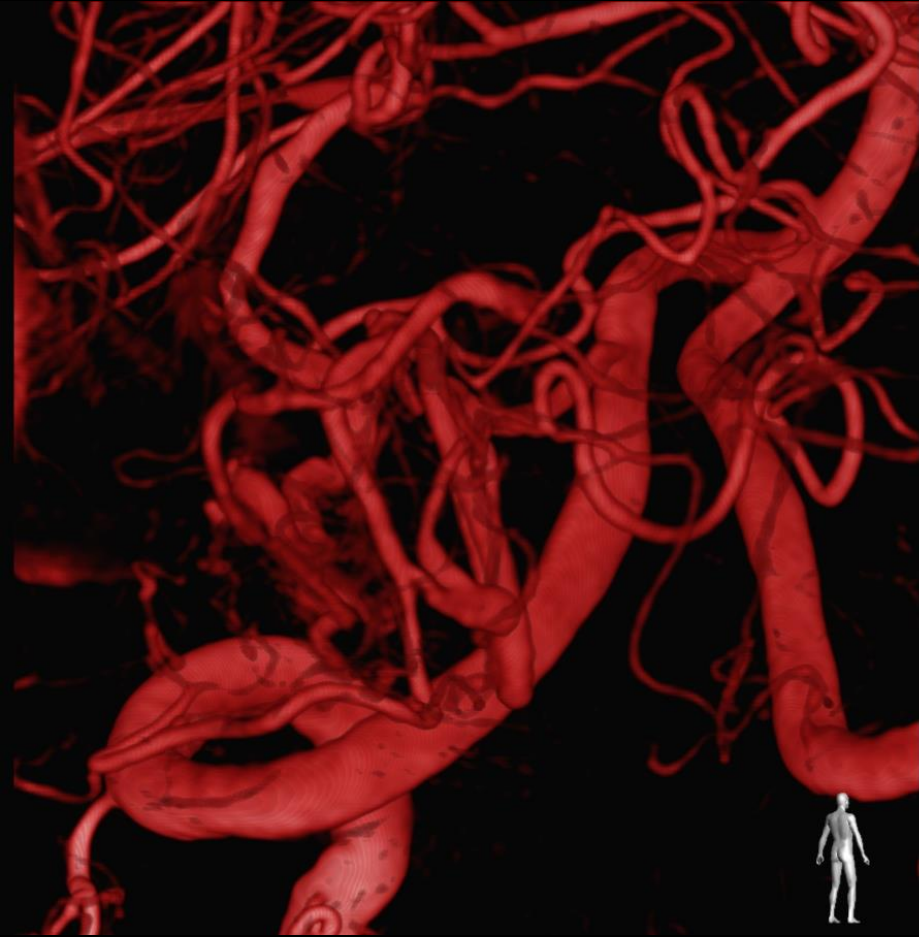


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WEB: 129 VVV-250

PAPOLA DE ARABASTO MARTHA ESTER 4088370 / 75 y / 75 y /
Cadena - Cadena, tipo: Normal View size: 1024 x 1024
13/02/15 15:44:13 WEB: 129 VVV-250

PAPOLA DE ARABASTO MARTHA ESTER 4088370 / 75 y / 75 y /
Cadena - Cadena, tipo: Normal View size: 1024 x 1024
13/02/15 15:44:13 WEB: 129 VVV-250



Image size: 1024 x 1024
View size: 1024 x 1024
WEB: 129 VVV-250

Image size: 1024 x 1024
View size: 1024 x 1024
WEB: 129 VVV-250

Image size: 1024 x 1024
View size: 1024 x 1024
WEB: 129 VVV-250

PAPOLA DE ARABASTO MARTHA ESTER 4088370 /
Cadena - Cadena, tipo: Normal



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