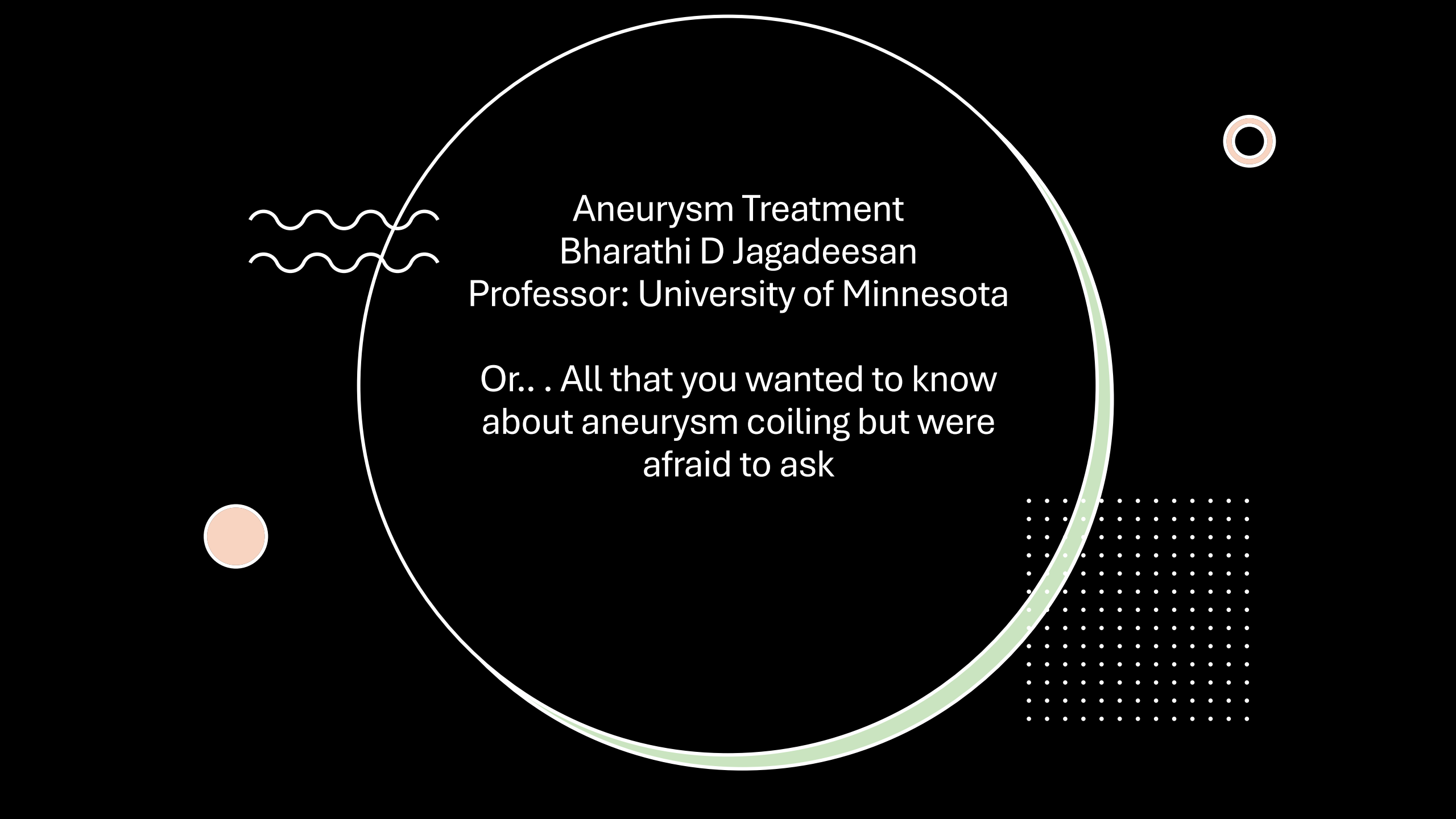




Aneurysm Treatment
Bharathi D Jagadeesan
Professor: University of Minnesota

Or.. . All that you wanted to know
about aneurysm coiling but were
afraid to ask

Conflicts of Interest

Consultant:
Microvention,
Medtronic, Stryker,
Boston Scientific

Scientific Board
Member: Peytant



LIVE AIR HOCKEY EVENT AT

BOISE STATE UNIVERSITY

STUDENT UNION BUILDING

MARCH 25TH - 5PM

ORGANIZED BY







6 SIGMA OF ANEURYSM COILING

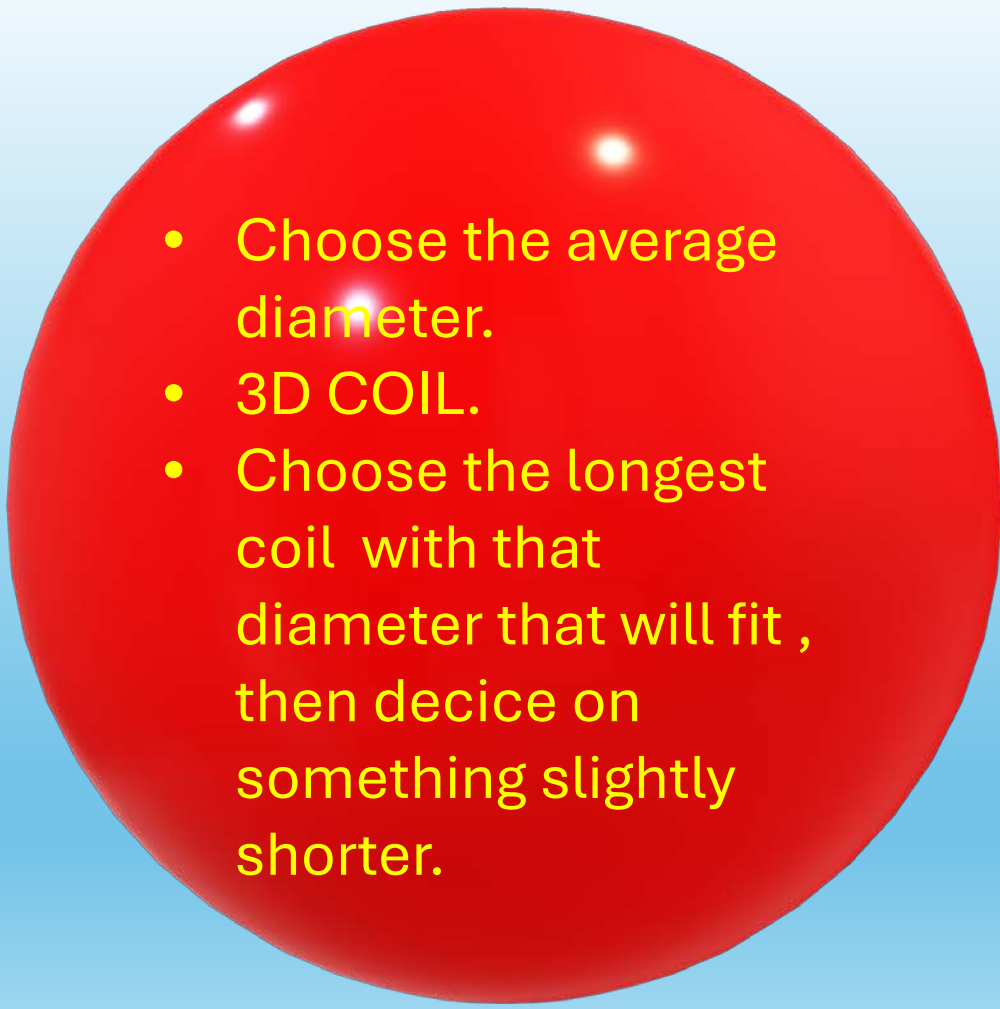
The 6 Sigma of Coiling

- 1. Size
- 2. Shape
- 3. Stiffness
- 4. Surface Modification
- 5. SAH
- 6. Support (Microcatheter/Balloon/Stent)

HOW TO CHOOSE THE FRAMING/FIRST COIL



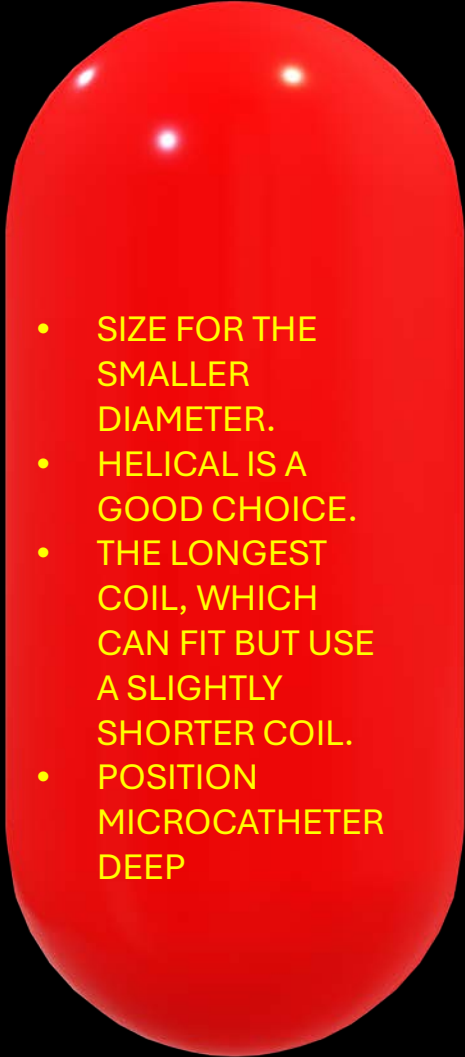
SIZE AND SHAPE: FIRST COIL

- 
- Choose the average diameter.
 - 3D COIL.
 - Choose the longest coil with that diameter that will fit , then decide on something slightly shorter.

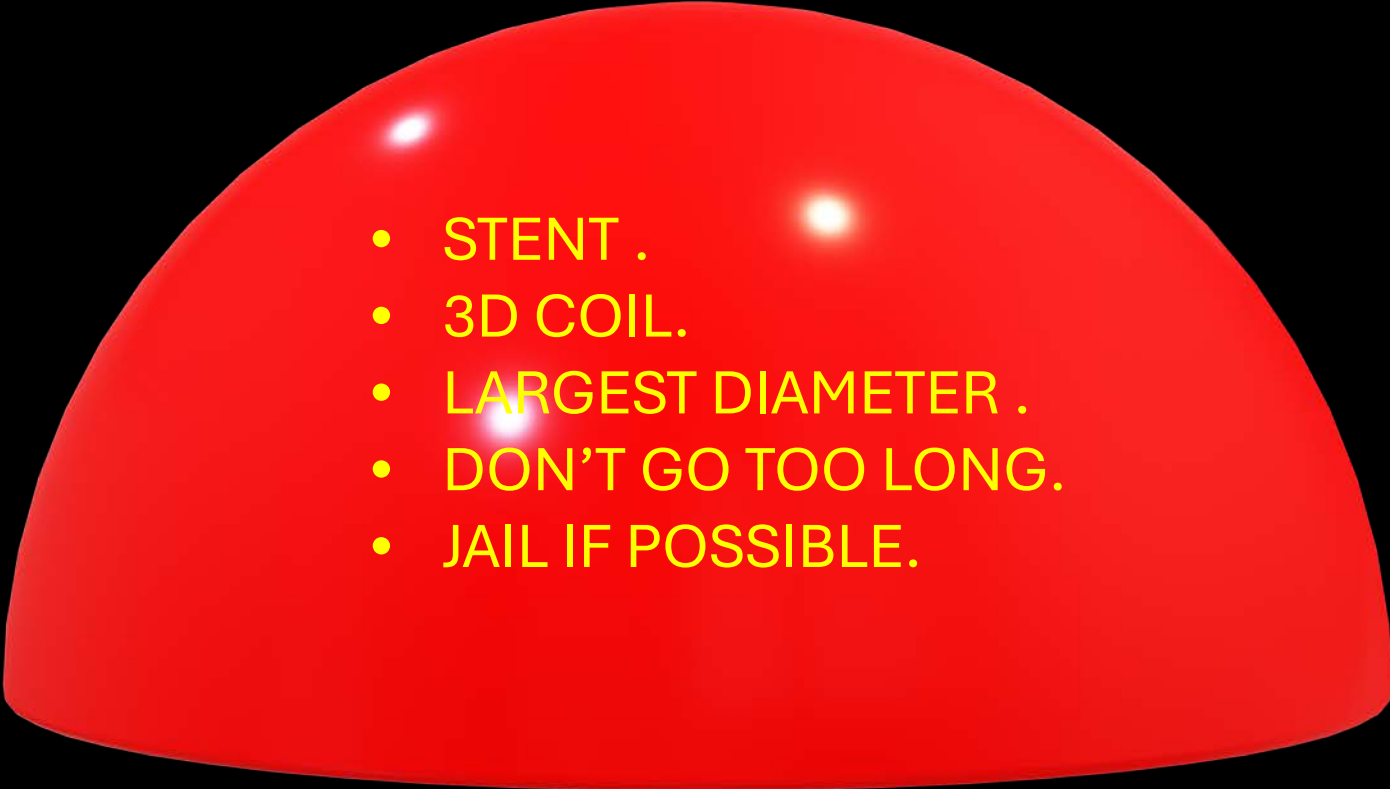
SIZE AND SHAPE: FIRST COIL

- SIZE FOR THE LARGER DIMENSION.
- 3D COIL; BOXY SHAPE.
- GO RELATIVELY FAST WHEN PLACING ACROSS NECK
- PLAN TO USE A BALLOON

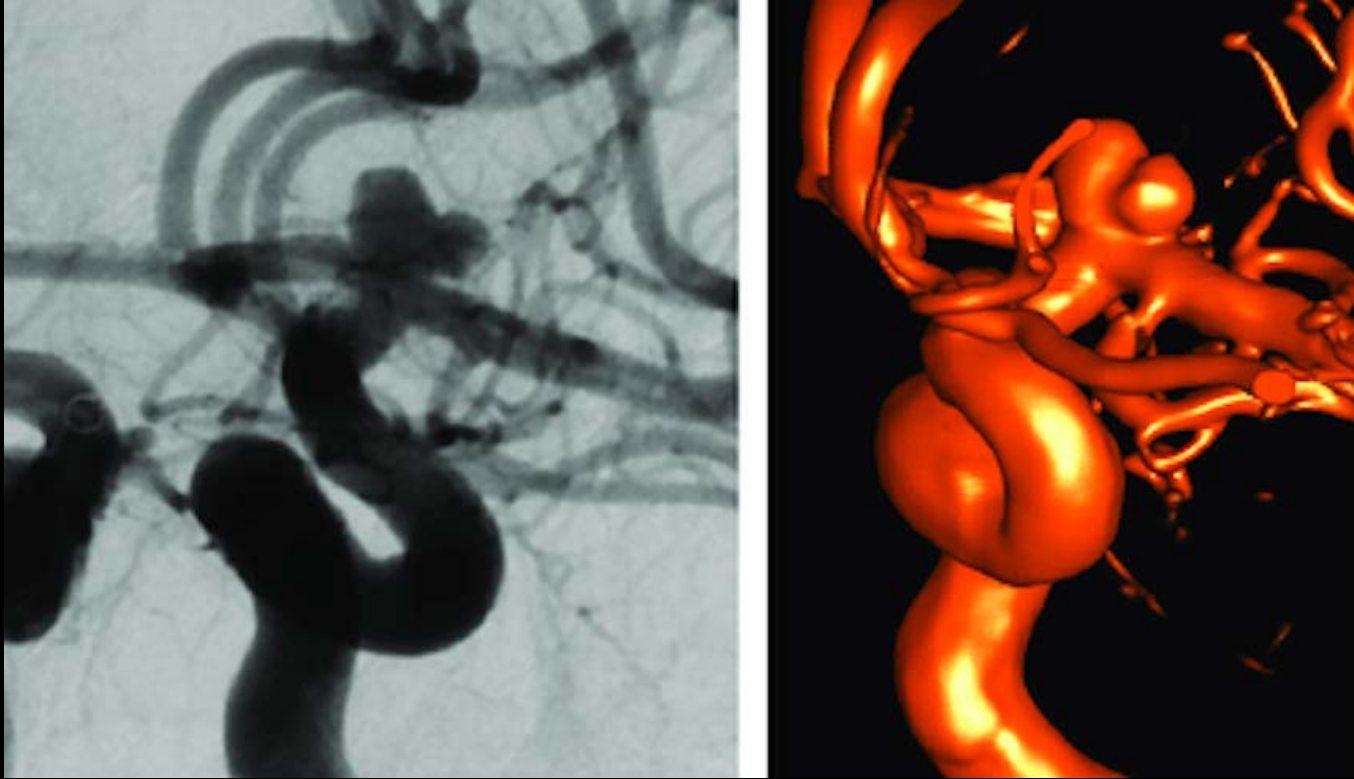
SIZE AND SHAPE: FIRST COIL

- 
- SIZE FOR THE SMALLER DIAMETER.
 - HELICAL IS A GOOD CHOICE.
 - THE LONGEST COIL, WHICH CAN FIT BUT USE A SLIGHTLY SHORTER COIL.
 - POSITION MICROCATHETER DEEP

SIZE AND SHAPE: FIRST COIL

- 
- STENT .
 - 3D COIL.
 - LARGEST DIAMETER .
 - DON'T GO TOO LONG.
 - JAIL IF POSSIBLE.

SIZE AND SHAPE: FIRST COIL



- 3D COIL
- COMPLEX SHAPE
SOFT
- DIAMETER ADJUSTED TO
NECK AND BODY OF
ANEURYSM.
- DO NOT GO TOO LONG

SIZE AND SHAPE: THE SECOND COIL

THERE IS NO
RULE ON
DOWNSIZING

- Need not always be helical
- Need not always be one size lower

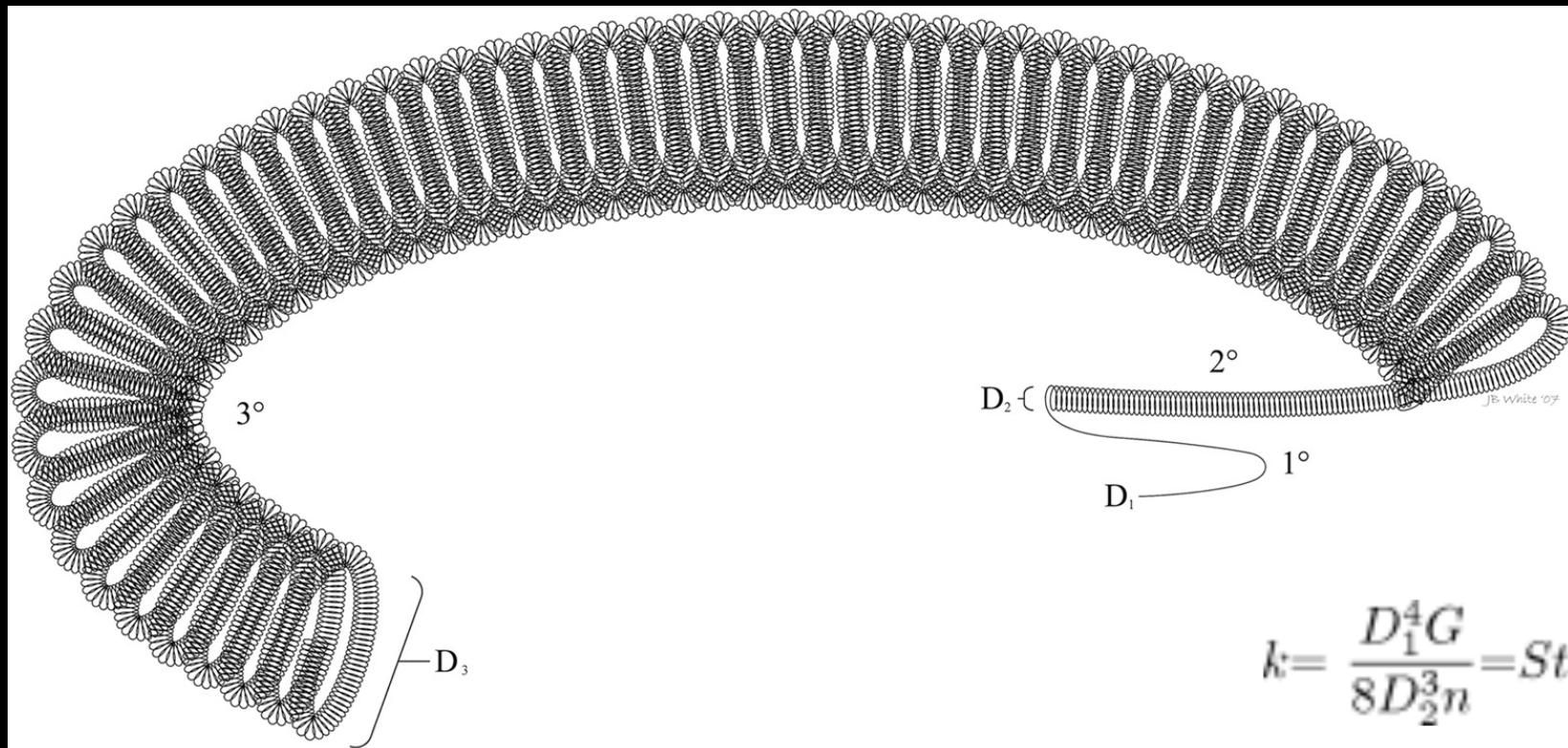
THE DECISION
SHOULD BE
BASED ON
FINISH OF FIRST
COIL AND
APPEARANCE

DO NOT PUSH IT,
PAINT IT.

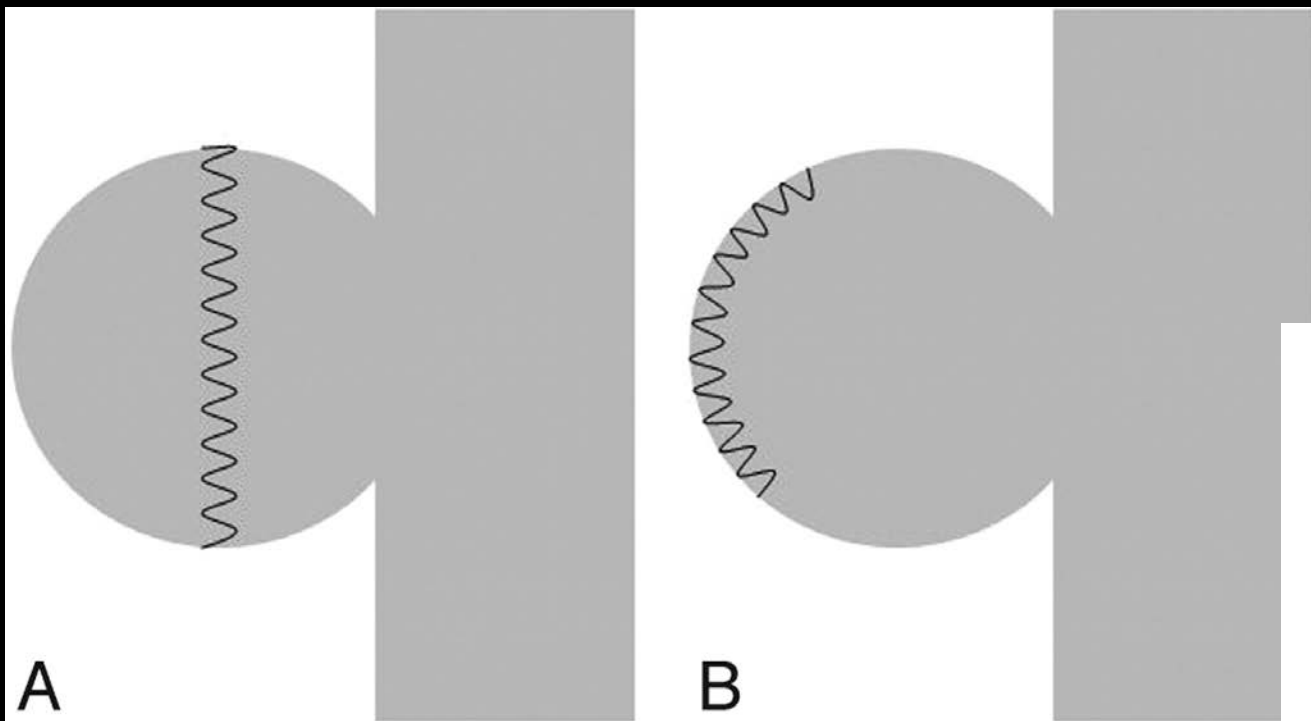
KEEP WITHIN
THE LANES

SIZE AND SHAPE: THE LAST COIL

- GO SHORT; FILL WITH PEBBLES NOT ROCKS
- THE ENEMY OF GOOD IS PERFECT
- COMPACTION WONT KILL, COMPLICATIONS WILL
- WHEN YOU WANT ONE MORE... DO NOT HAVE IT
- GEL IF YOU CAN
- GO SOFT
- DON'T GO SO SHORT THAT IT FALLS OUT



$$k = \frac{D_1^4 G}{8 D_2^3 n} = \text{Stiffness} \propto \frac{D_1 G}{D_2 n}.$$



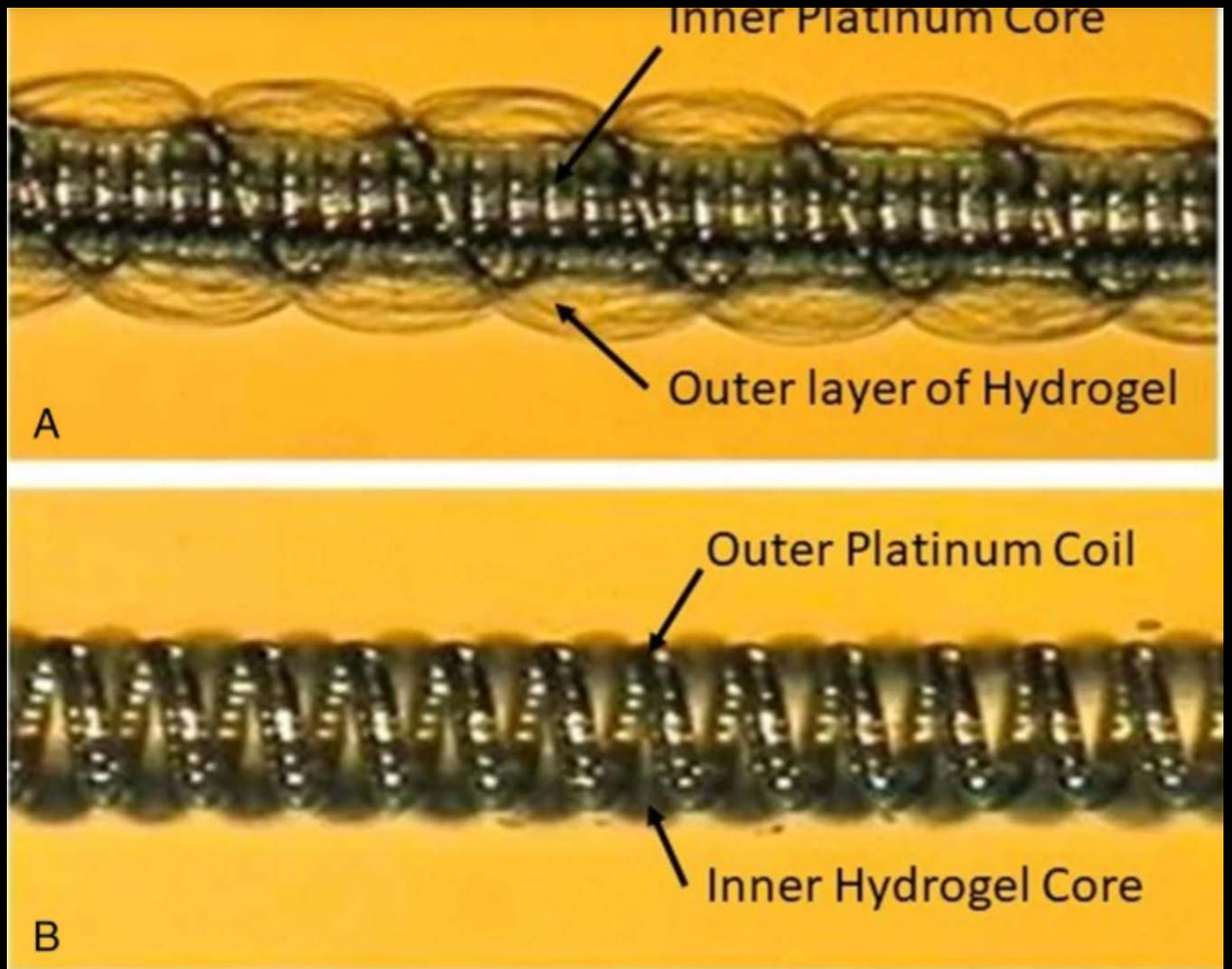
$$\begin{aligned} \text{Bending stiffness} &= \frac{GD_1^4 p \cos(\gamma)}{16D_2 \left[\frac{1 + \sin^2(\gamma)}{1 + \nu} + \cos^2(\gamma) \right]} \\ &= \frac{GD_1^4 \pi \sin(\gamma)}{16 \left[\frac{1 + \sin^2(\gamma)}{1 + \nu} + \cos^2(\gamma) \right]} \end{aligned}$$

STIFFNESS AND SELECTION: FRAMING

STIFFNESS AND SELECTION: FILLING

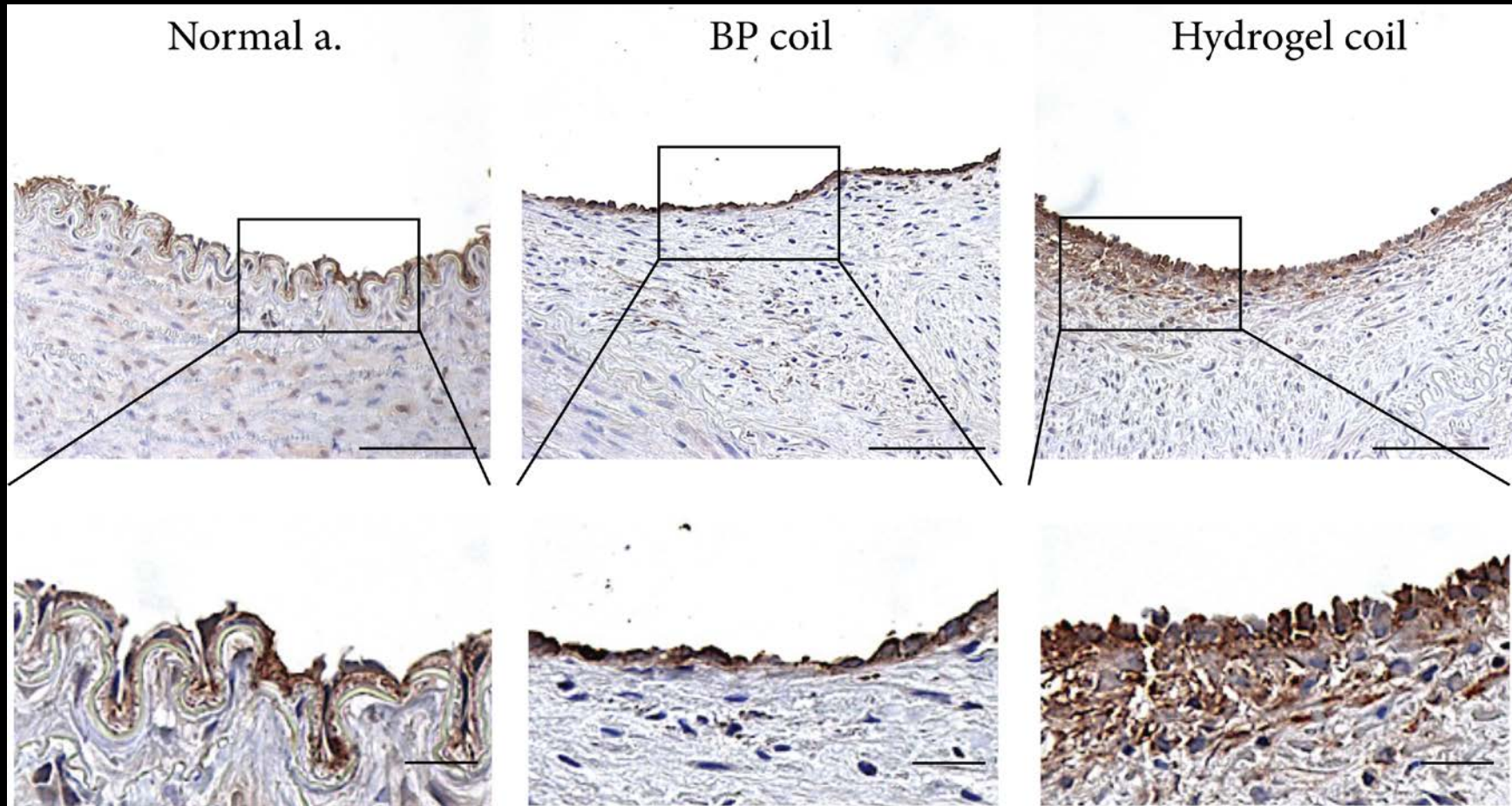
STIFFNESS AND SELECTION: FINISHING

Surface Modification

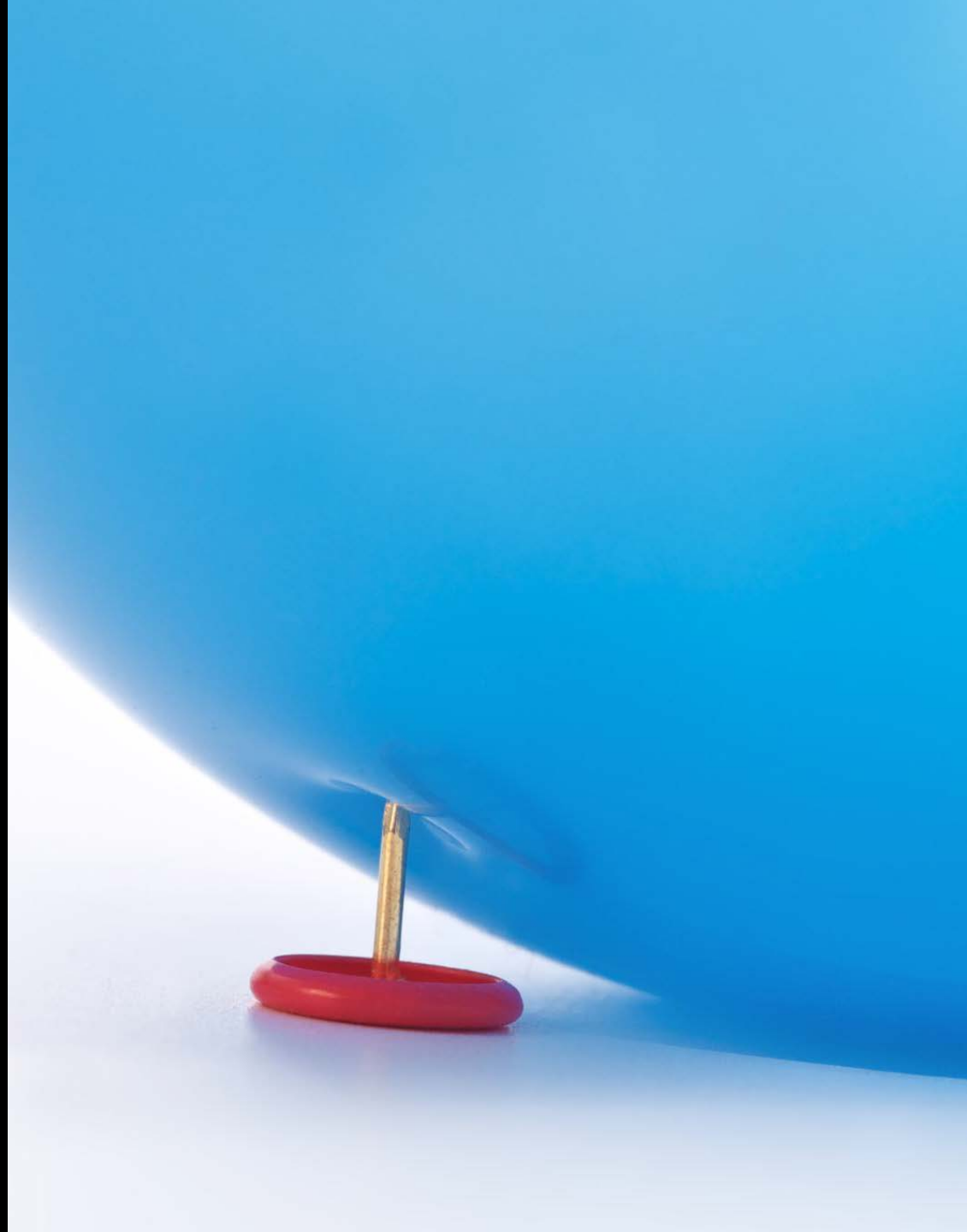




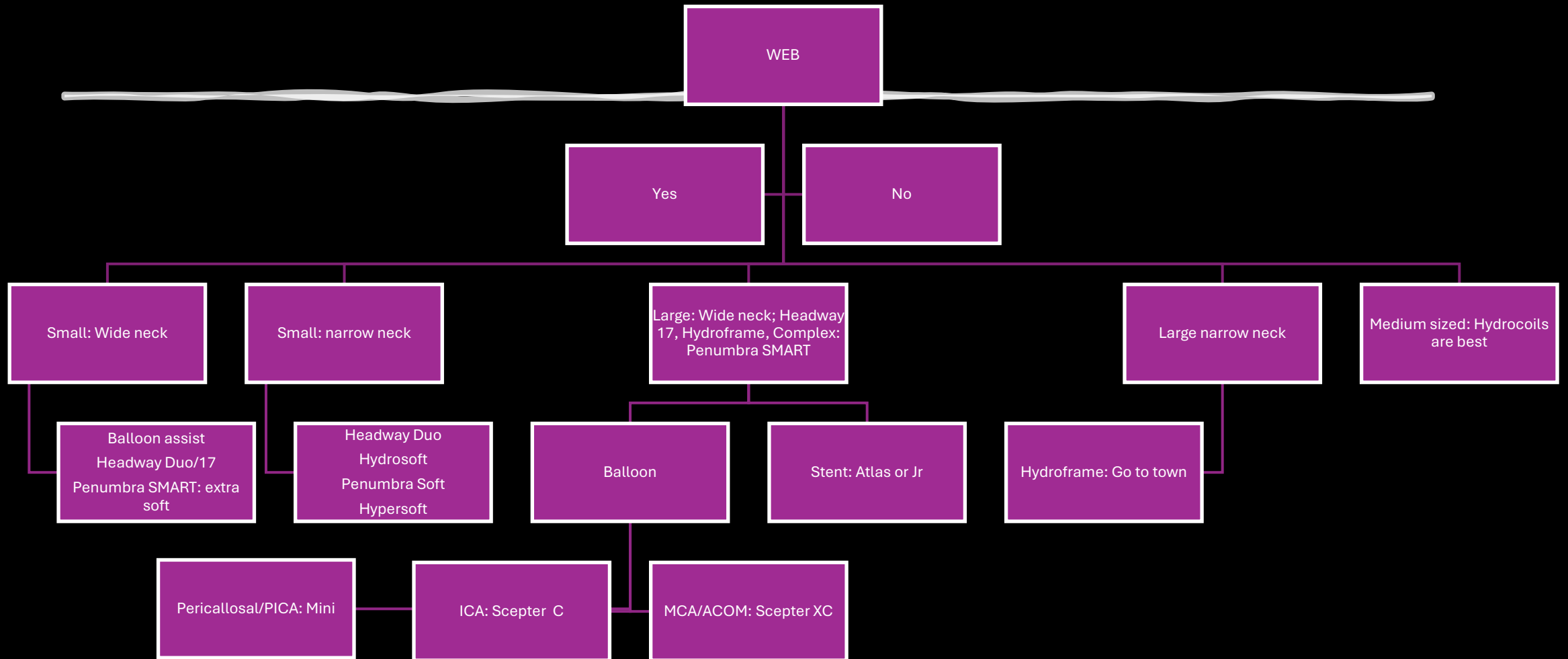
Histology



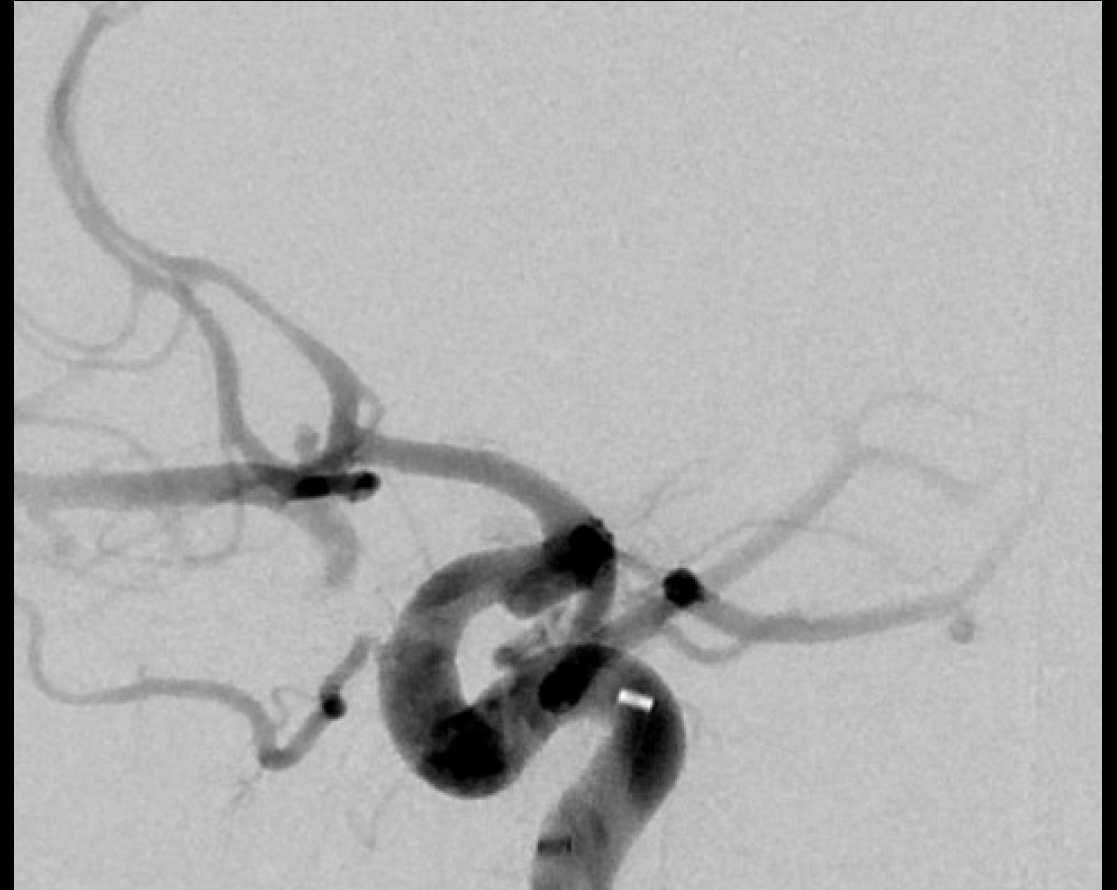
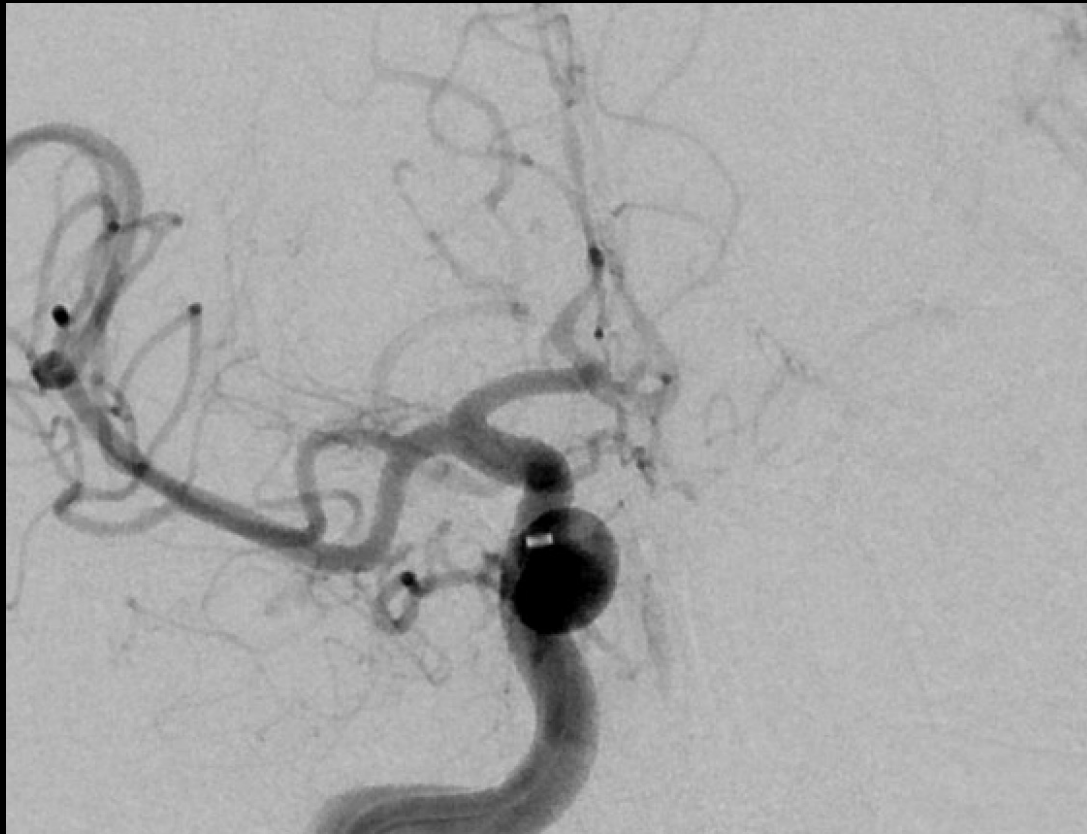
- Softer coils are better for most aneurysms
- Balloon assistance can help reduce intra-operative rupture but can also have higher thromboembolic complications
- Packing density is important
- Give hydrocoils time to swell: interstices might stop filling
- Staged procedures are not uncommon



CASE SERIES: SAH



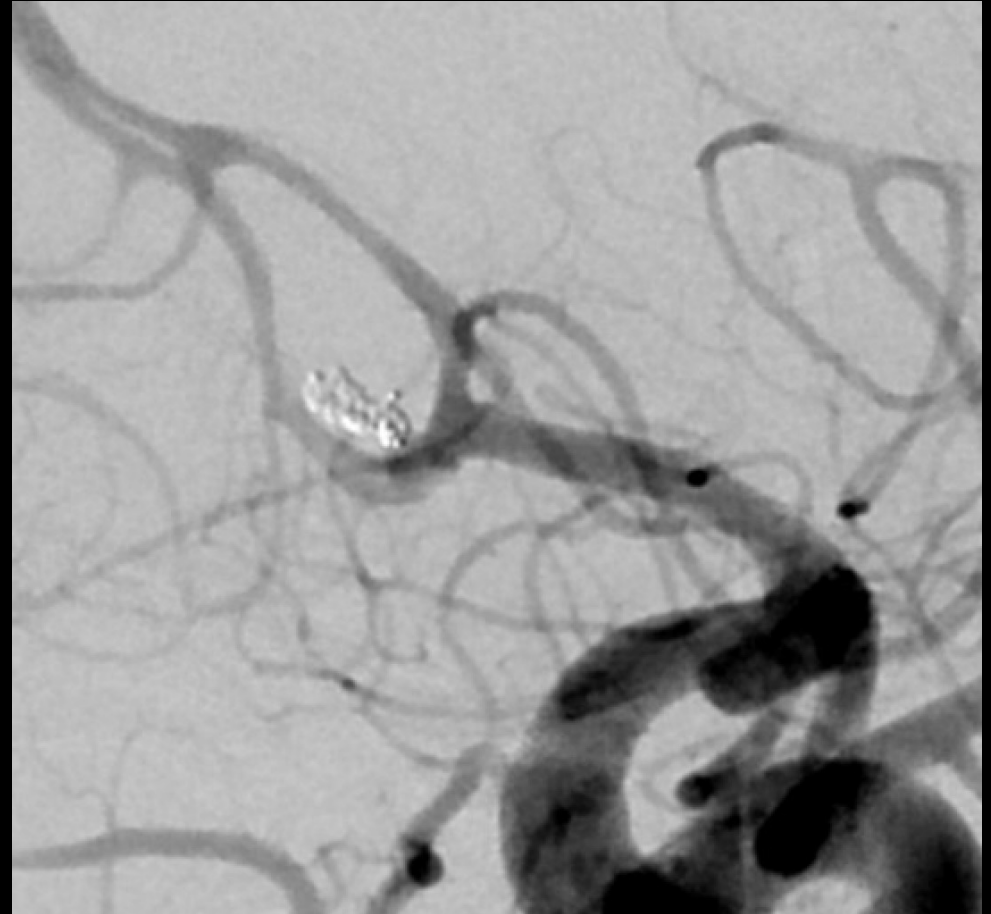
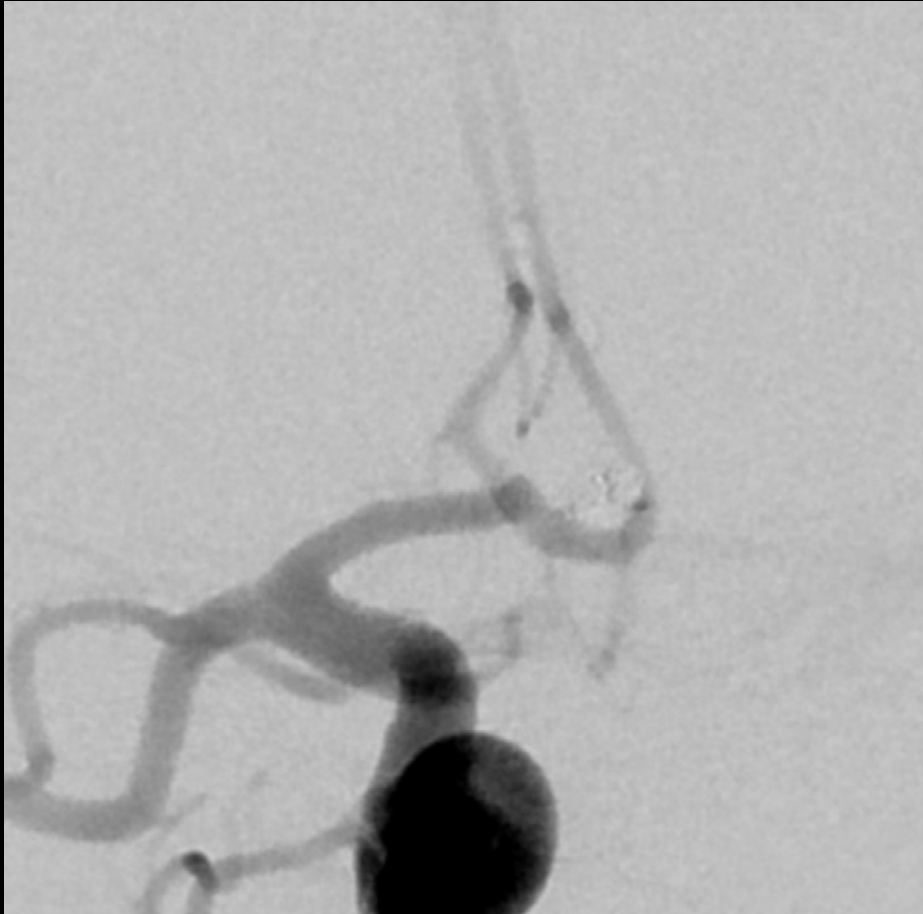
83 year old with HH3 SAH



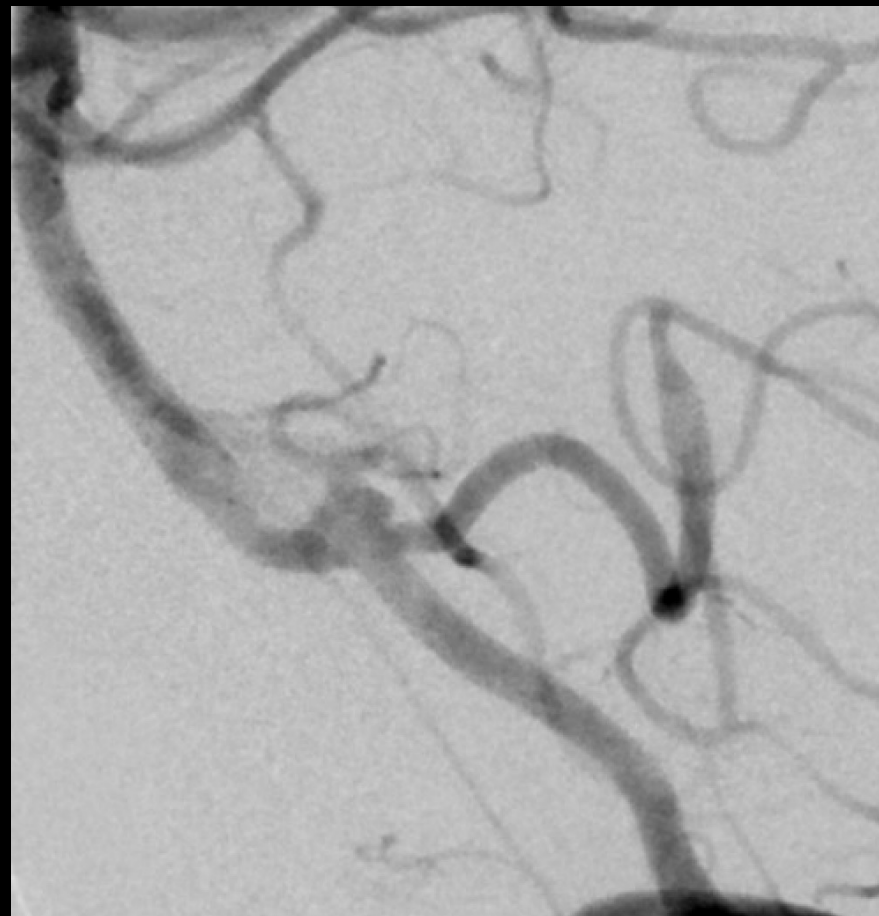
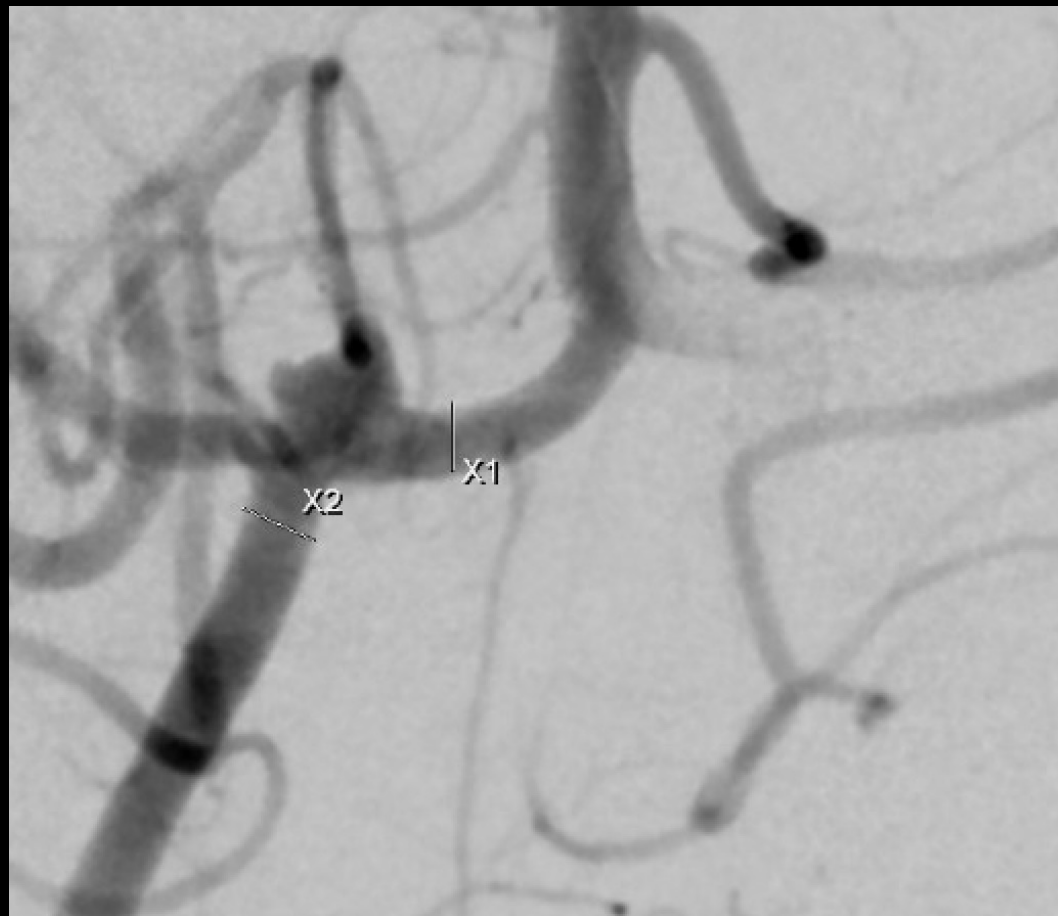
Headway Duo 156 , Scepter XC 4 x 11



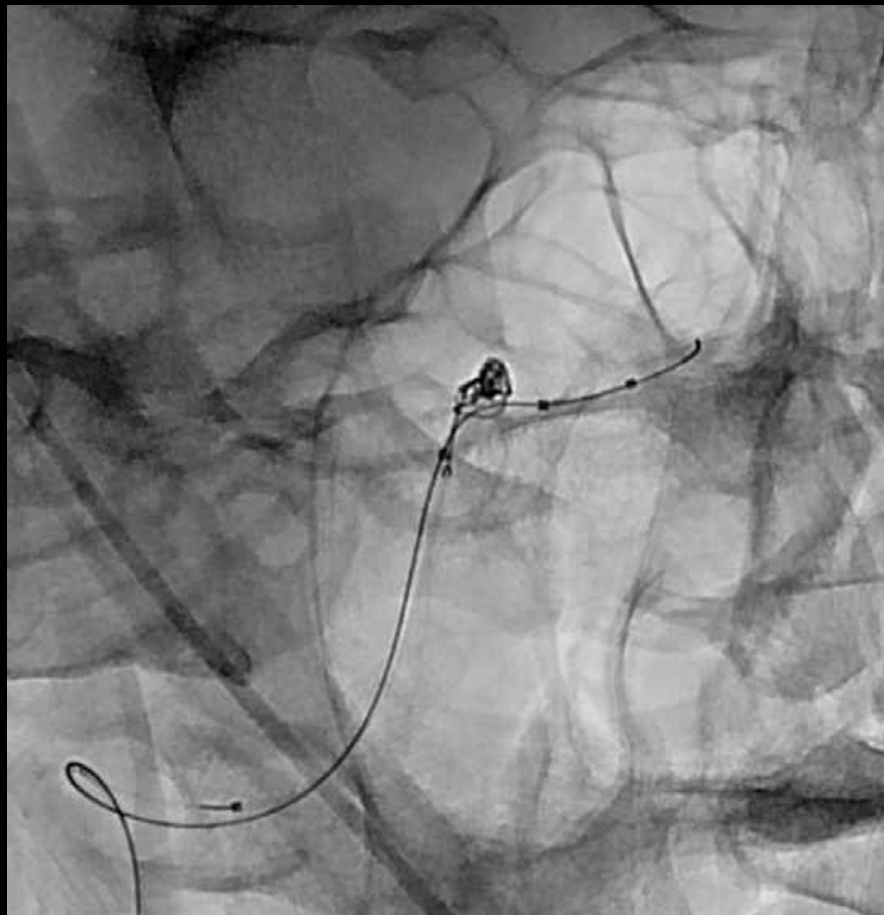
Penumbra extra soft, hydrosoft, Penumbra wave



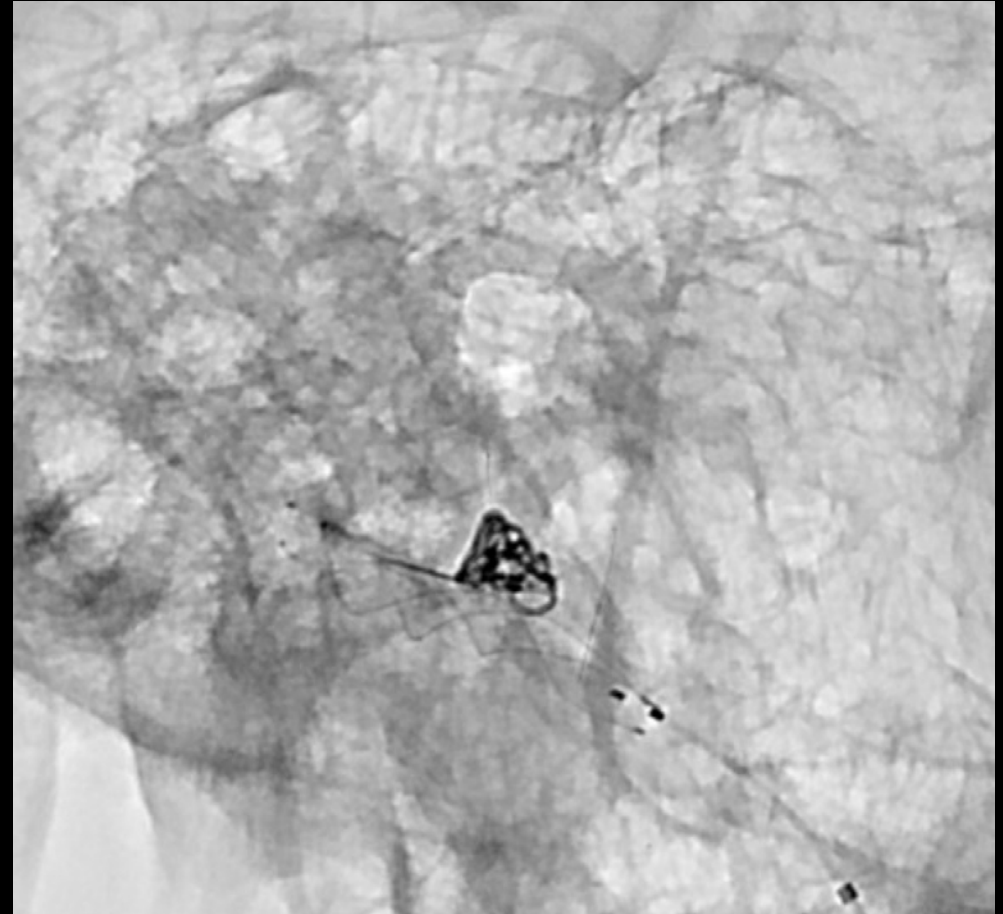
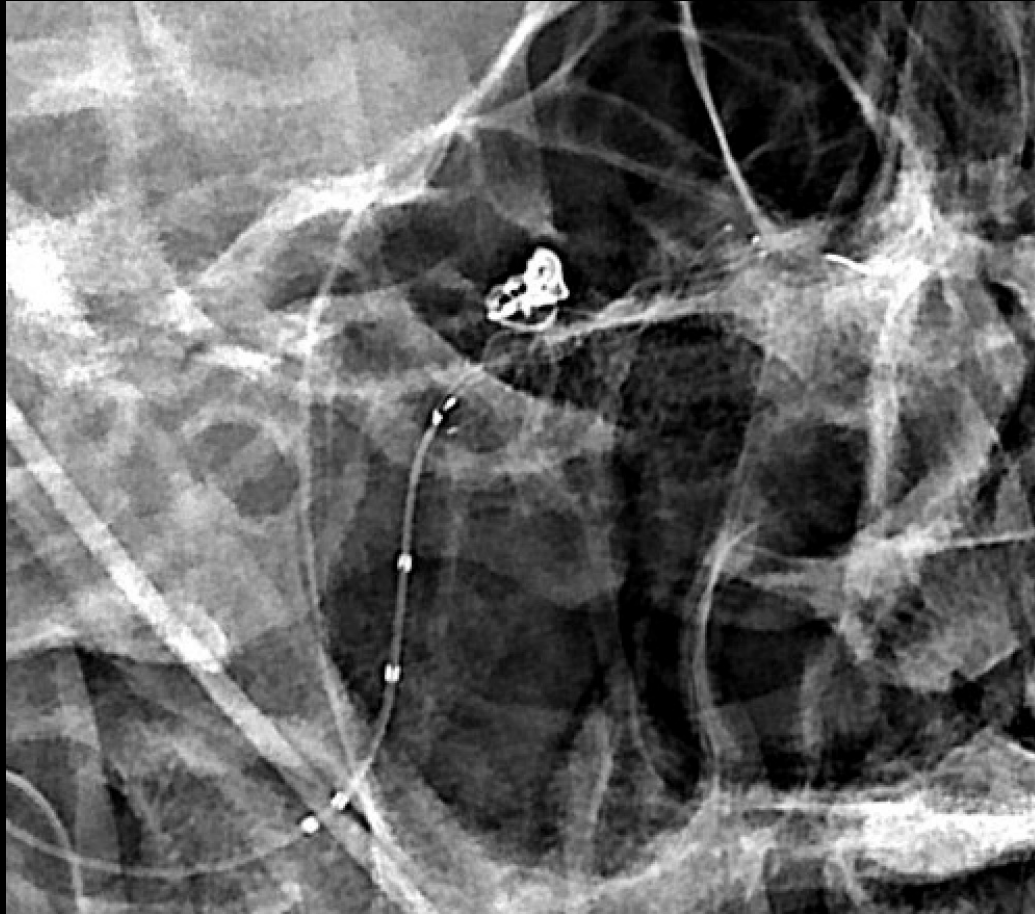
43 Year old with HH 4 SAH



Headway 17, Scepter XC 4 x 11; Hydrocoils



FBTS



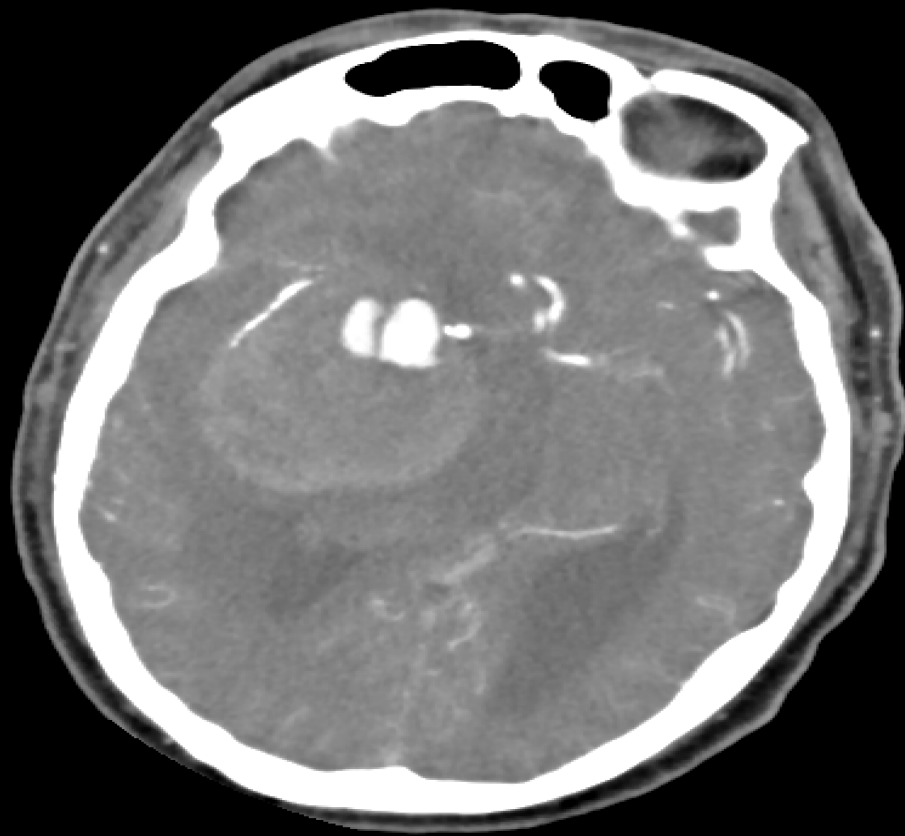


LVIS JR: 2.5 x 23: keep calm and coil on

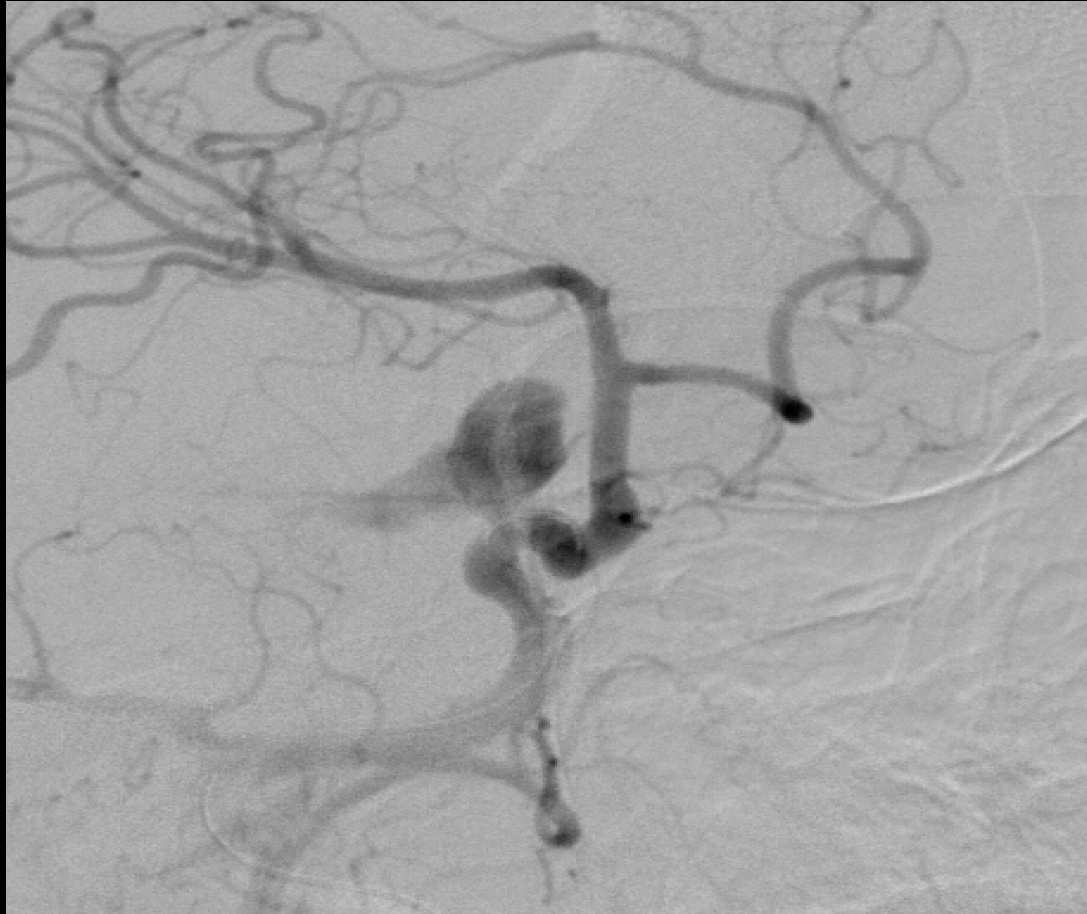
Final result



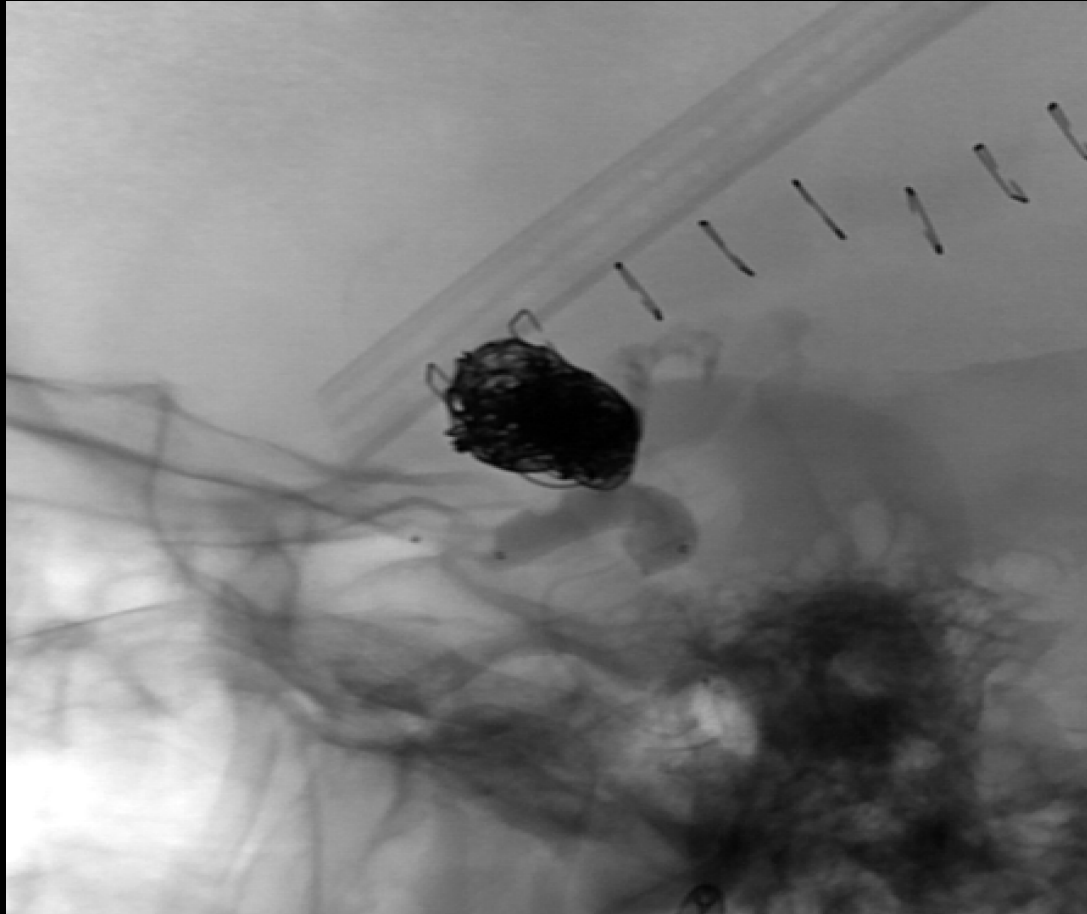
50 year old with hemiparesis



DSA

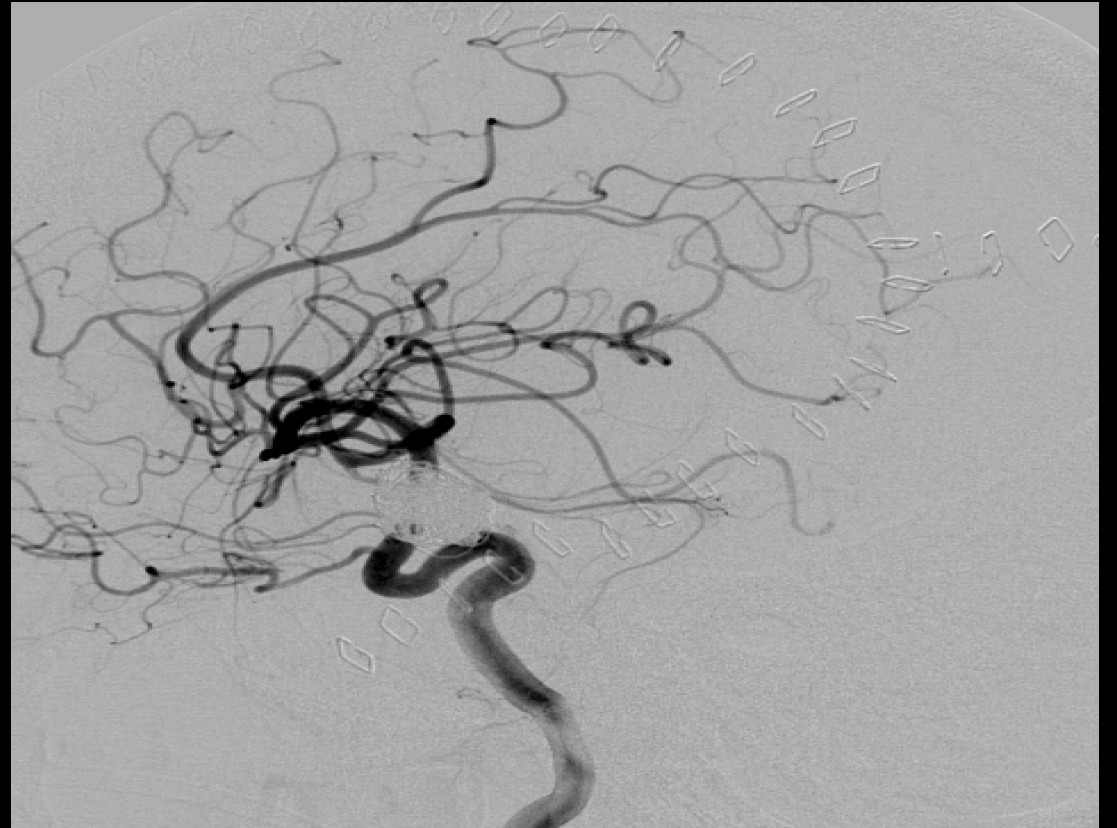


Balloon remodeling



- Scepter XC 4 x 11 mm
- Hydrocoils

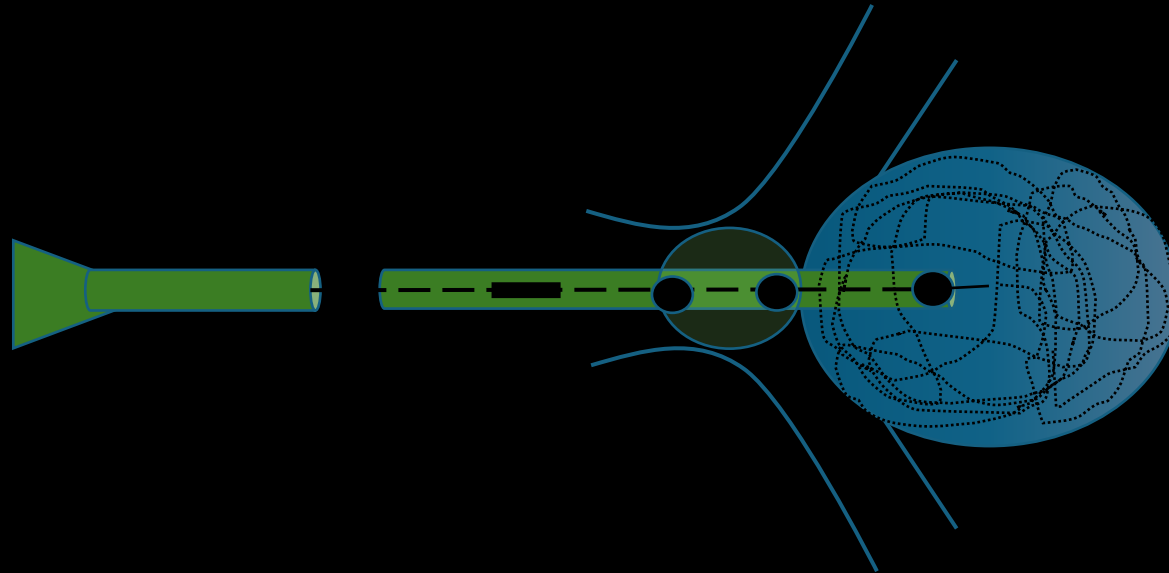
Post embolization



Coiling through the Scepter



Coiling through the Scepter

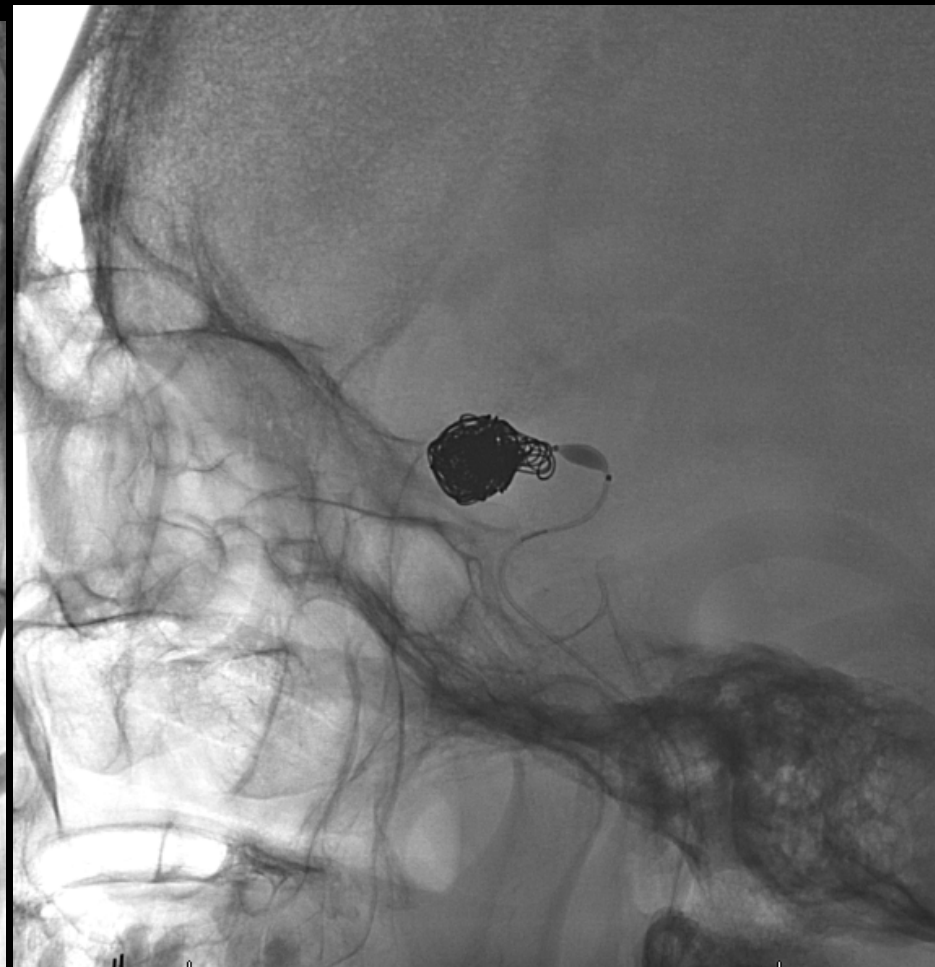


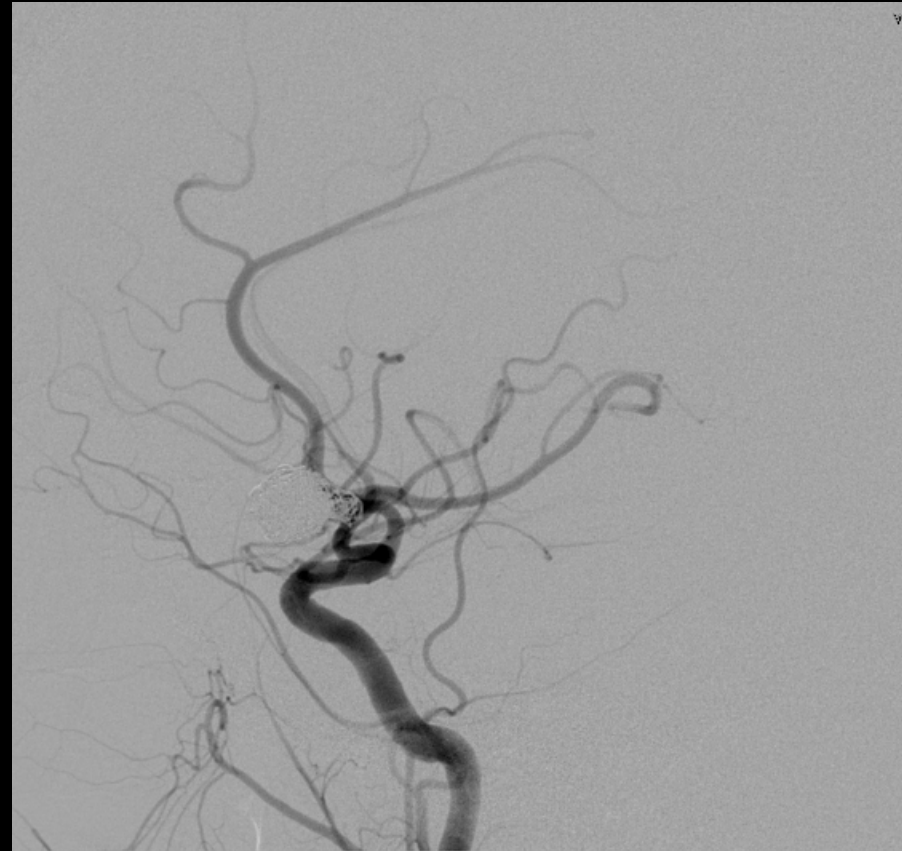
54 y/o with SAH



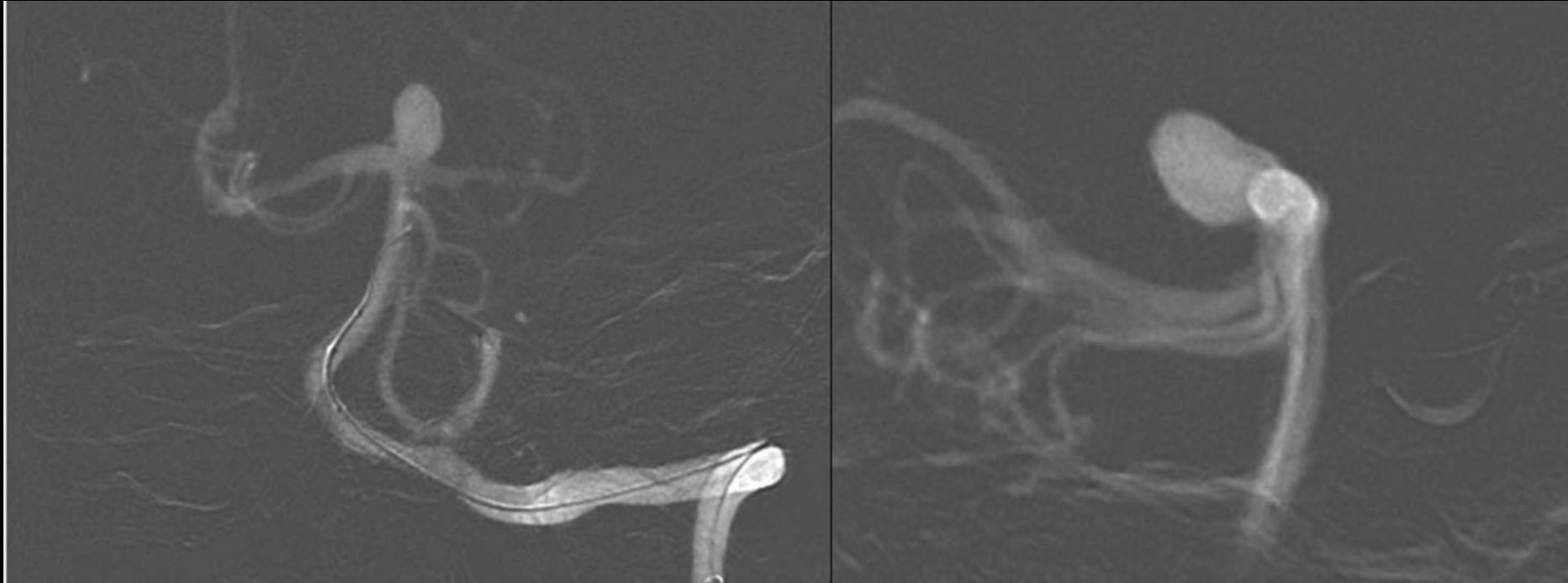




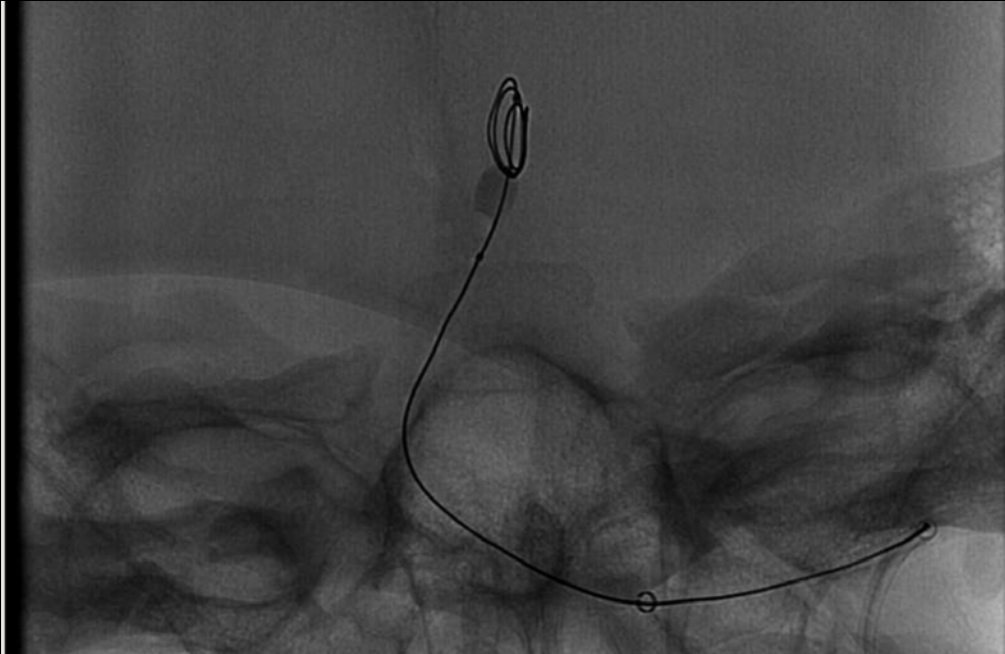




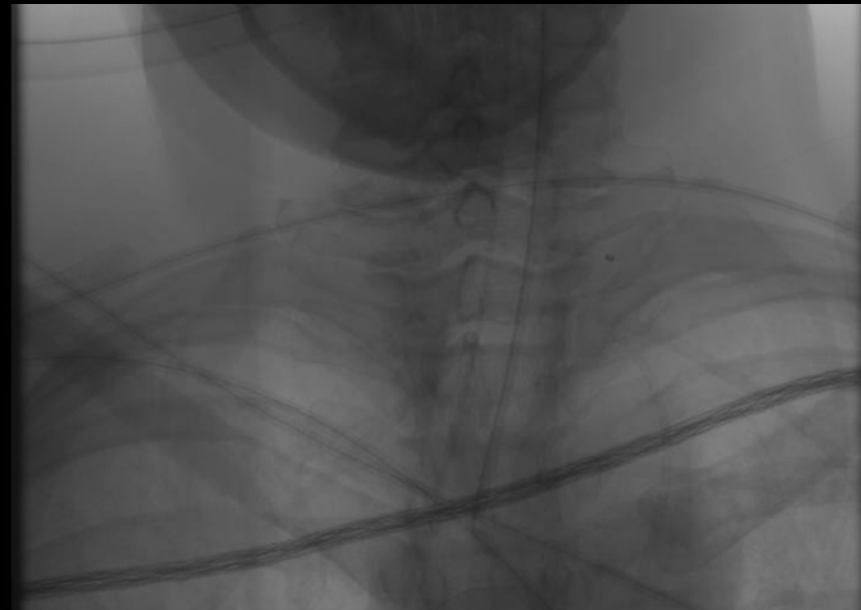
60 year old with SAH



Sofia and Scepter XC



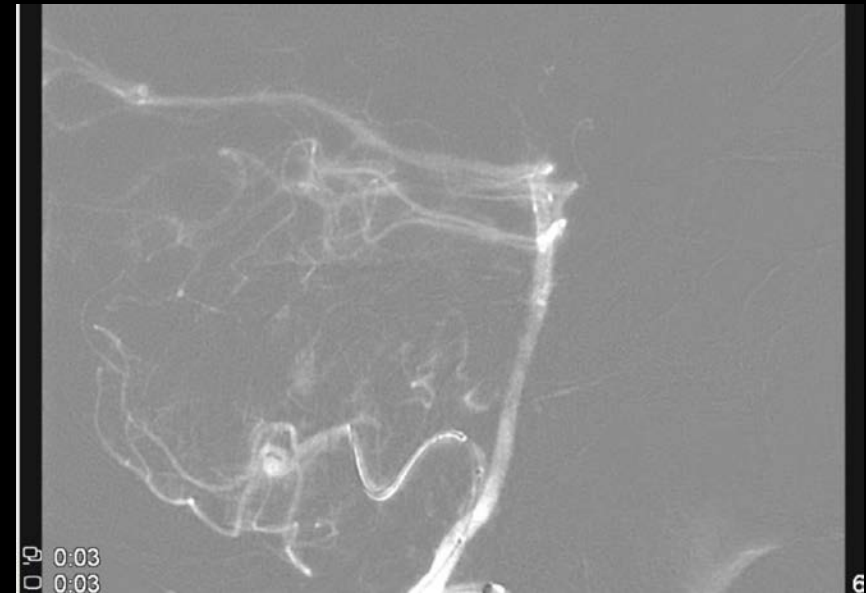
Post coiling



66 year old with SAH



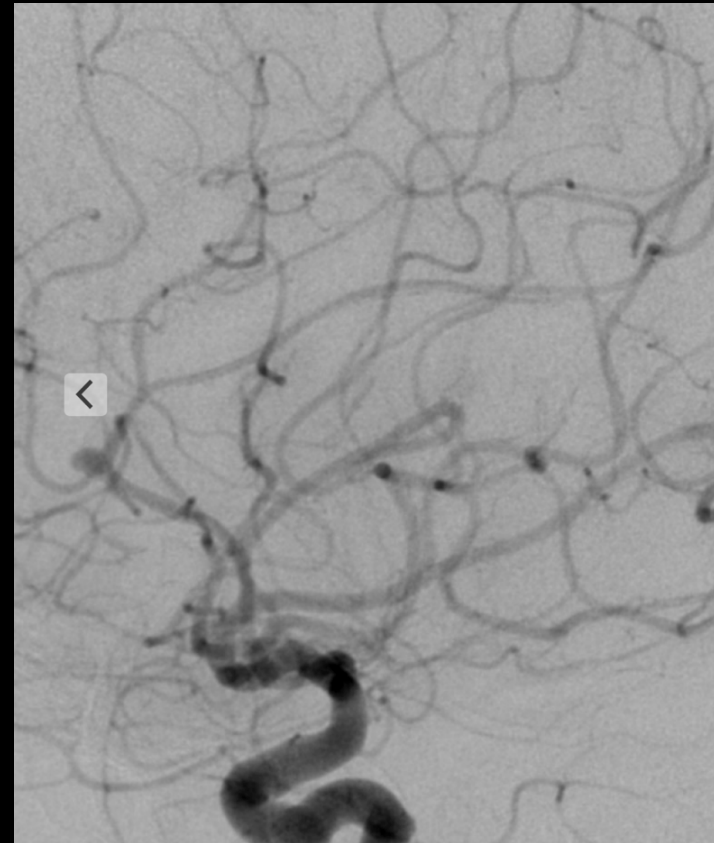
Scepter XC and Traxcess



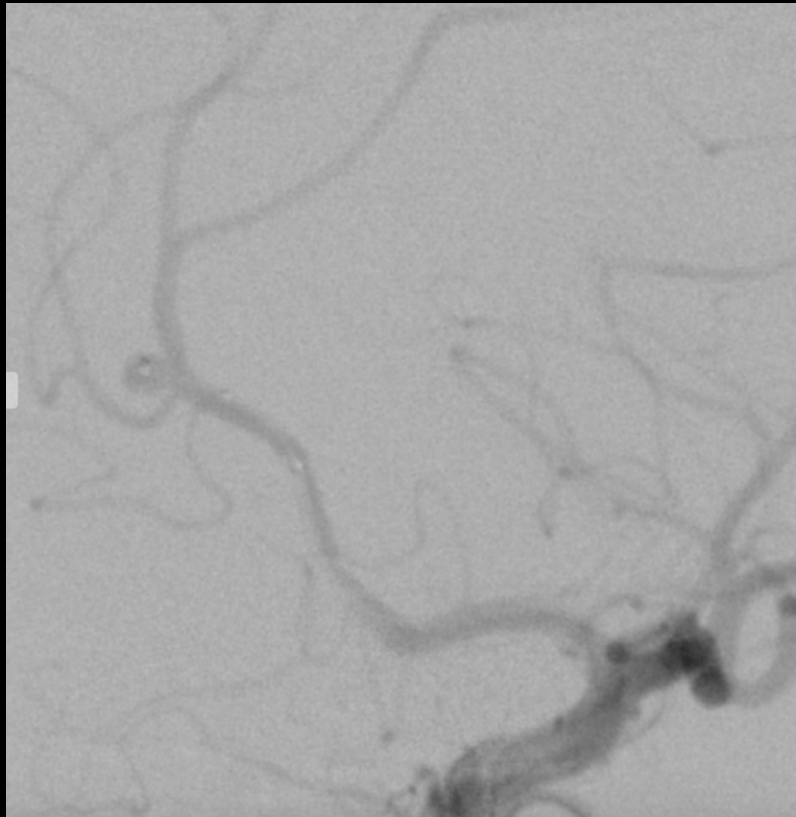
Post coiling



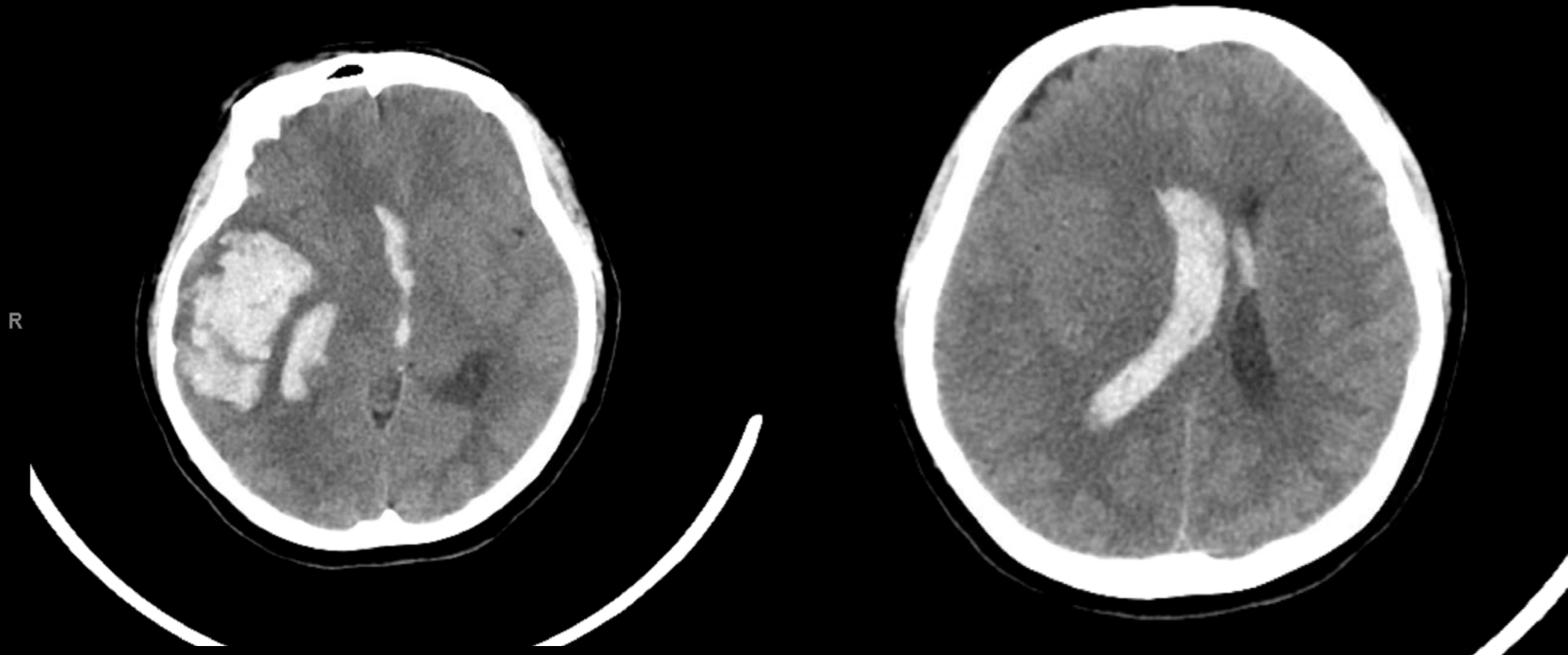
45 y/o with SAH



Scepter XC 4 x 11



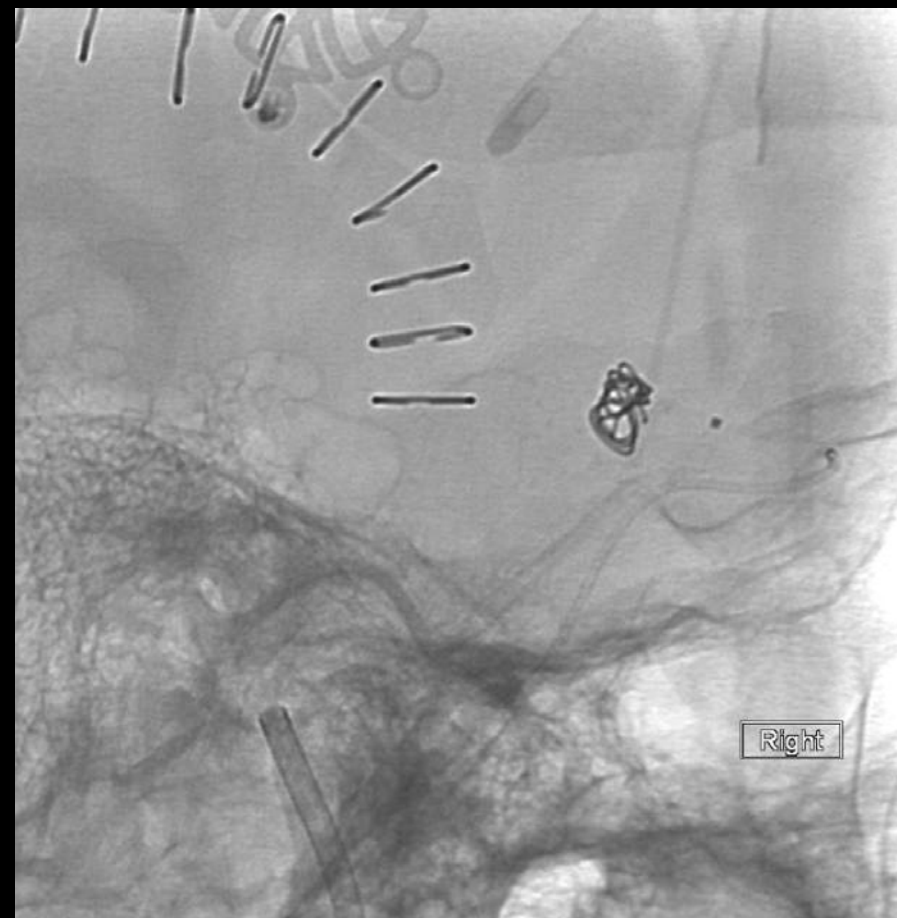
Stent coil with LVIS Blue ..45 year old with SAH



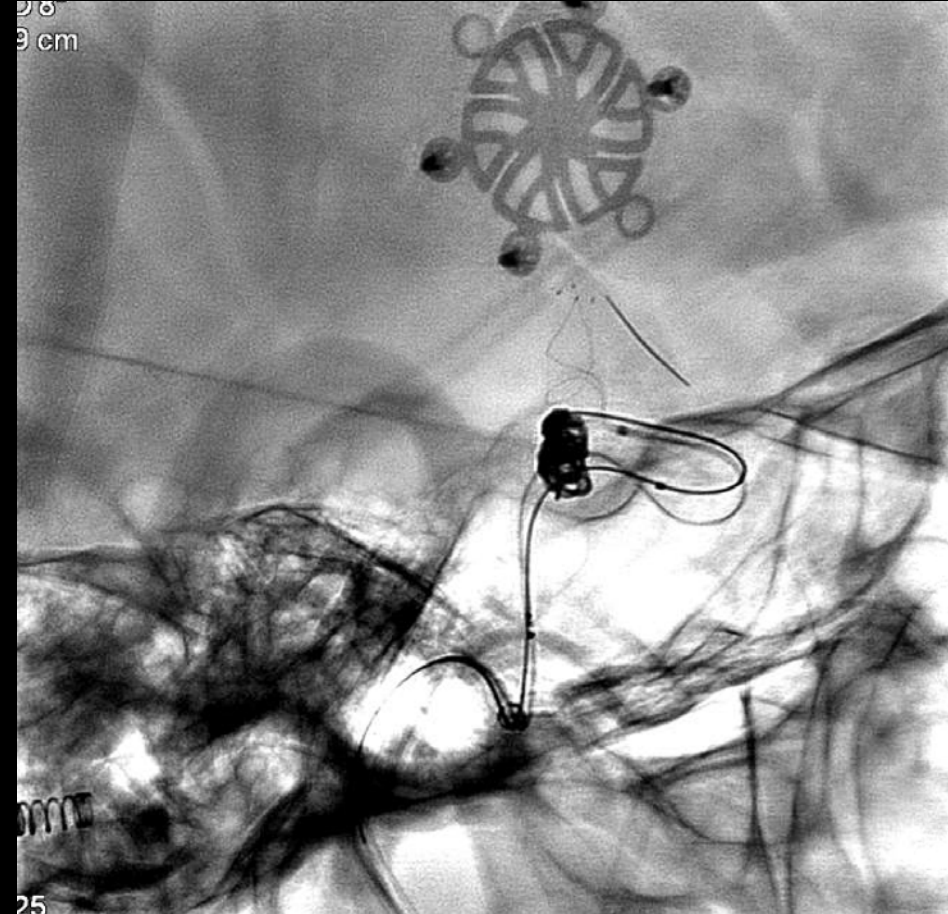
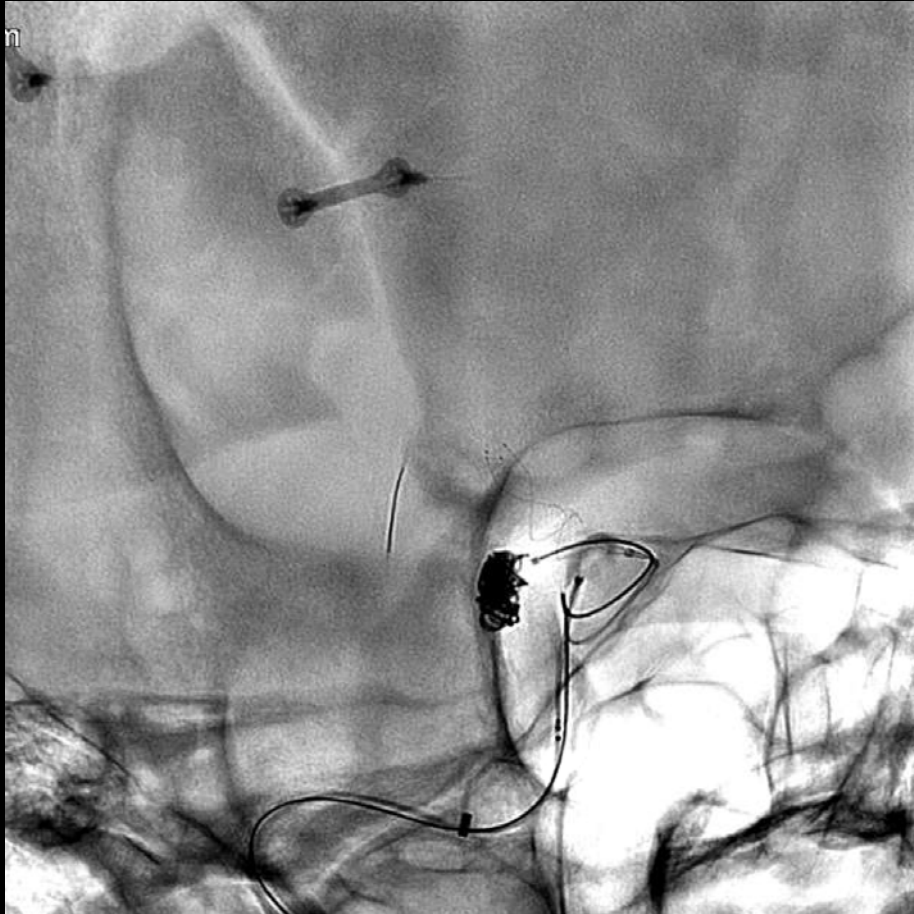
Extremely irregular PCOM aneurysm



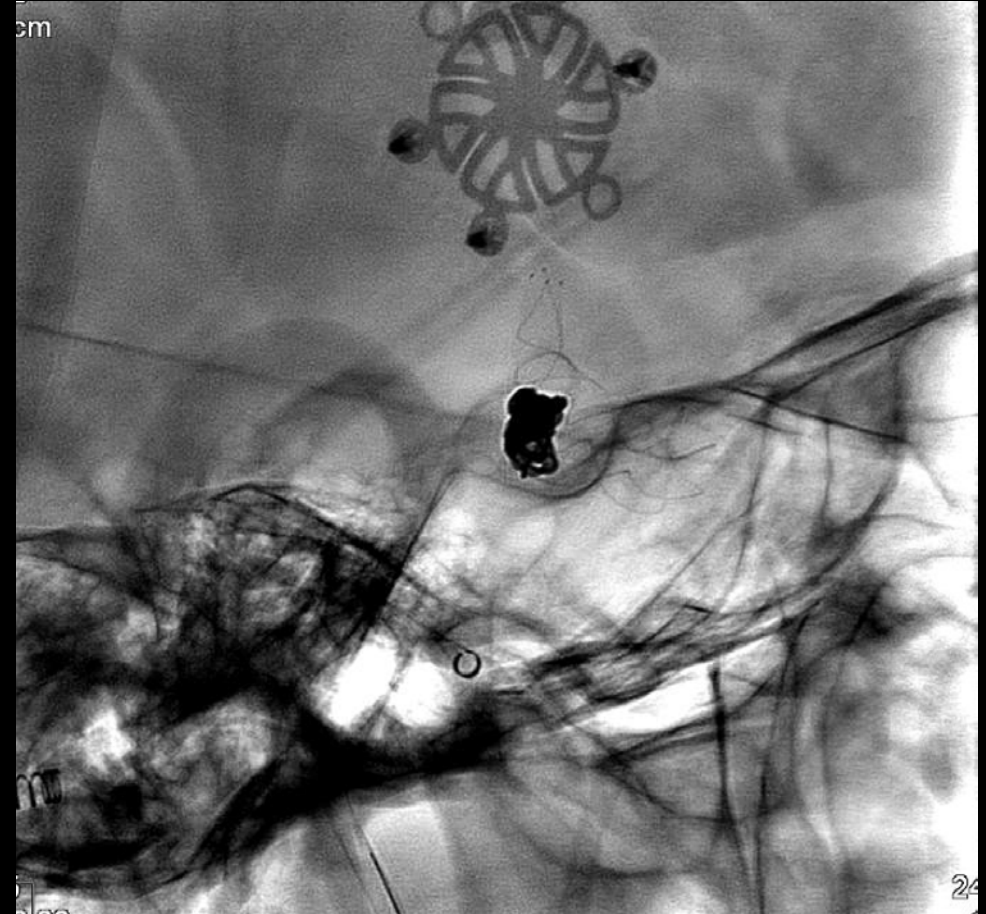
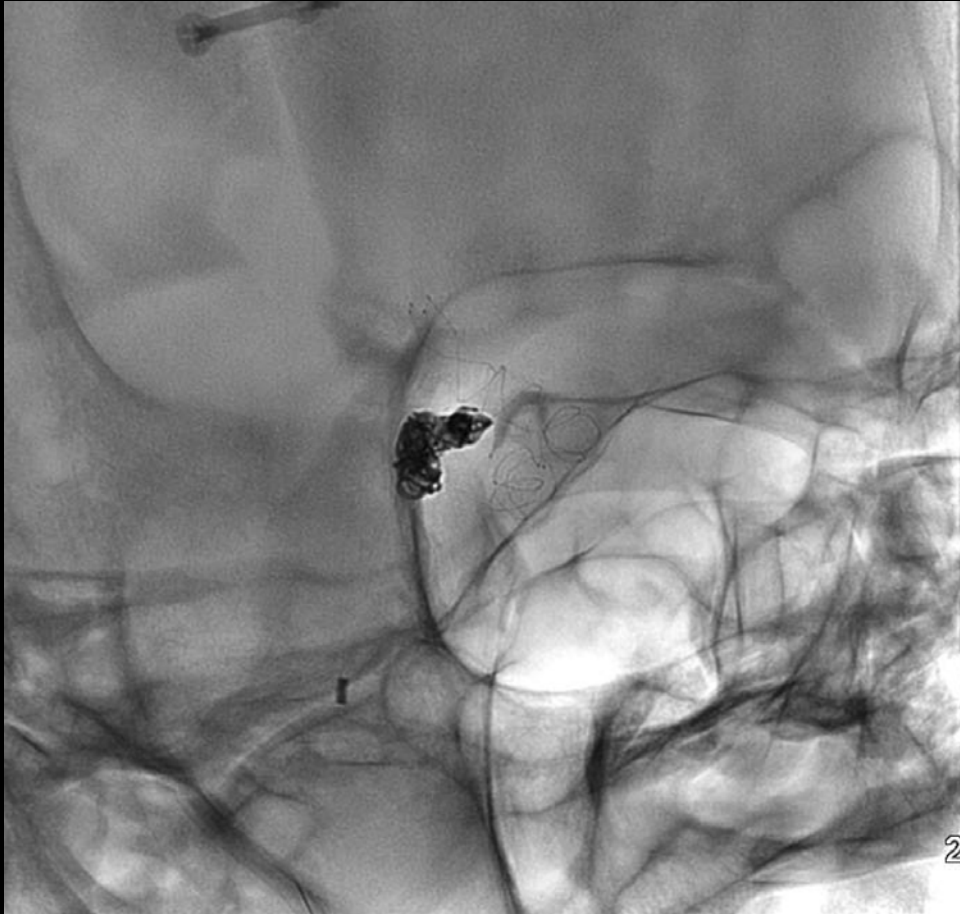
Initial Coil Embolization: Scepter XC



Delayed finish : LVIS Blue 3.5 x 22, Duo
Microcatheter for coiling.



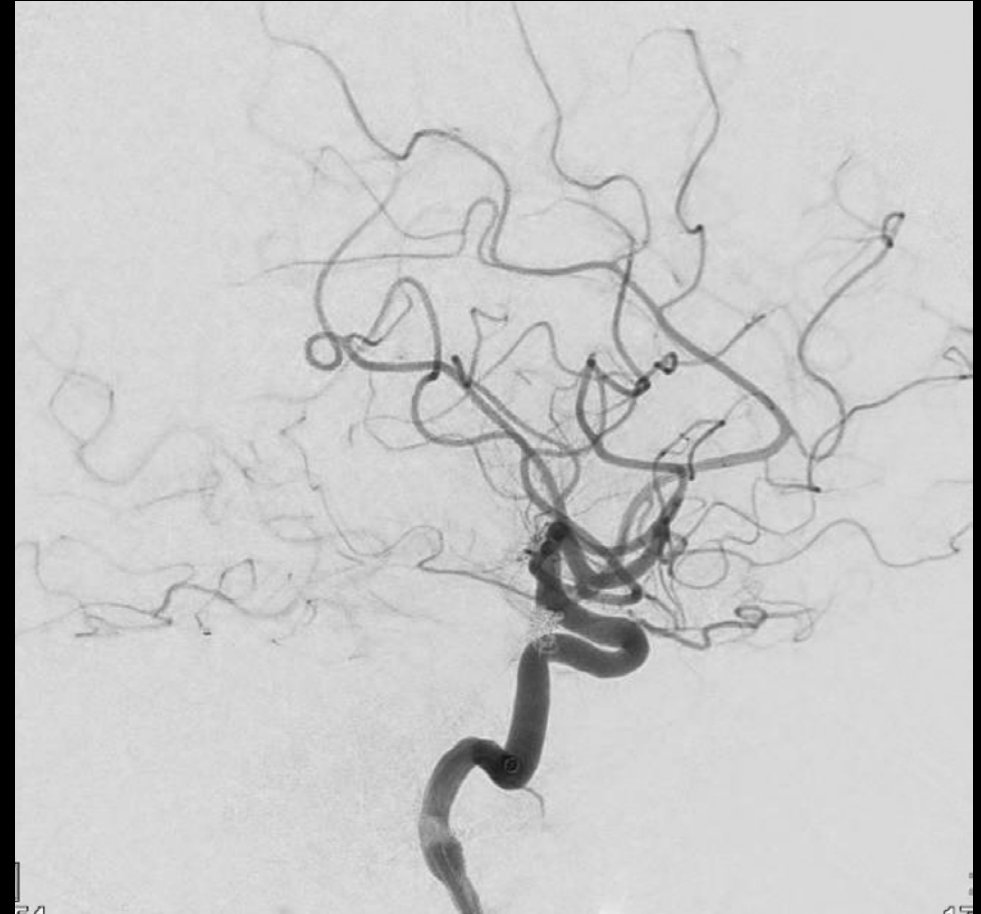
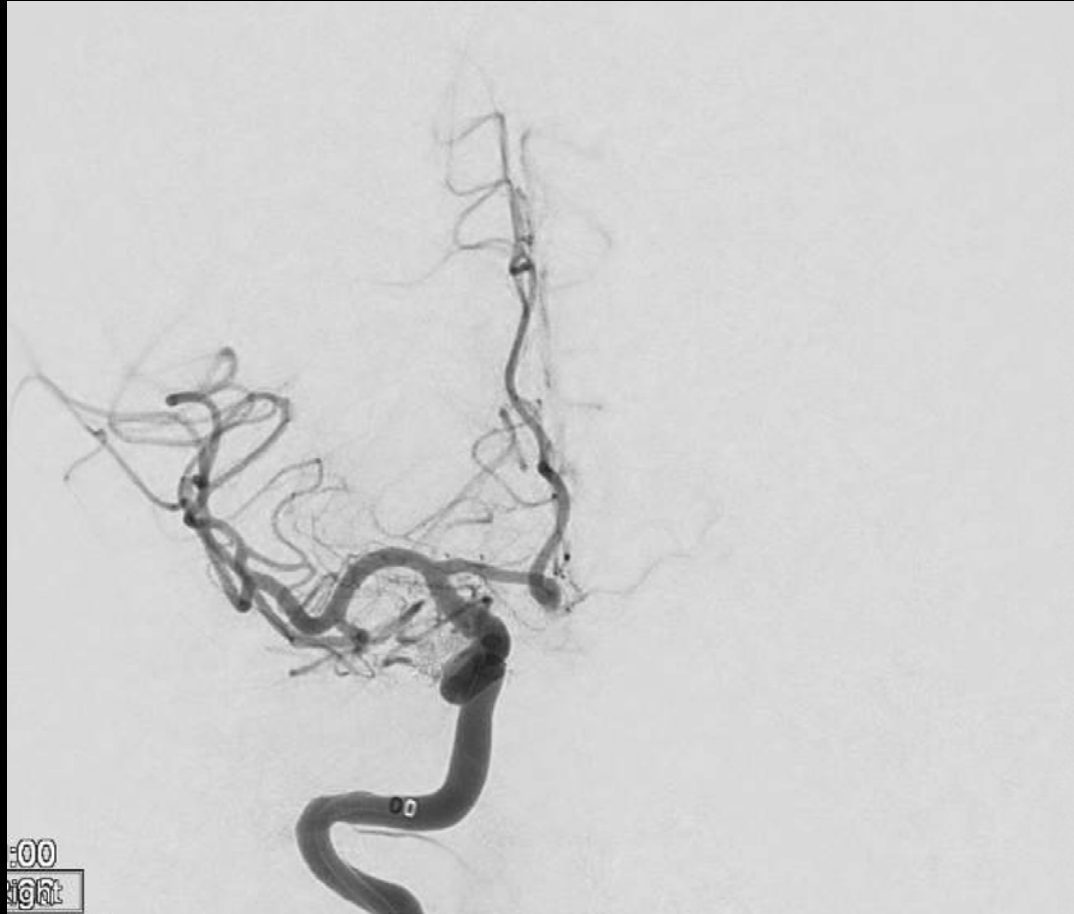
Final Construct



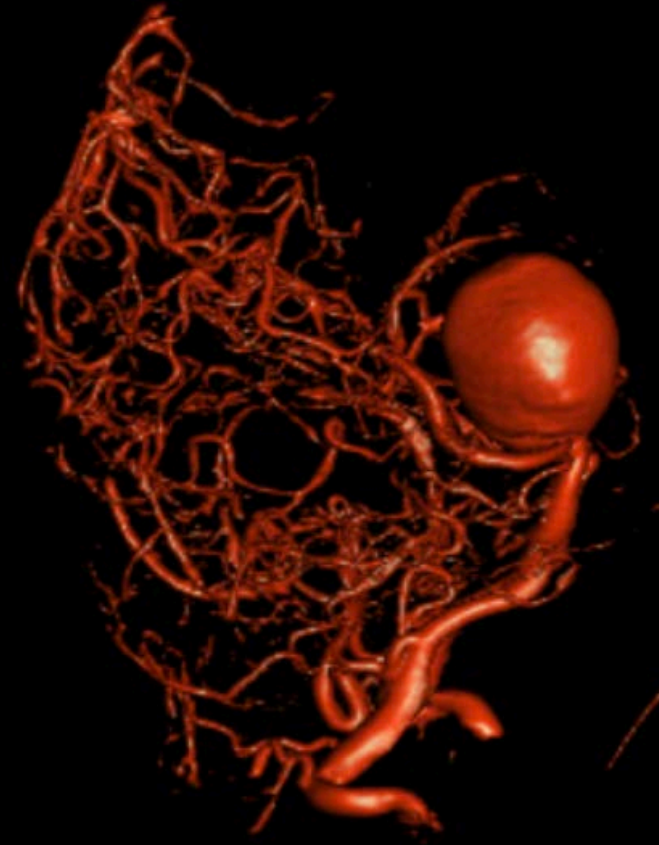
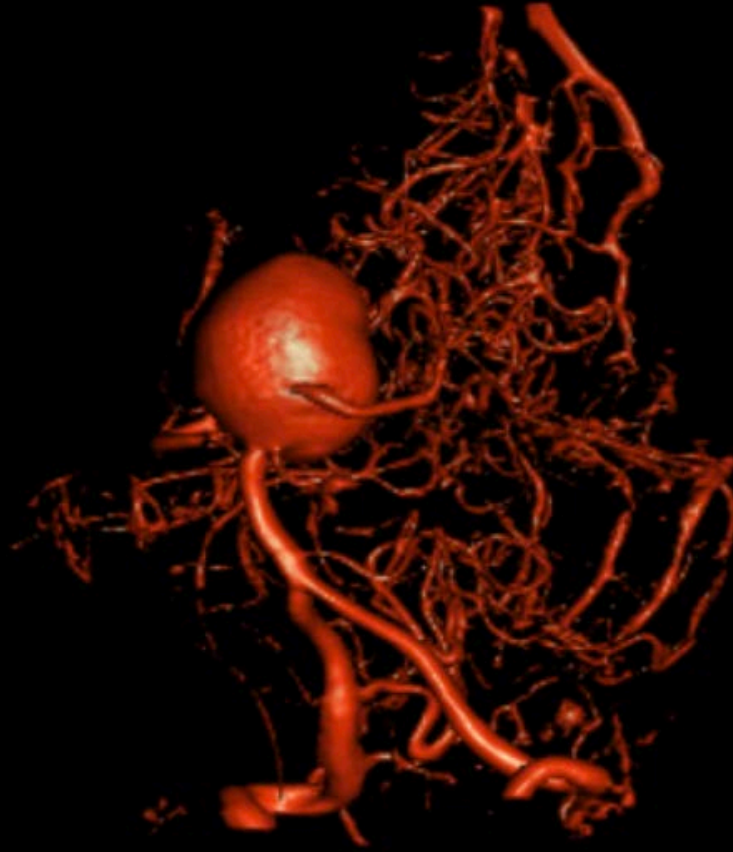
Excellent wall apposition in a tight turn



Final DSA result



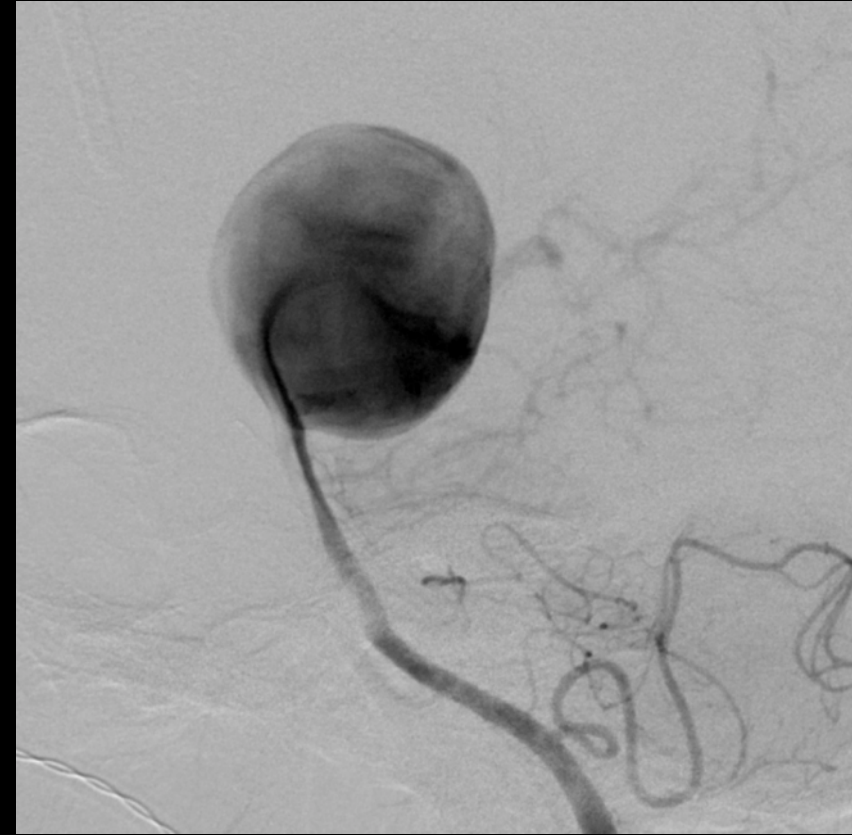
Simultaneous coiling: 69 year old with ruptured giant aneurysm at the top of the basilar (2.9 x 2.6 x 2.6 cm) . The aneurysm incorporates both PCAs



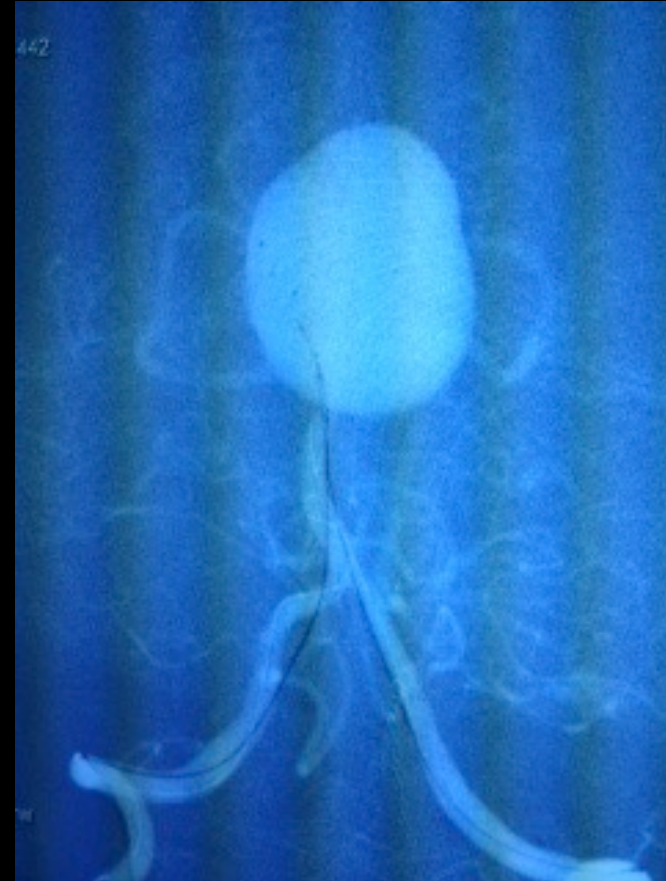
69 year old with ruptured giant top of basilar aneurysm 2.9 x 2.6 x 2.6 cm in size



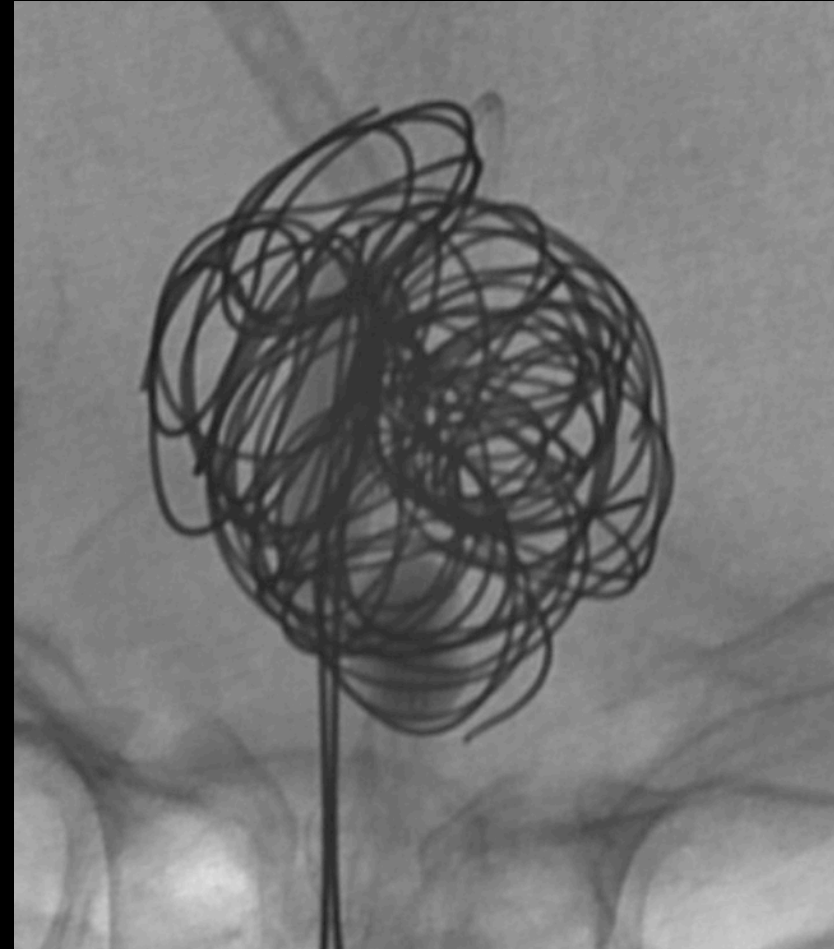
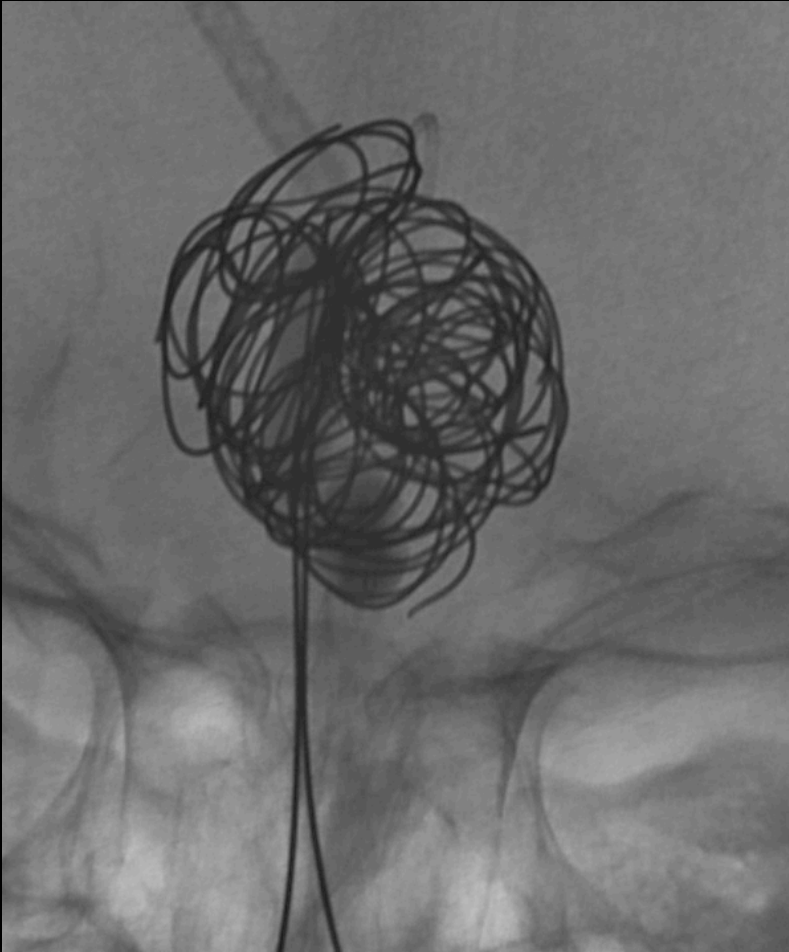
It was difficult to visualize the PCAs on single vessel injection, a 7 french guide cath in the left vert and a 5 french guide cath in the right vert both had to be injected for 14 seconds before start of DSA to see PCAs, 3D runs also needed a 14 second delay



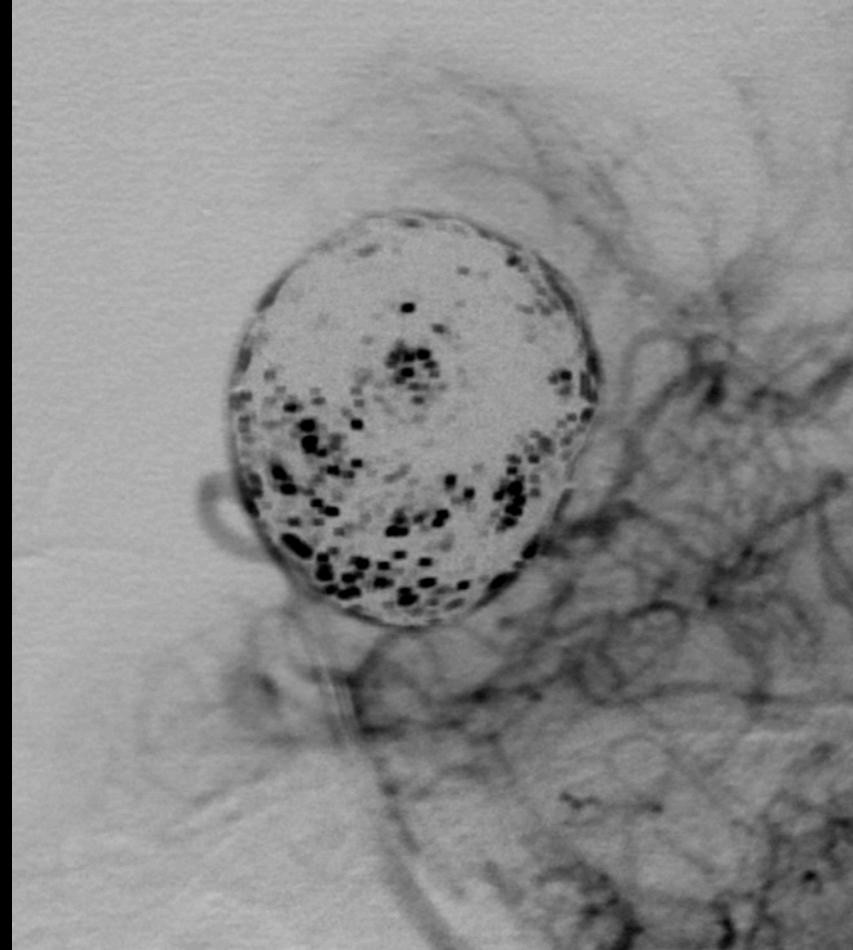
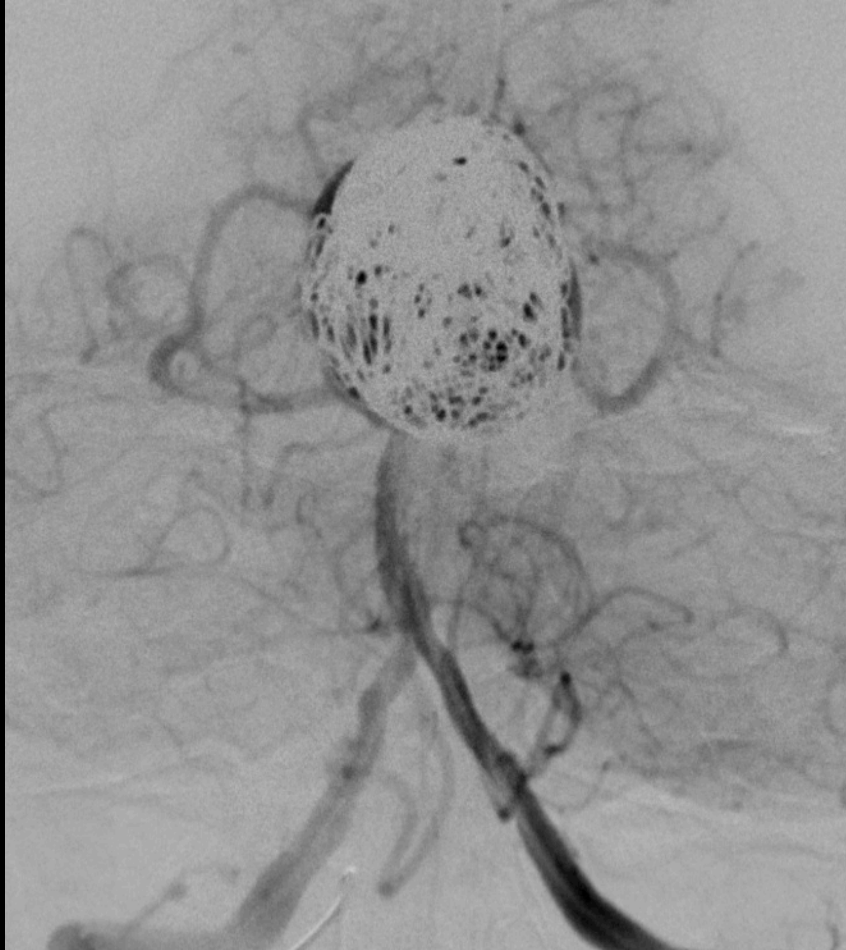
2 Scepter XC catheters were advanced into the aneurysm



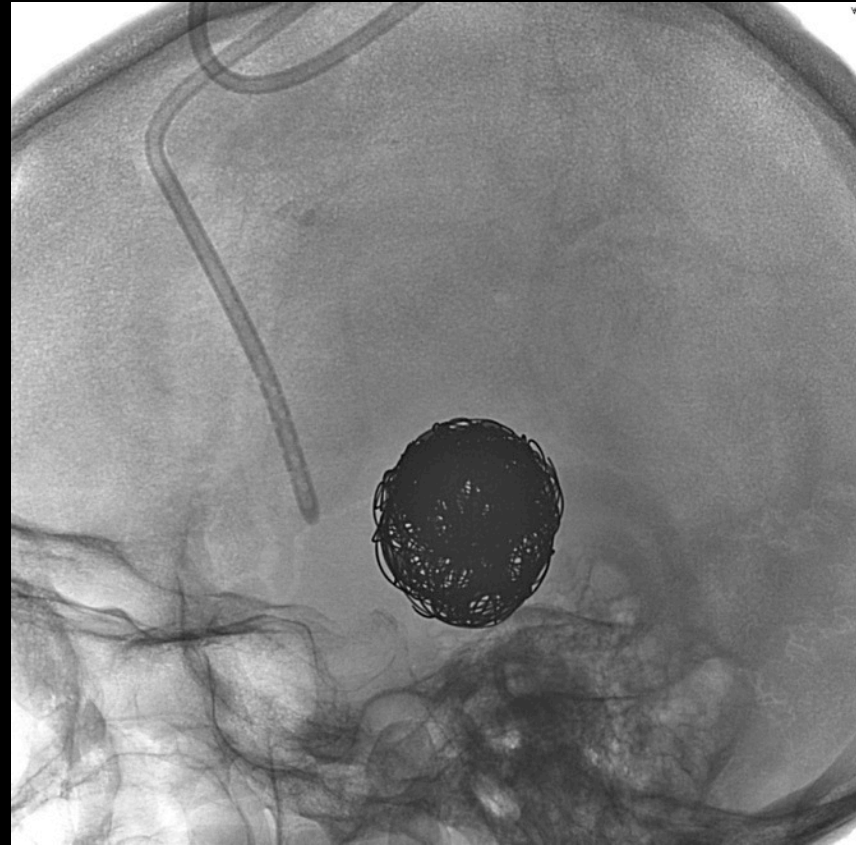
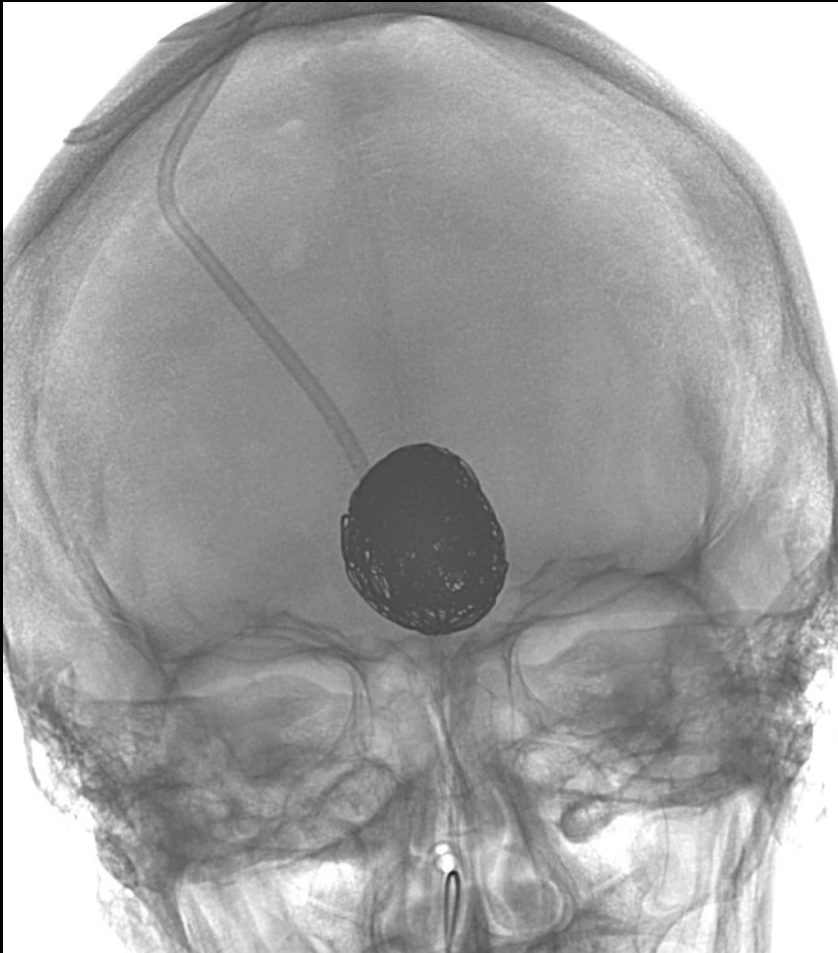
Both balloons were then repositioned within the aneurysm , the right was inflated to protect the right PCA origin and also to keep the left balloon in the midline and slightly to the left within the aneurysm neck to protect the SCAs . It was decided that patient may tolerate left PCA sacrifice.



Multiple coils were placed through the simultaneously inflated Scepter balloons using the dual microcatheter technique.

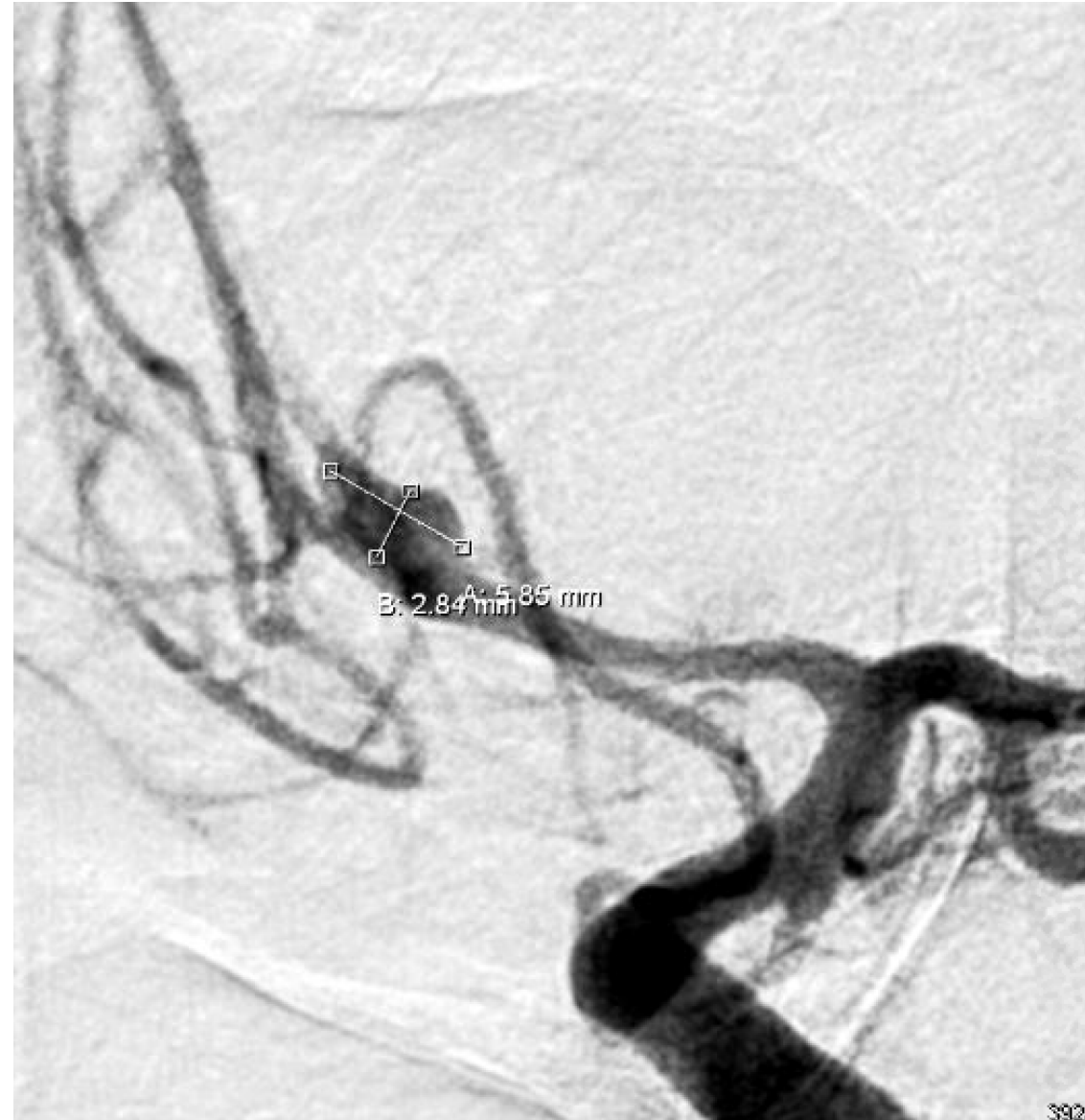


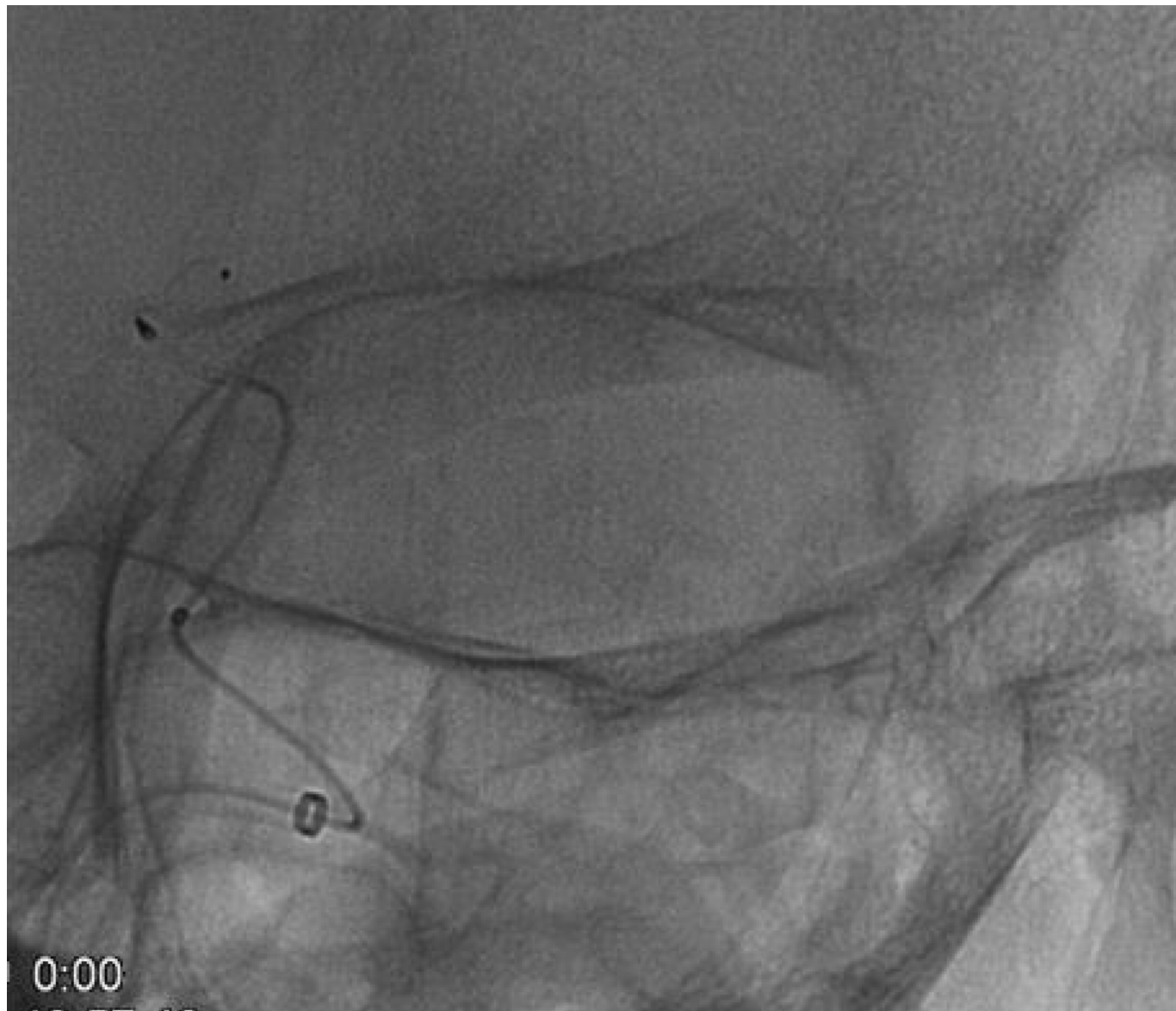
Skull radiographs to show baseline coil mass and assess for future coil compaction.

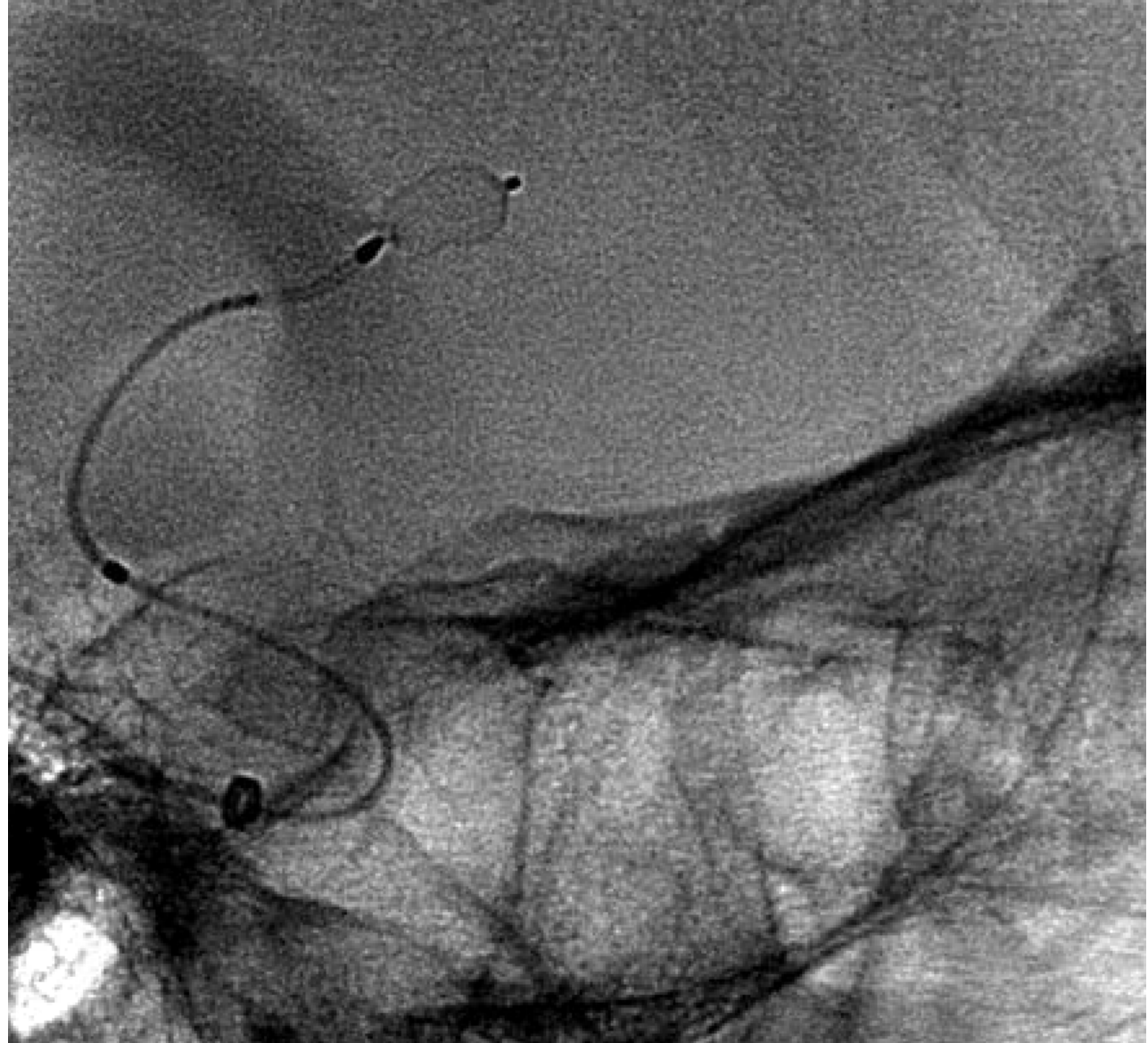


76 year old with SAH

















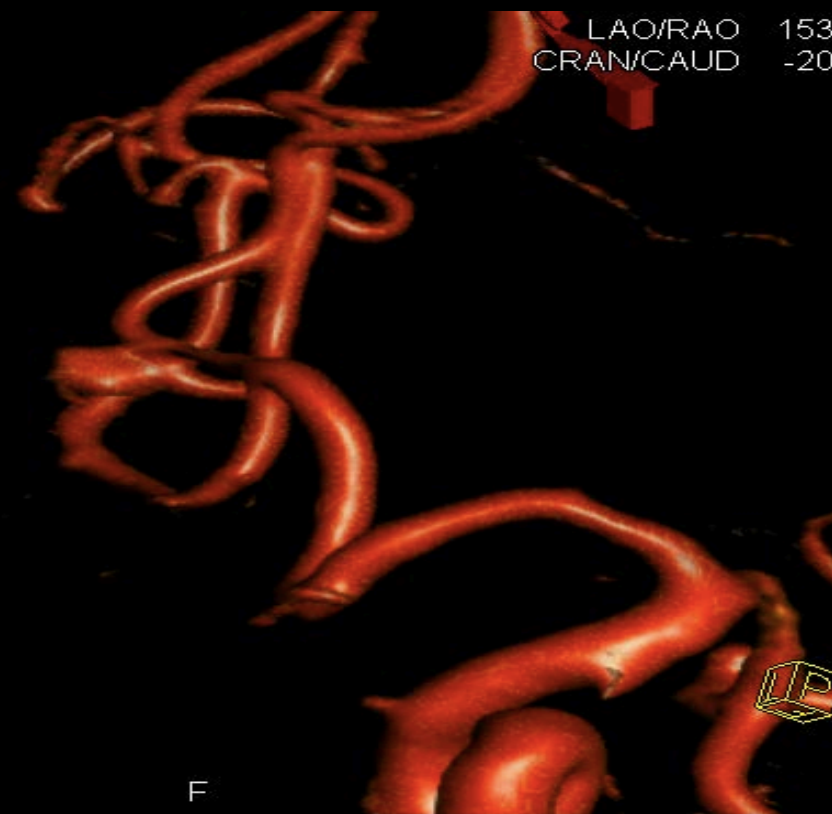
What about What about recurrent aneurysms??

- Fill it with Pebbles not rocks
- Consider balloon or stent coiling or flow diverter
- No one said that you cannot Web it or Onyx it?!?
- I strongly prefer LVIS Blue

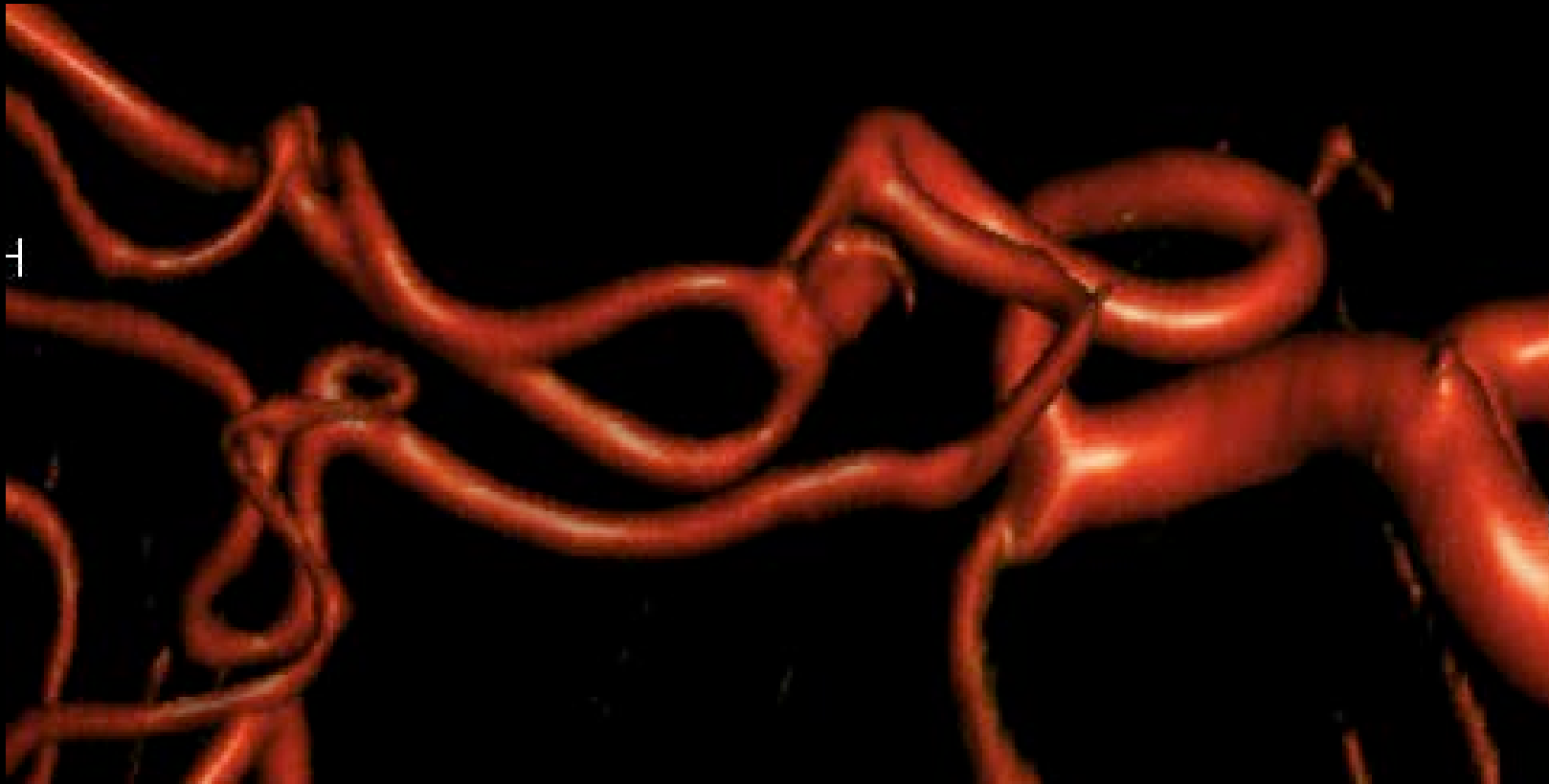
Durability of Rx: 63 year old patient with residual from previously coiled ruptured wide necked pericallosal aneurysm.



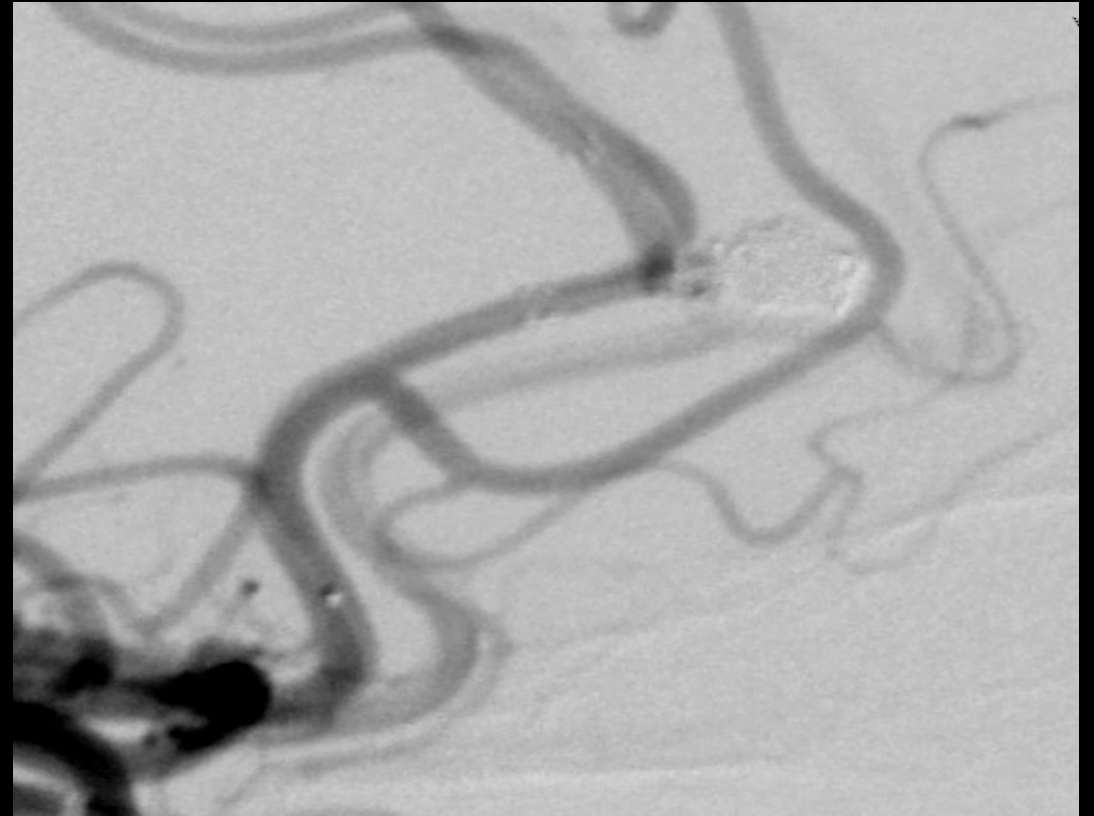
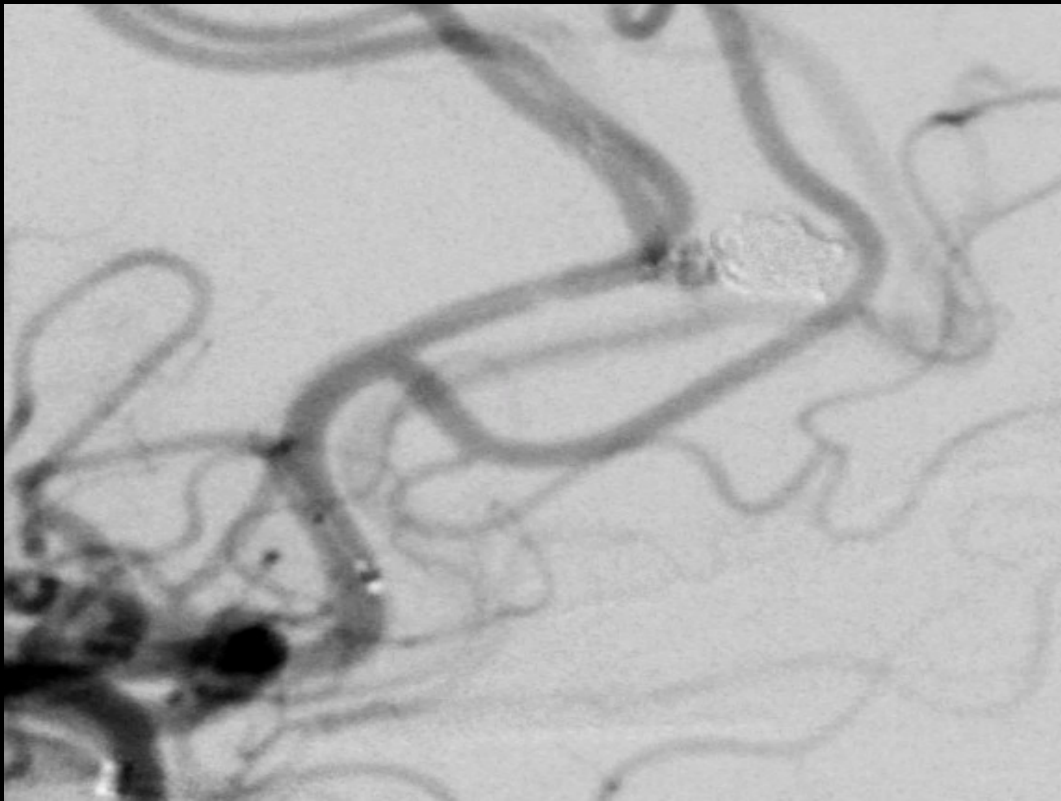
63 year old patient with residual from previously coiled ruptured wide necked pericallosal aneurysm.



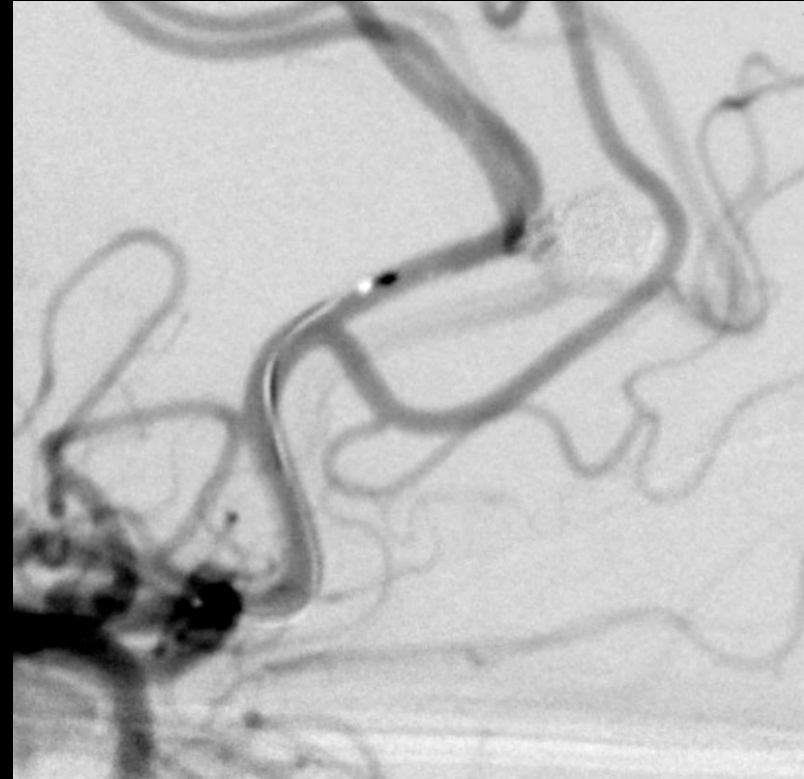
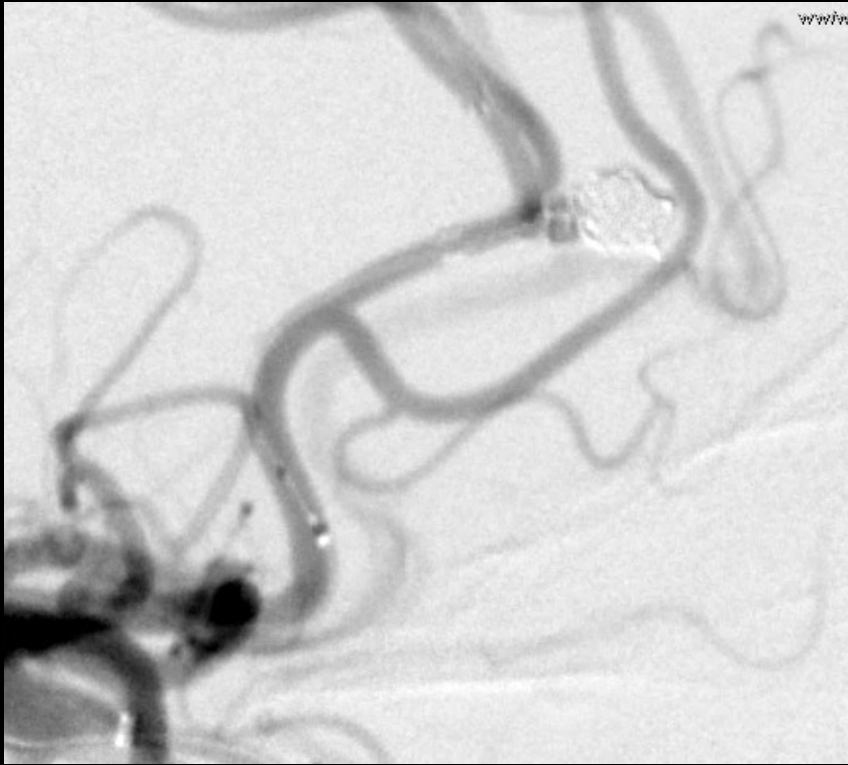
63 year old patient with residual from previously coiled ruptured wide necked pericallosal aneurysm



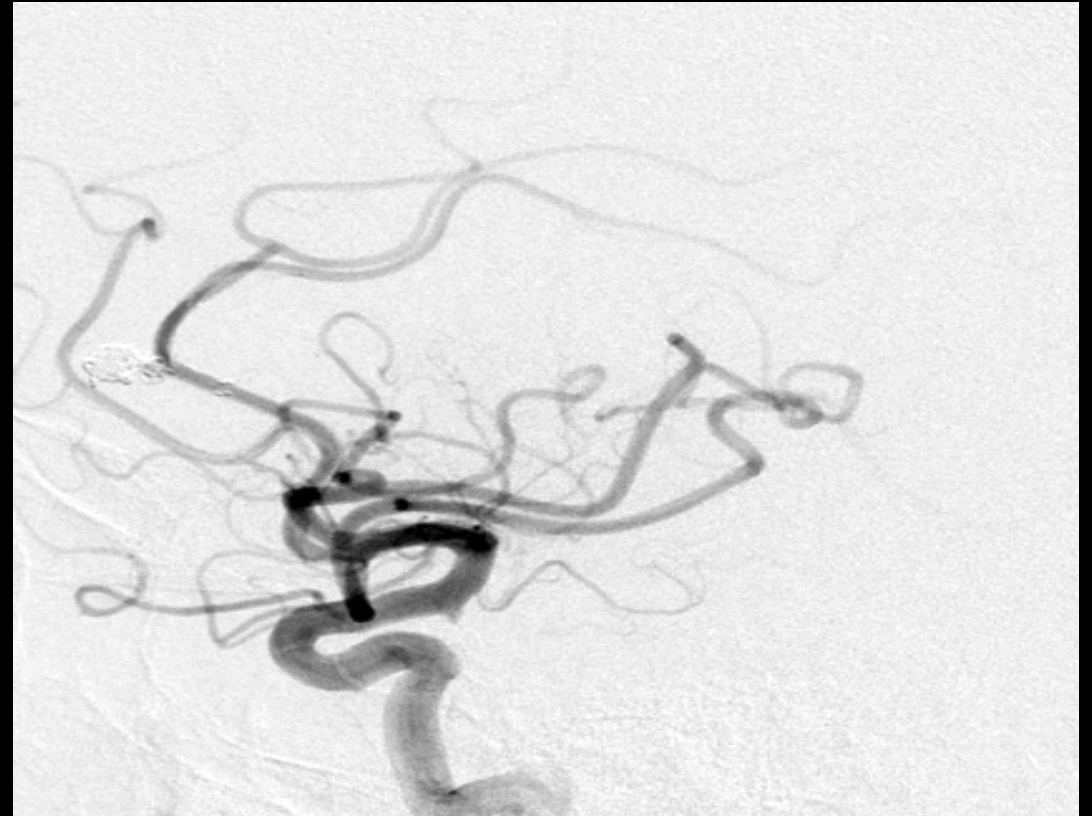
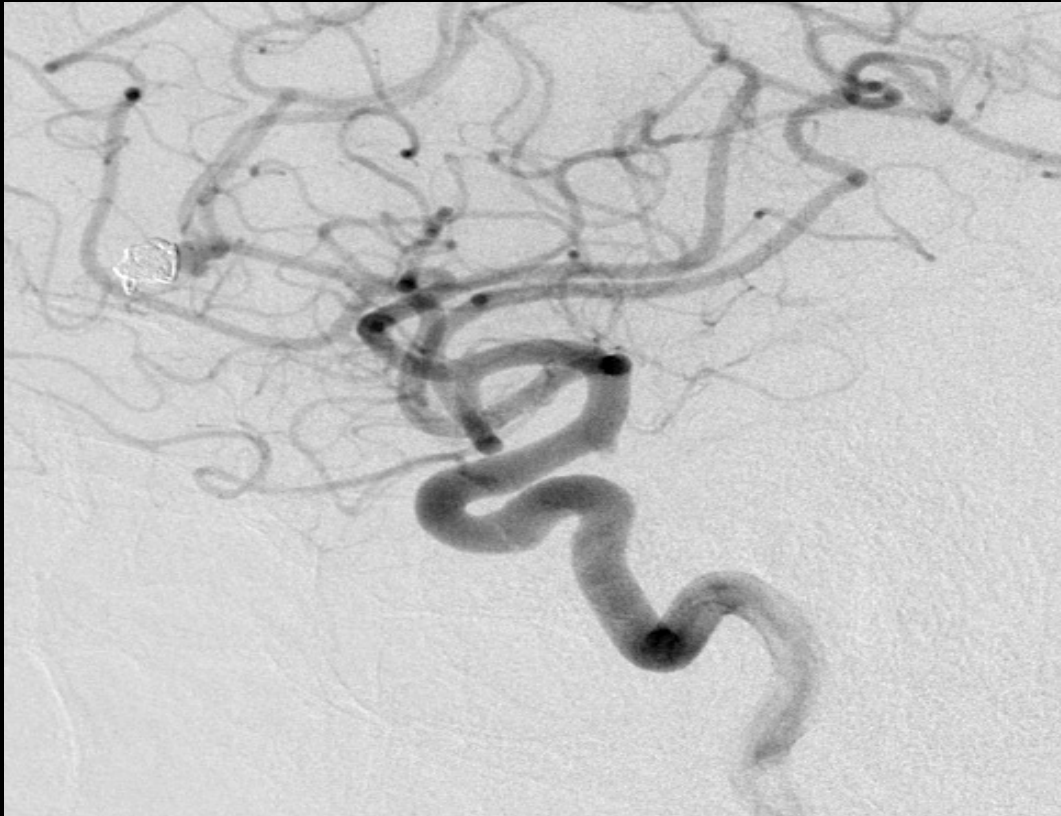
3 x 15 Neuroform stent was placed and Duo catheter was used to access neck of aneurysm



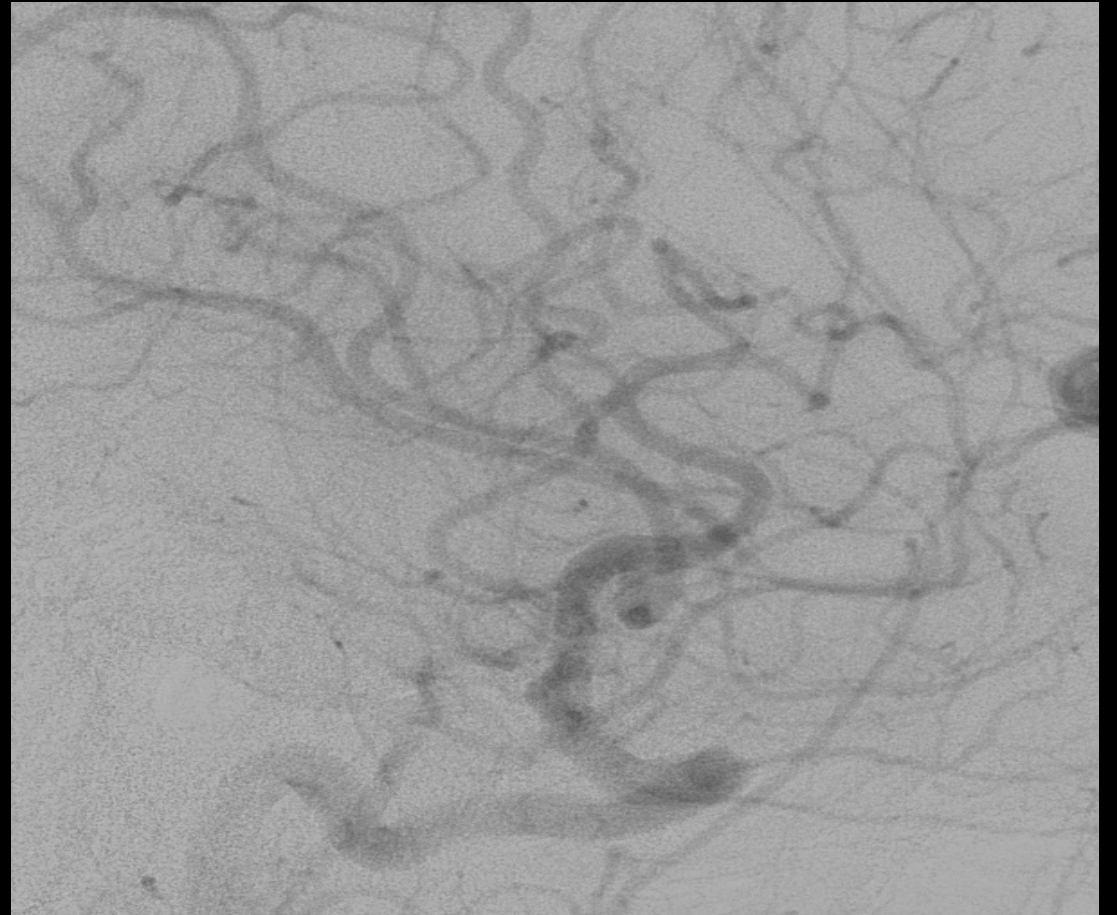
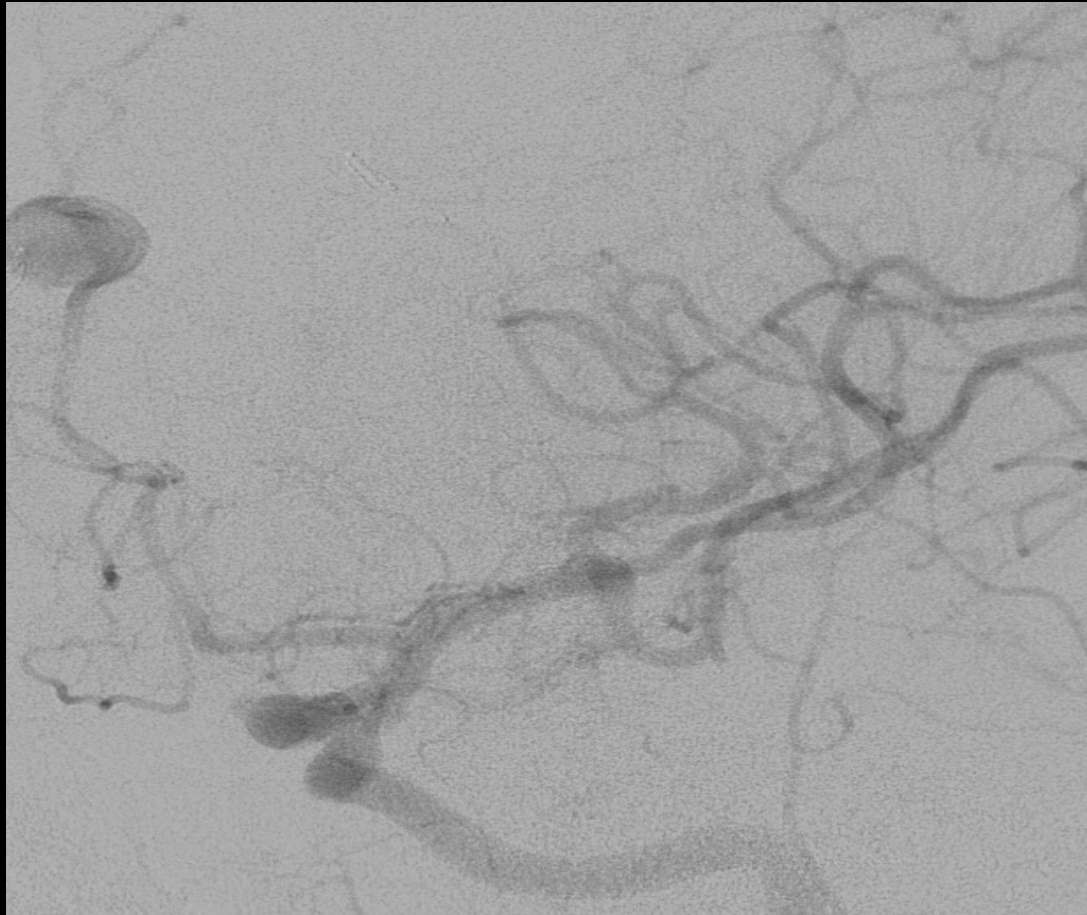
Hydrocoils were used



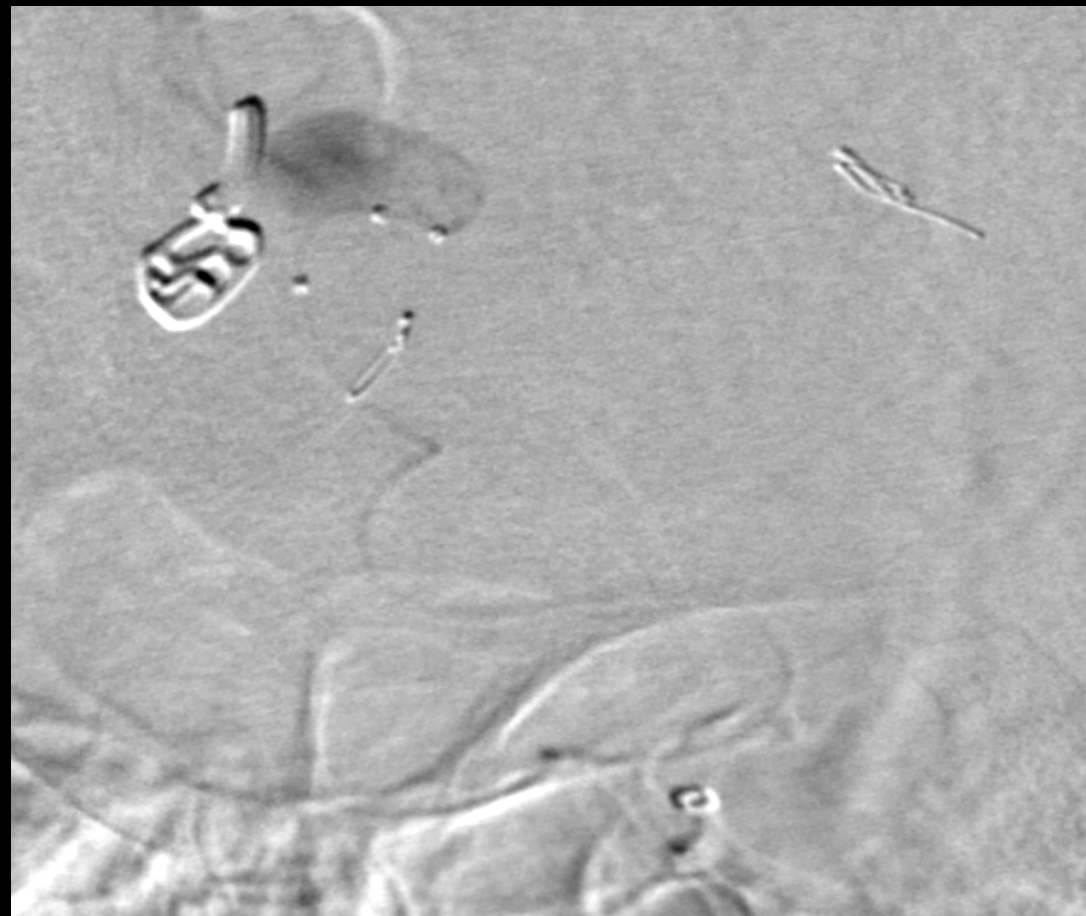
Pre and post: 10 years on



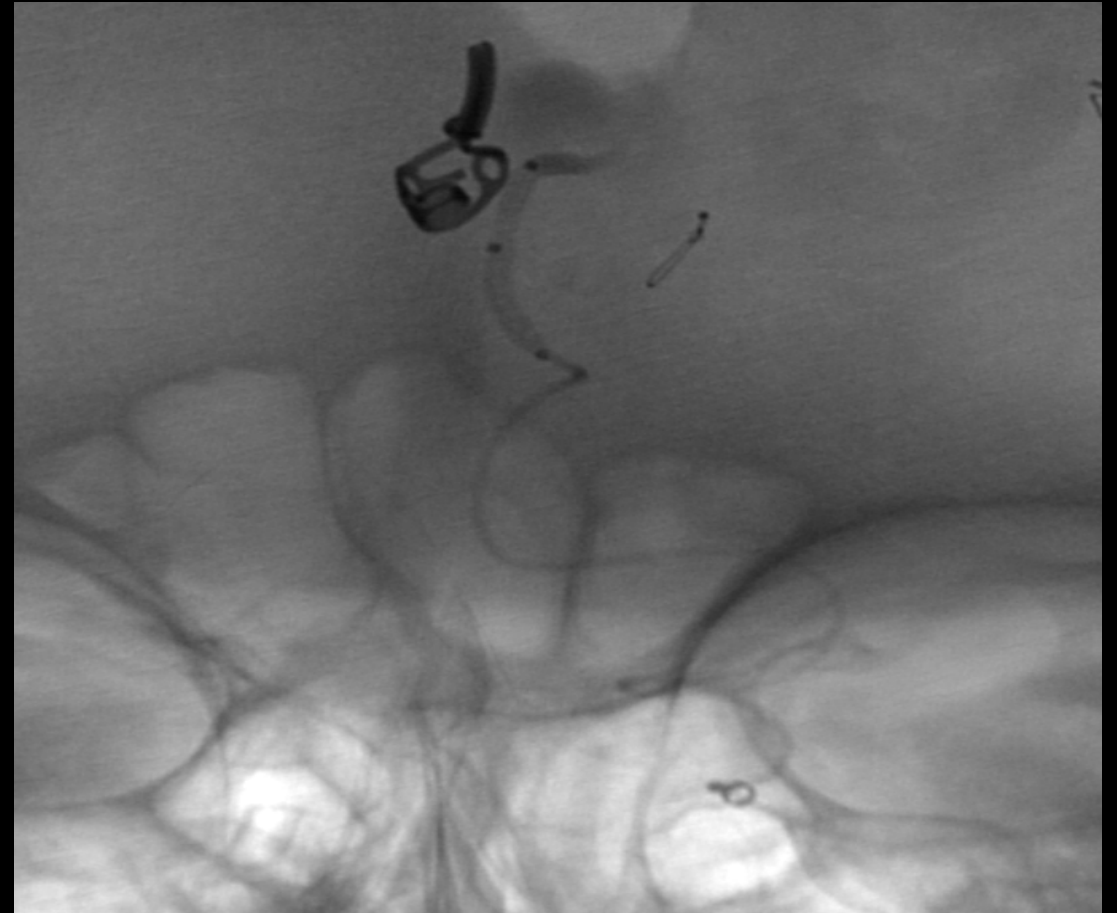
40 year old with headaches and previously clipped
aneurysm from the fronto-polar artery



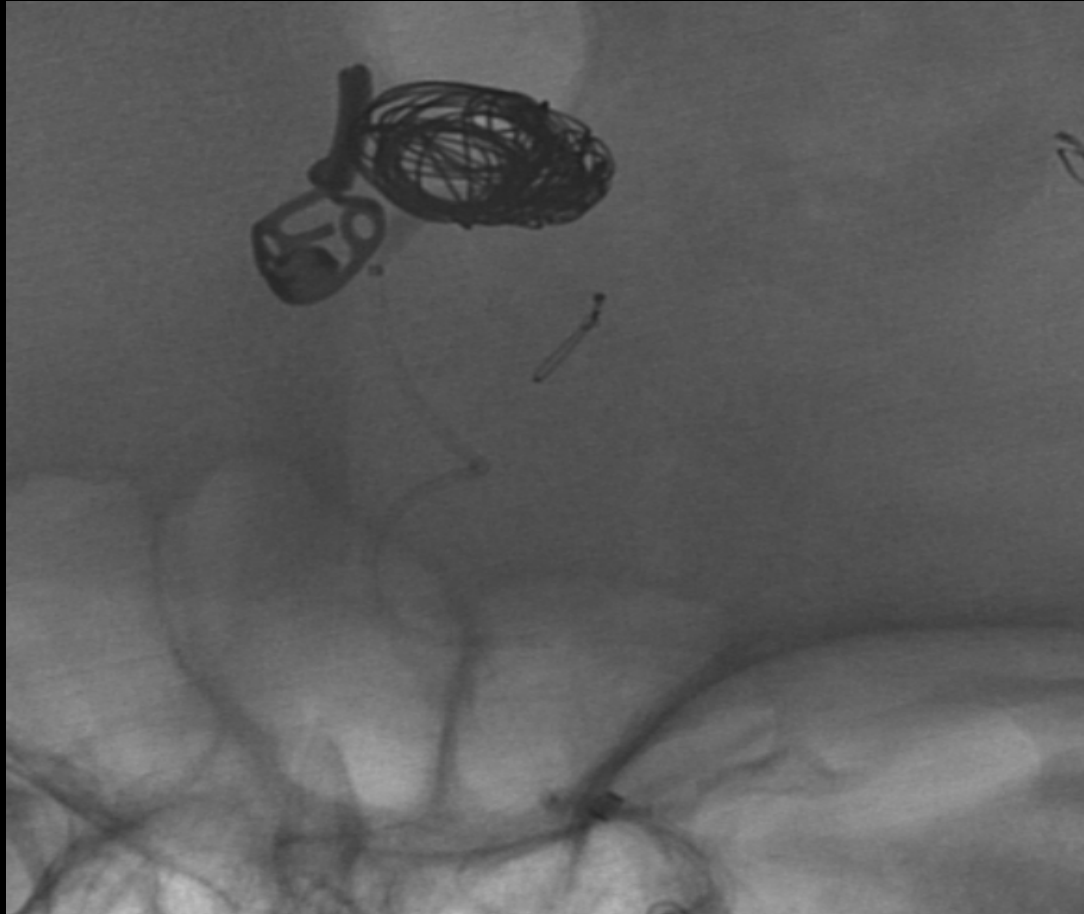
Superselective WADA through Scepter



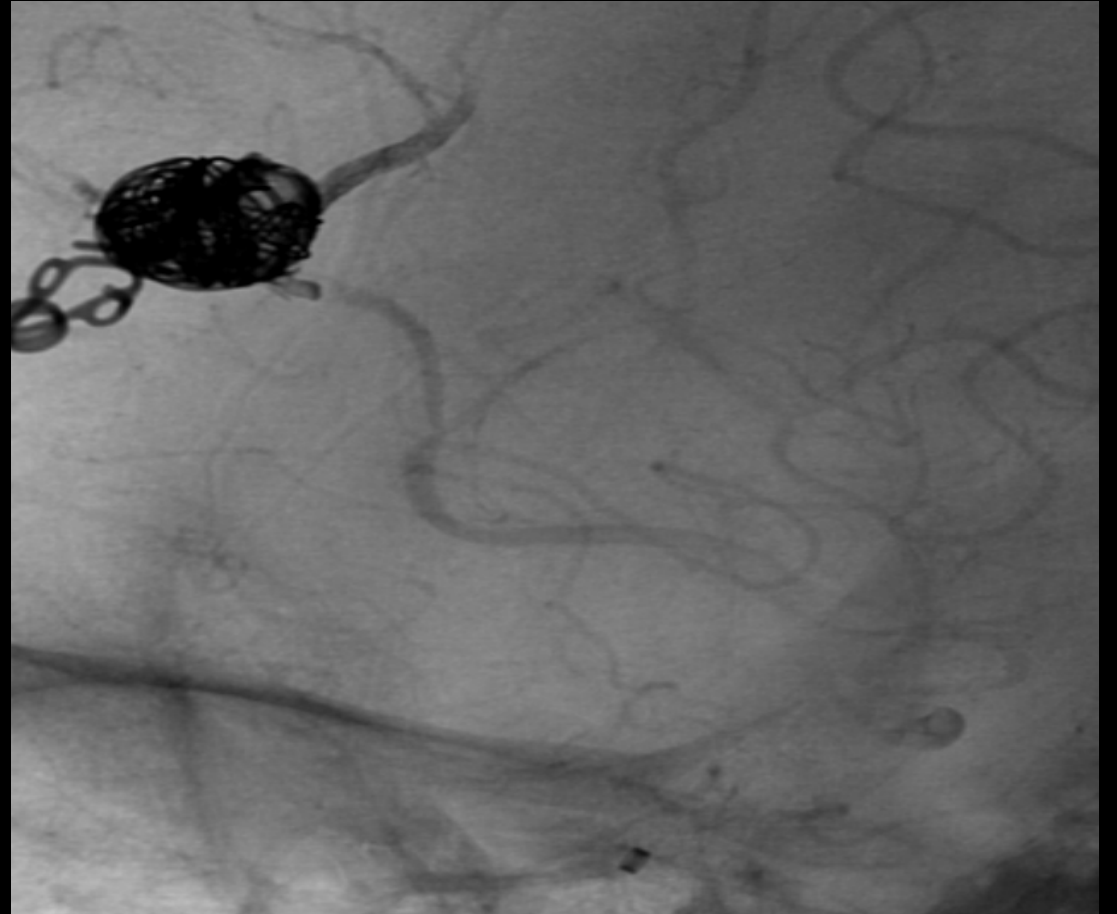
Balloon test occlusion with Scepter XC



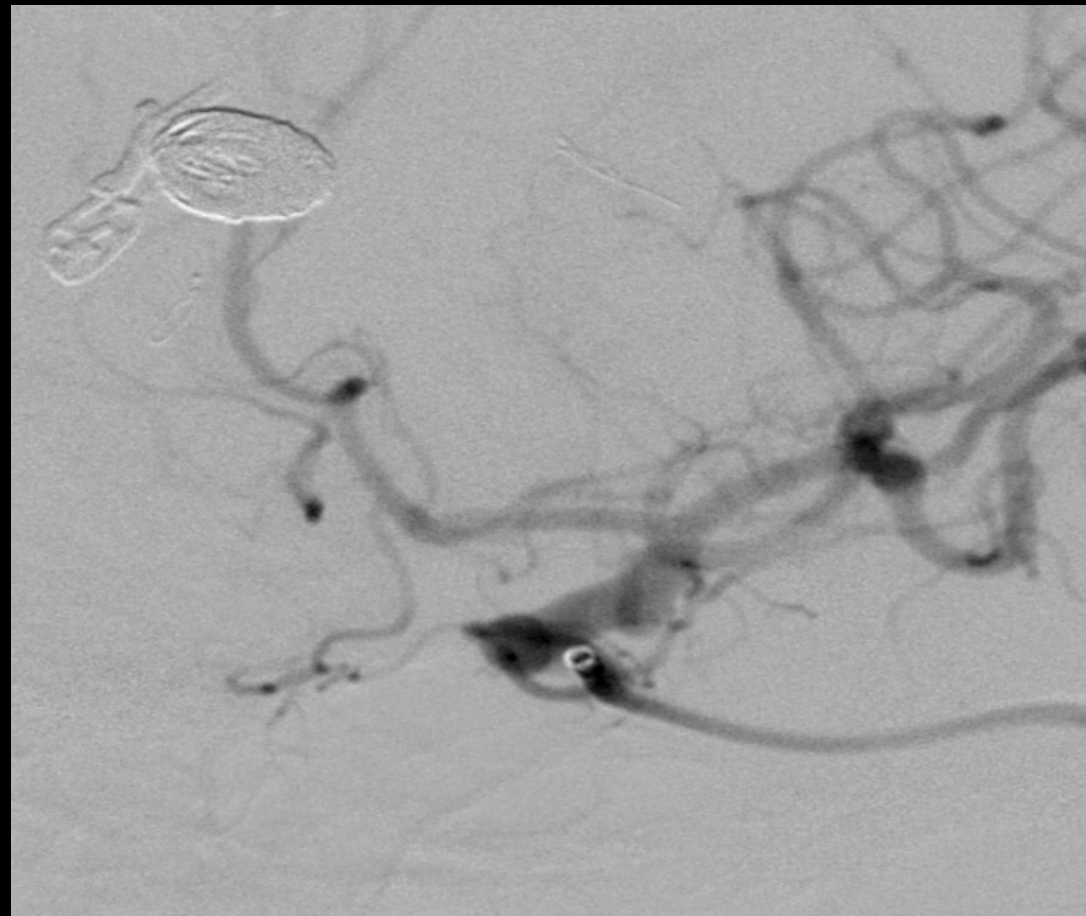
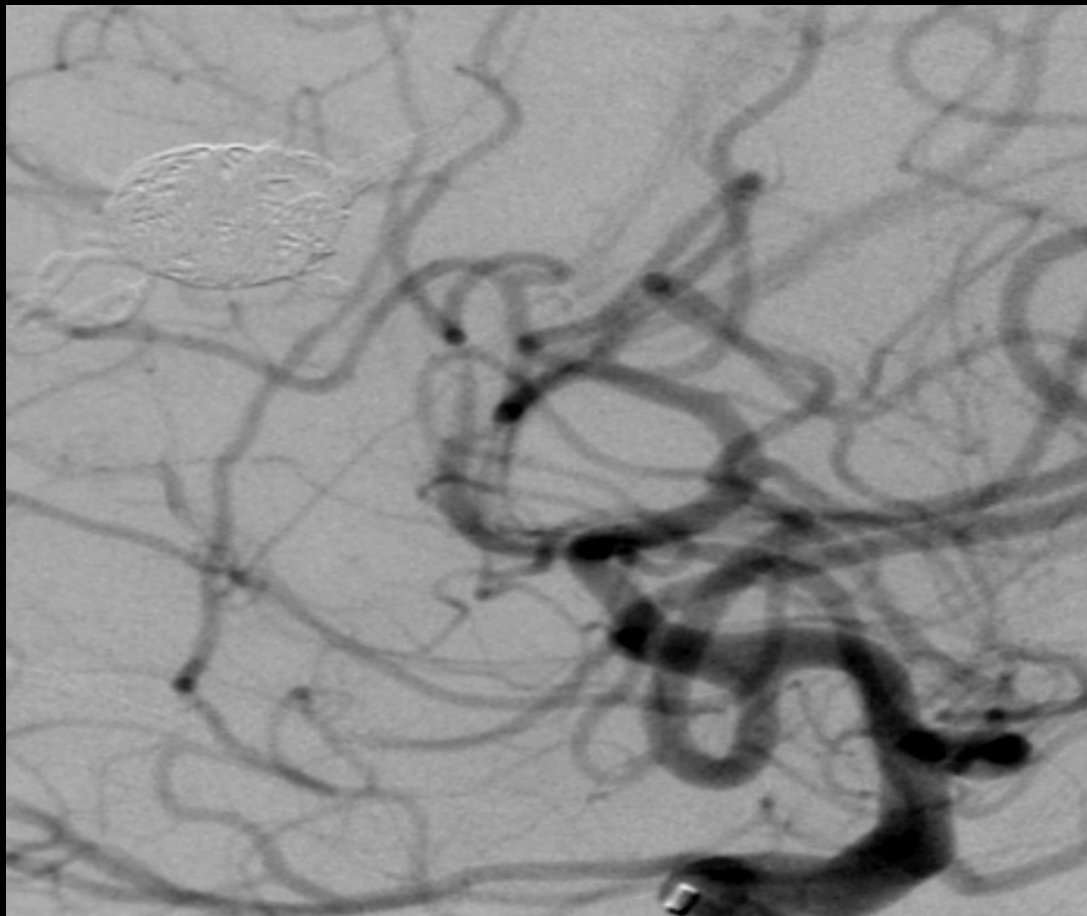
Coiling through Scepter XC



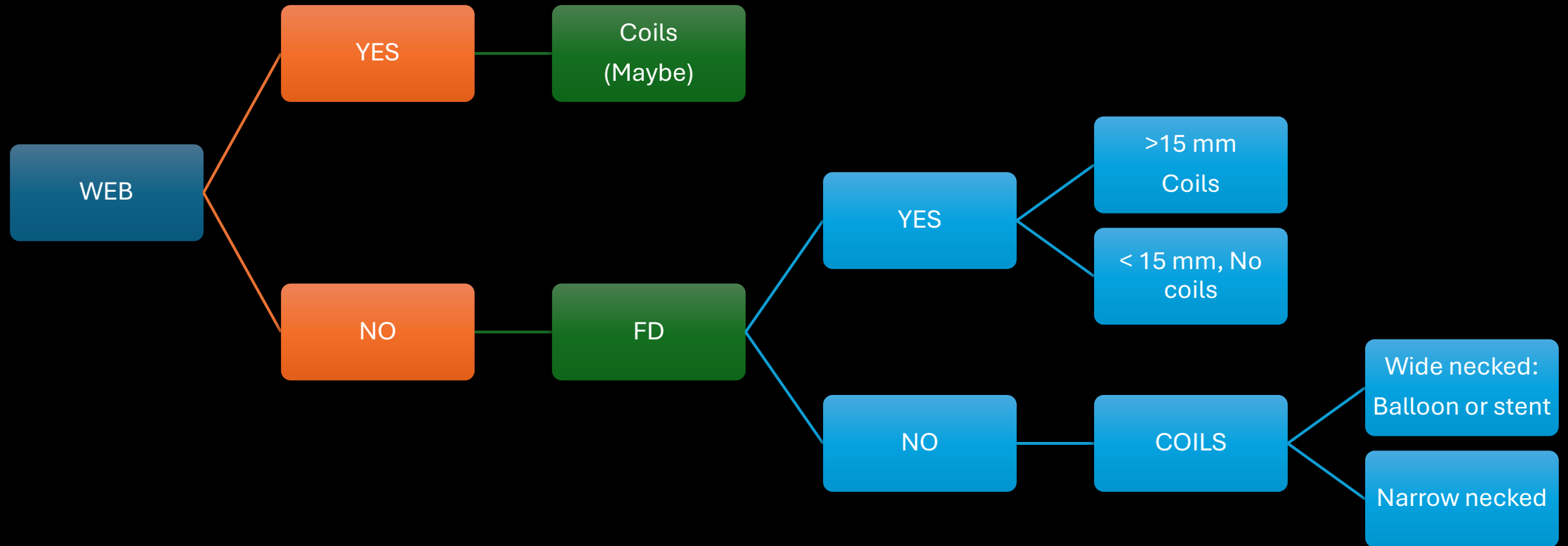
Onyx through Scepter XC



Aneurysm no longer fills: Patient sent home the next day



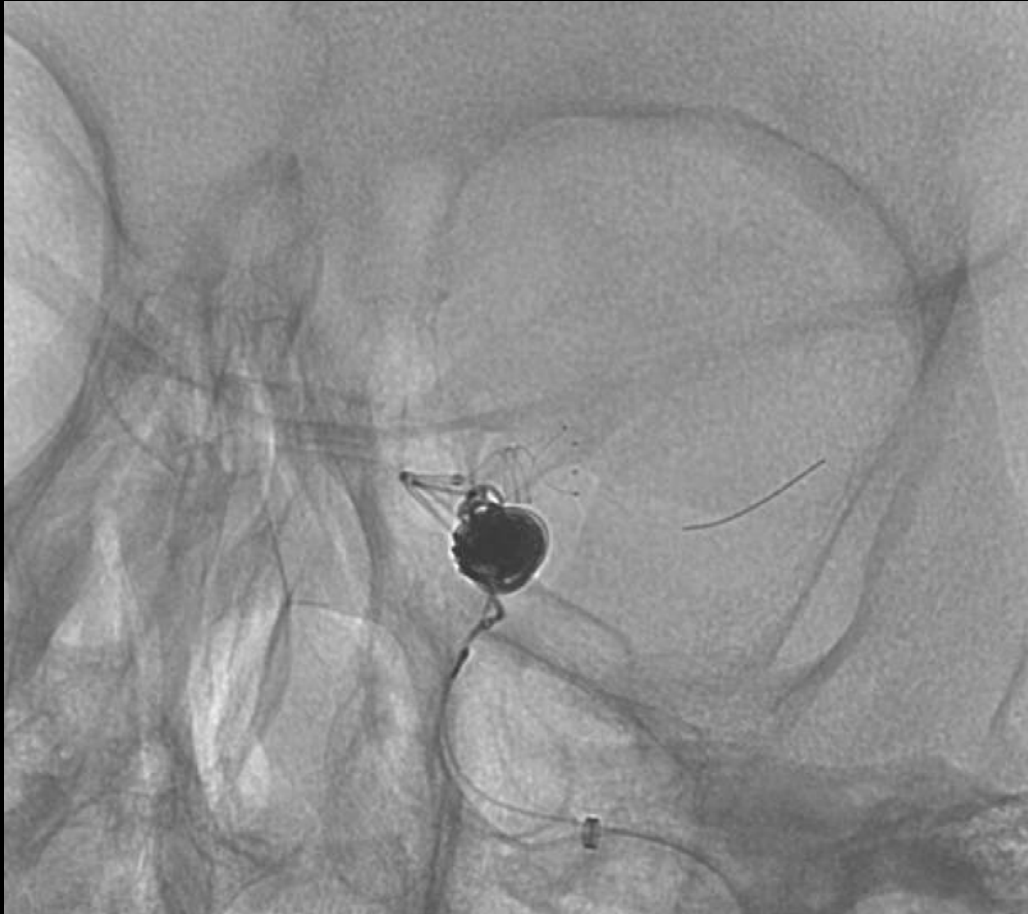
Unruptured Aneurysms



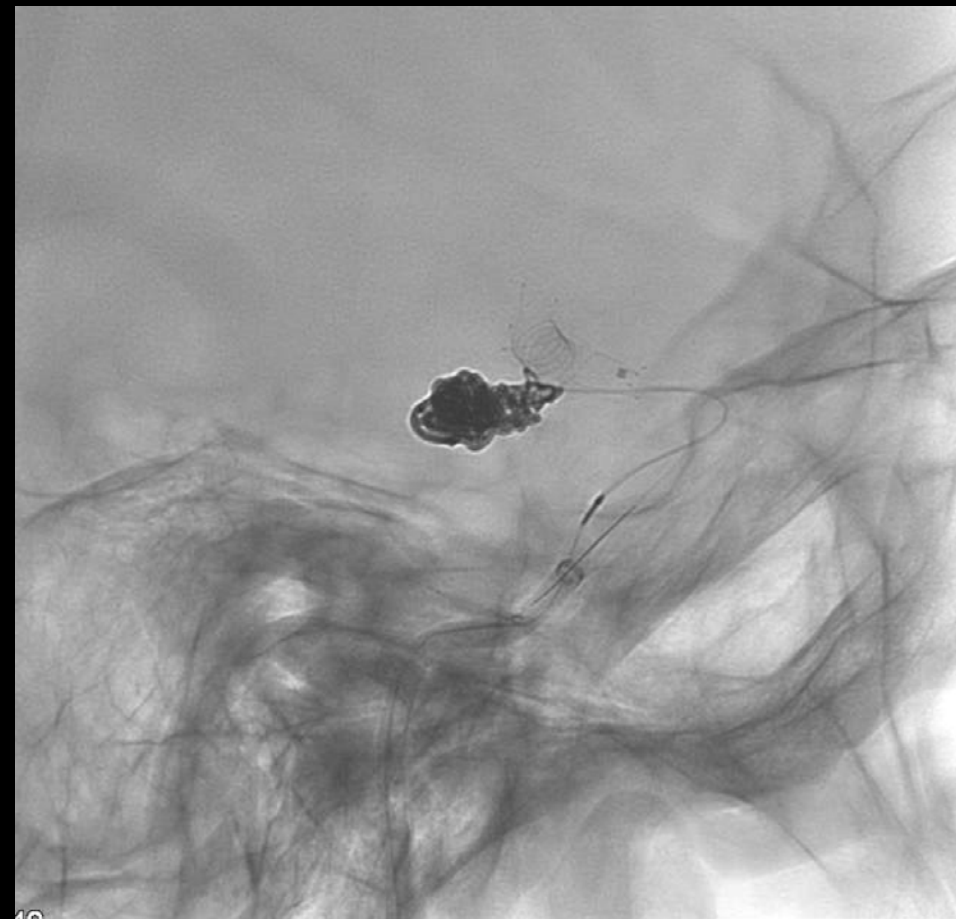
Stent coiling with LVIS Blue: 45 year old with unruptured PCOM aneurysm



Stent assisted coiling after jailing and partial deployment



Compaction of stent tines at neck of aneurysm

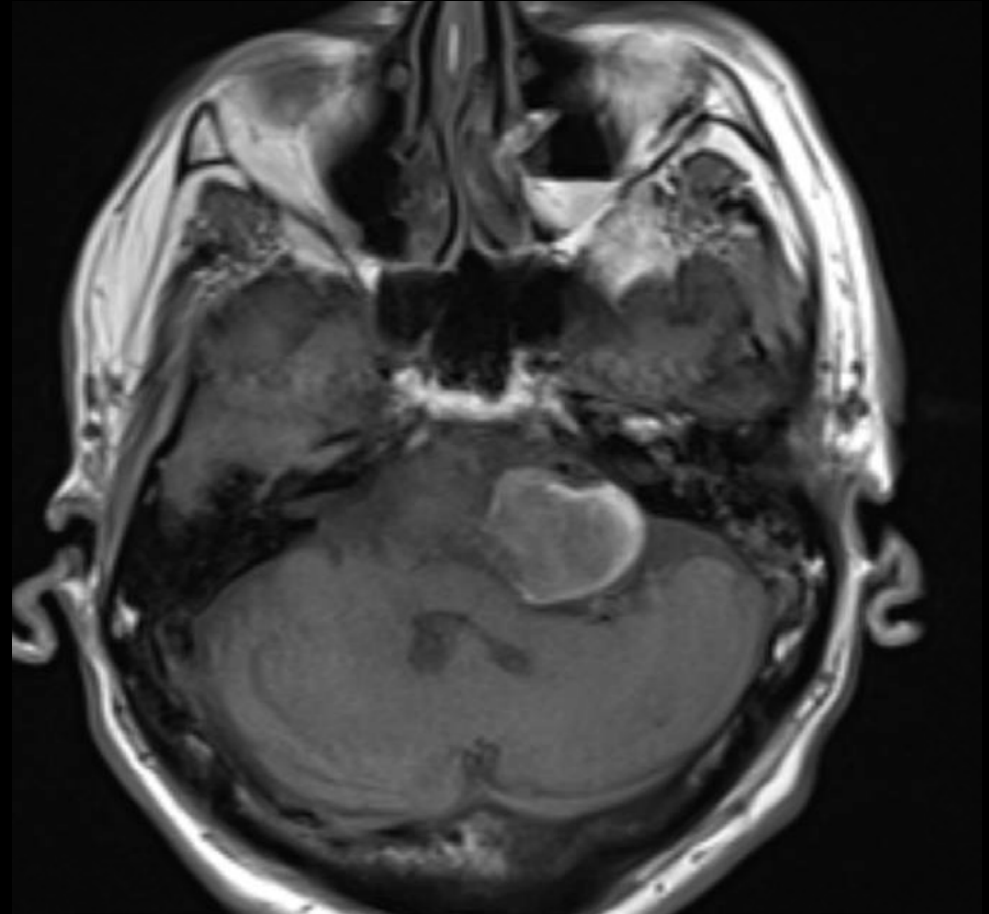
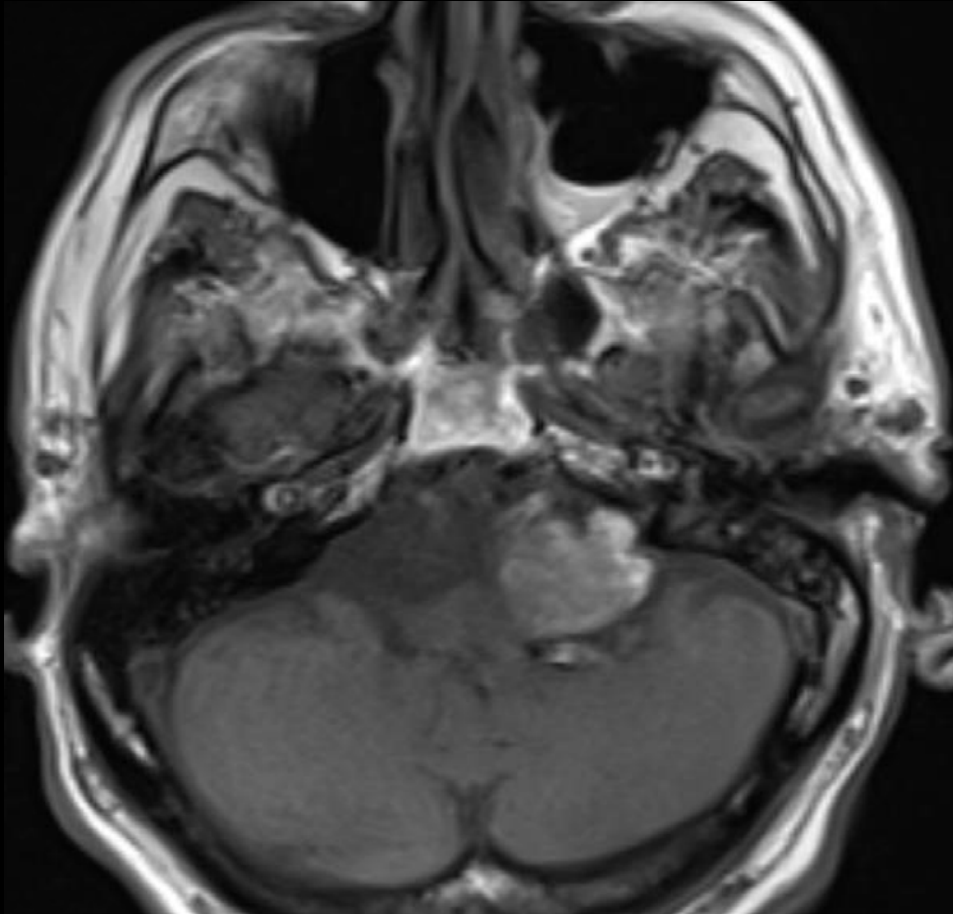


Final DSA

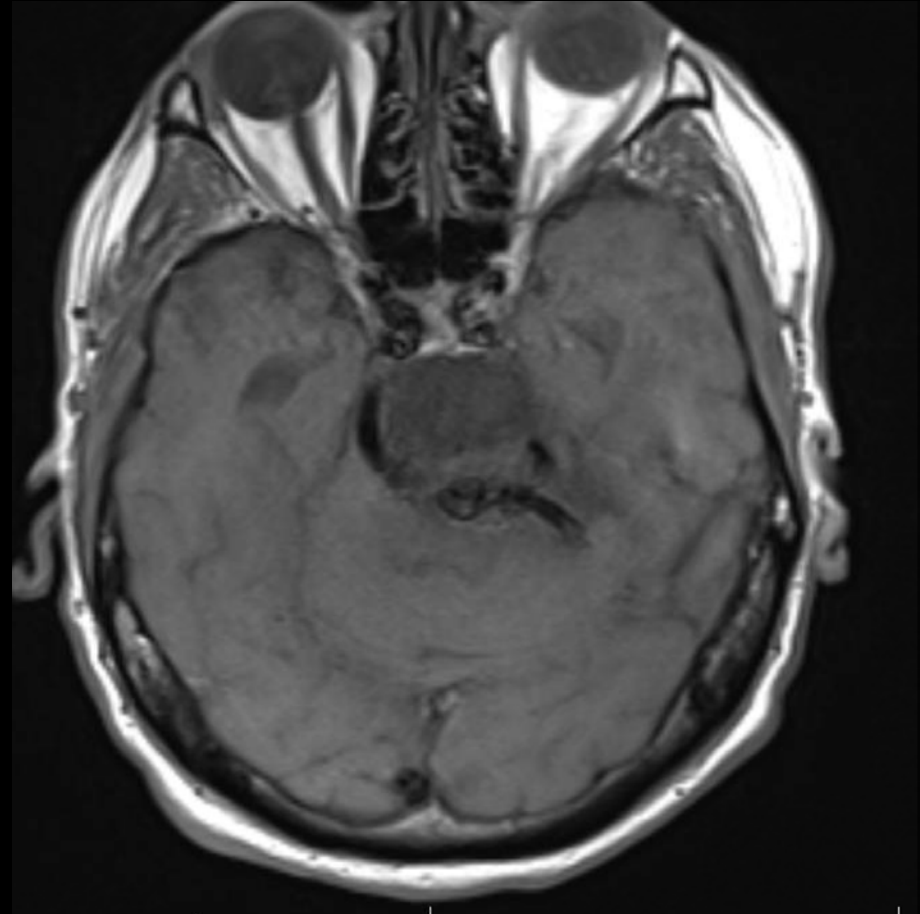
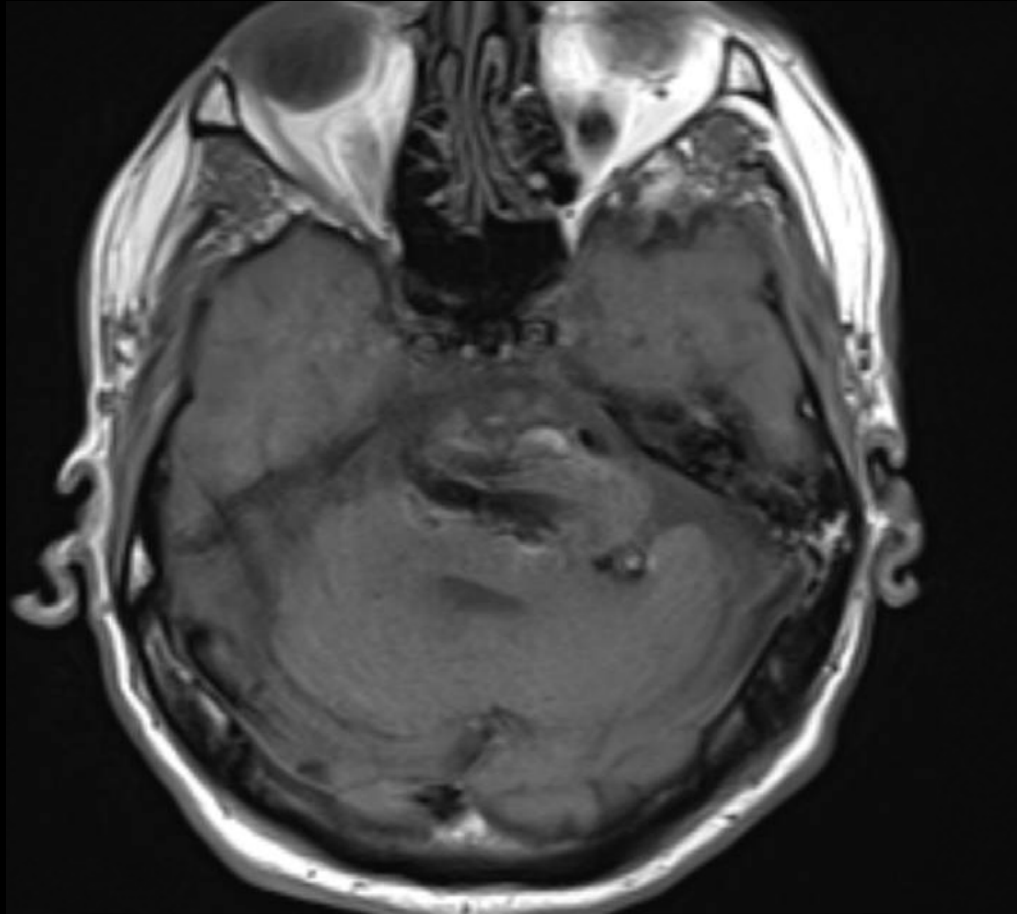


- Significant ability to manipulate coverage of neck.

Flow diversion



Flow Diversion

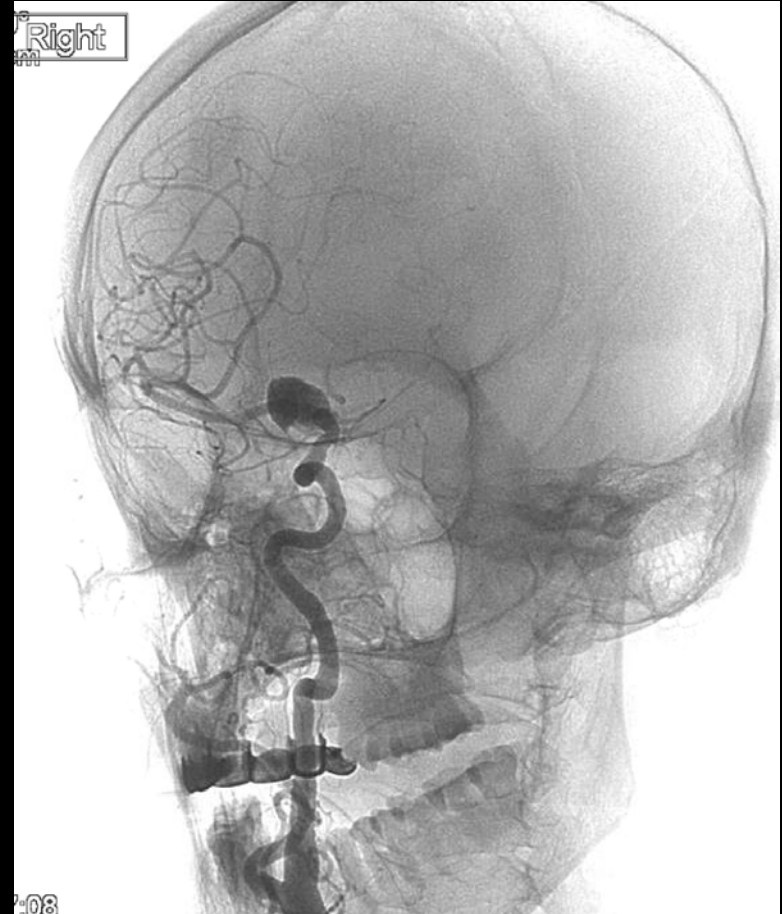
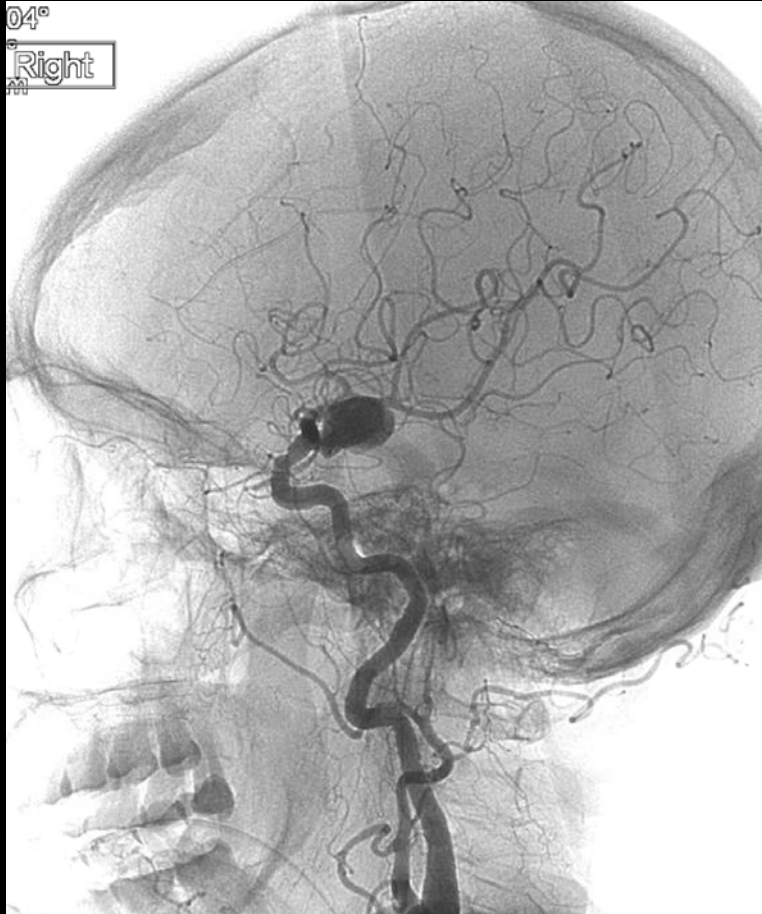


PED + hydrocoils: 60 year old with right eye retro-ocular pain

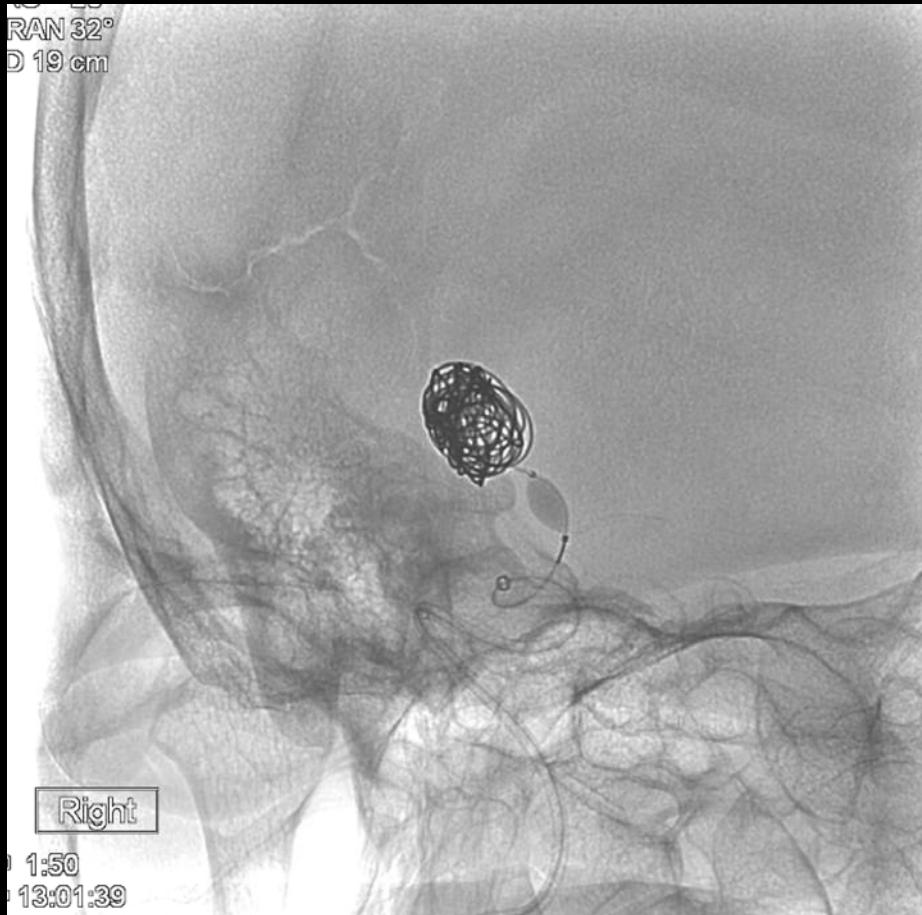


- Giant partly thrombosed ICA communicating aneurysm.
- Decision to partly coil and placed PED.

DSA images from 3D



Placement of coils through Scepter XC



PED placement x 1

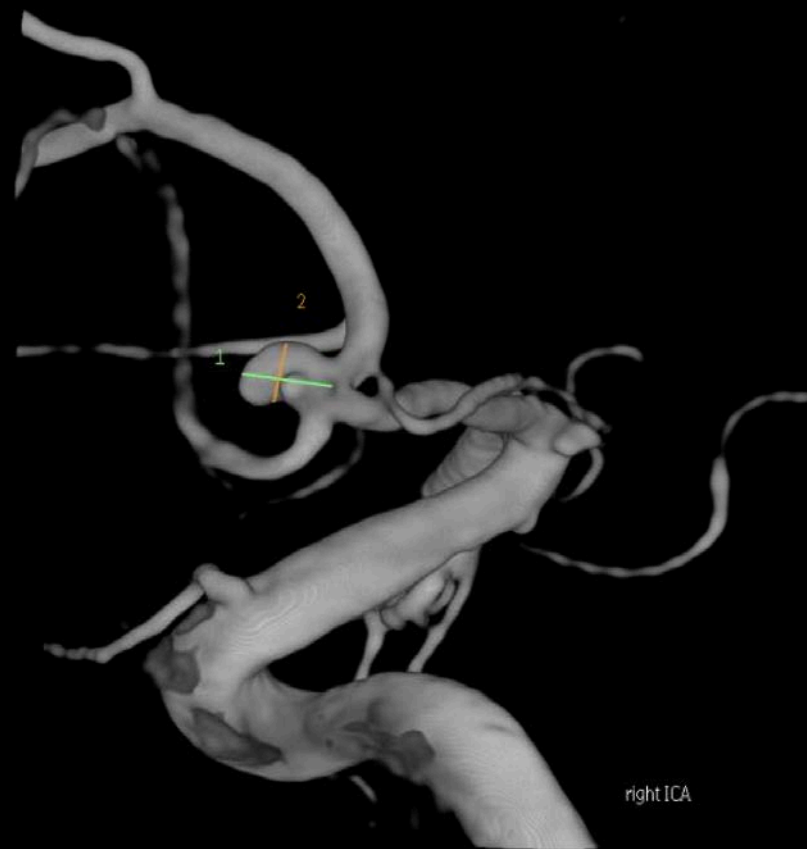


S/P PED x 2 and 18 months



Stent coiling with the LVIS Jr: 50 year old with growing ACOM aneurysm

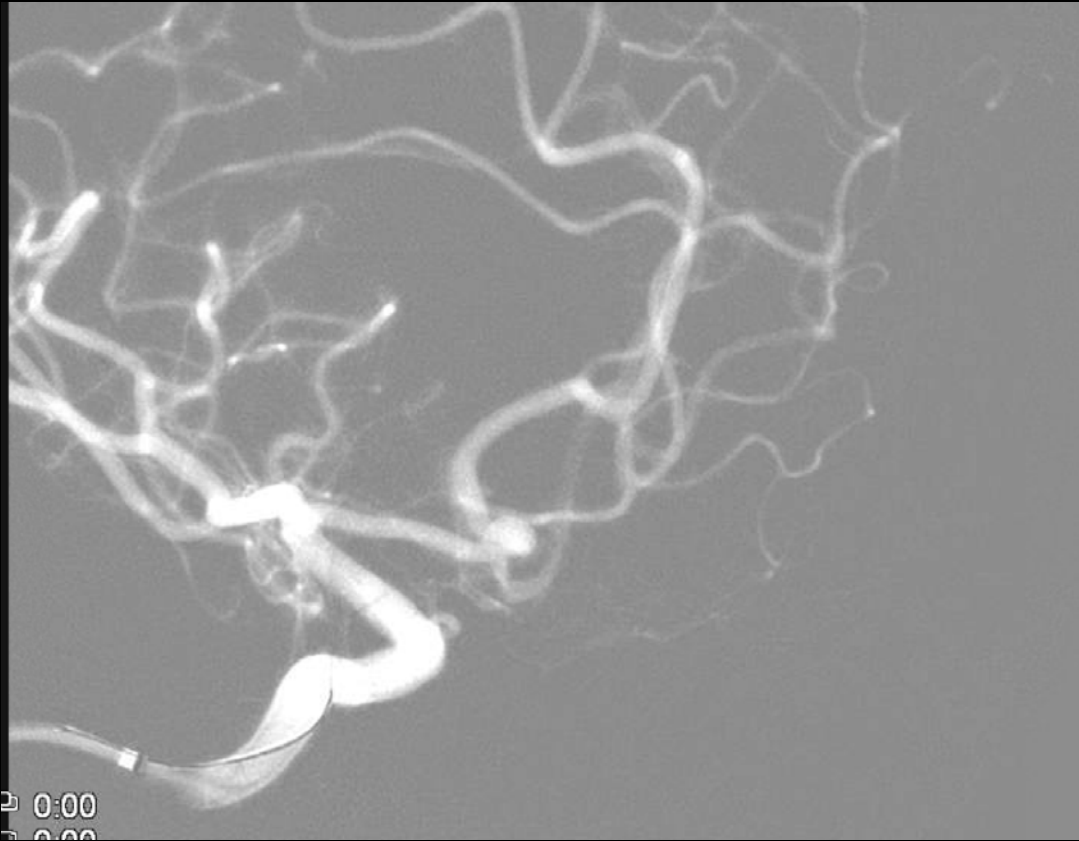
Rot: +144°
Ang: +1°



Initial DSA



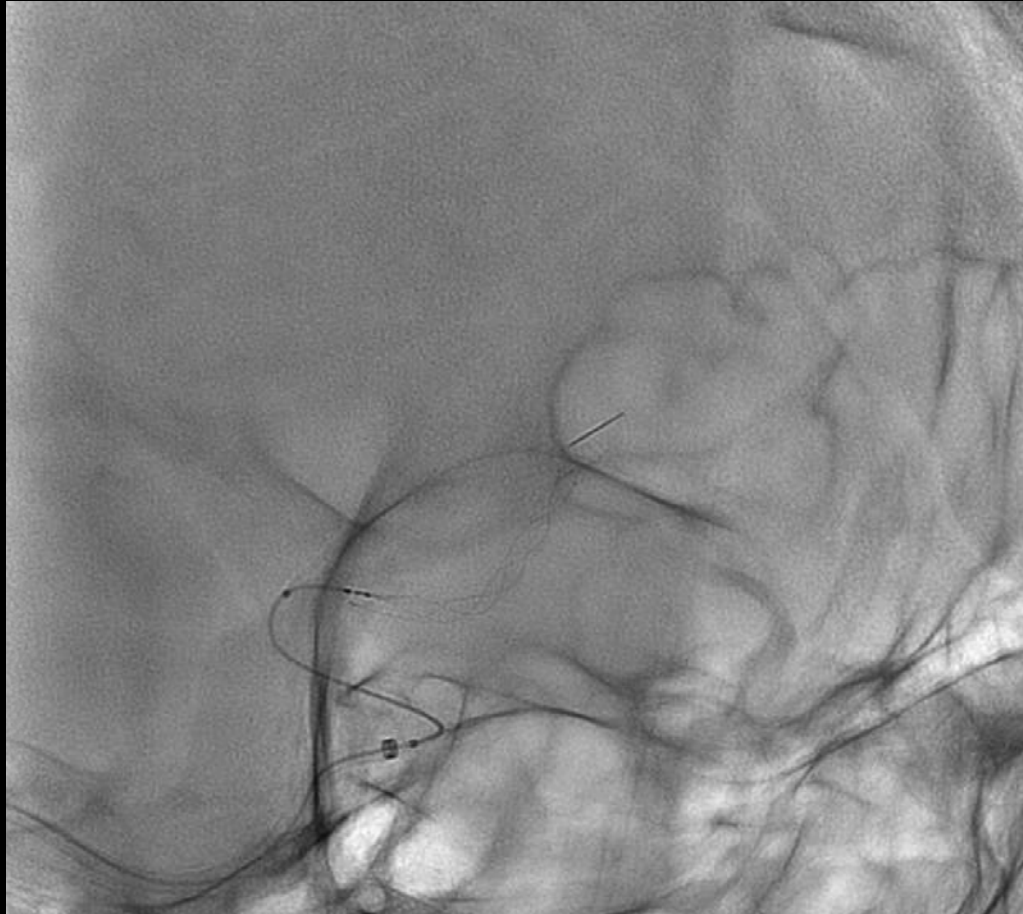
Road Map



Headway Duo 156



2.5 mm LVIS Jr in place



DSA post stent placement



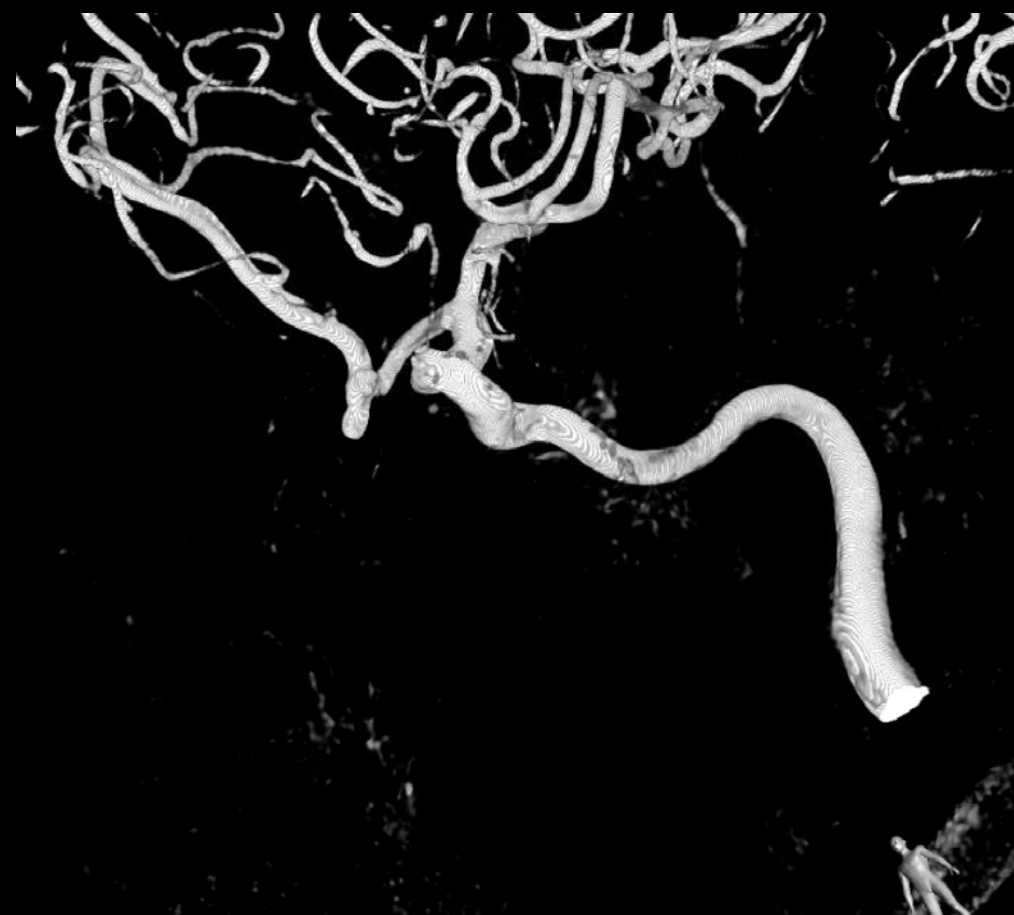
Delayed Coil Embolization



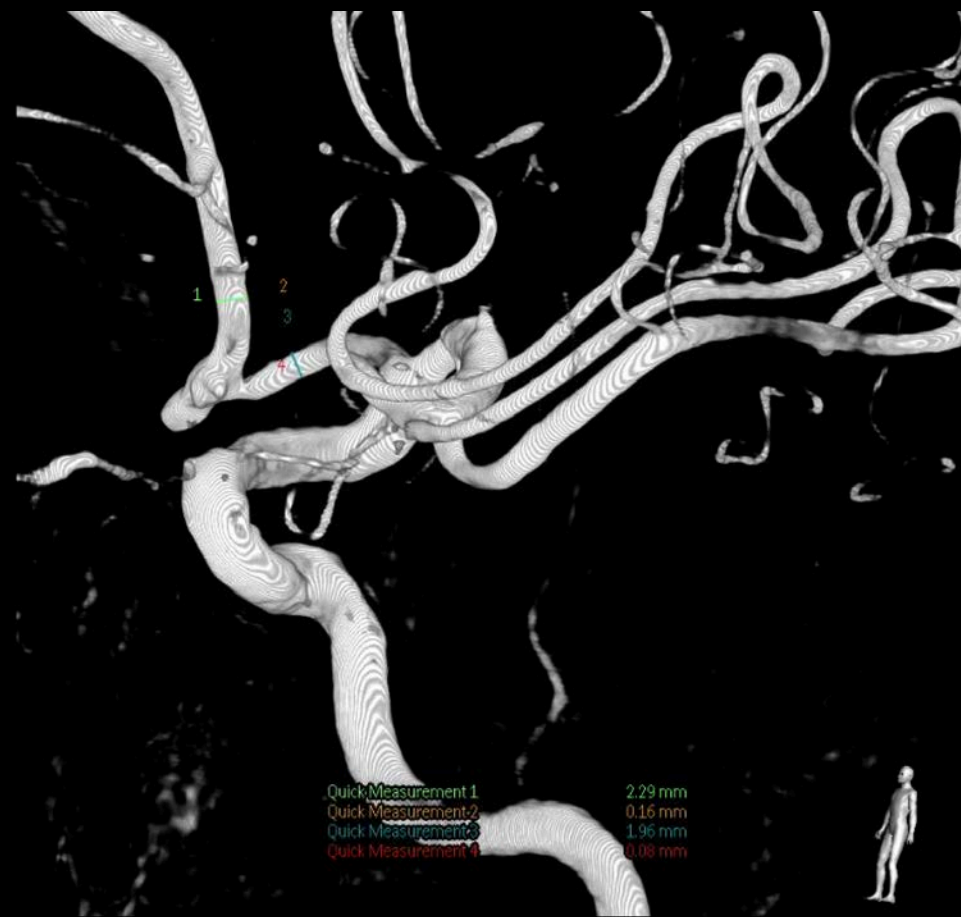
Final result



Stent coiling with LVIS Jr: 58 year old with incidentally discovered 7 mm ACOM aneurysm



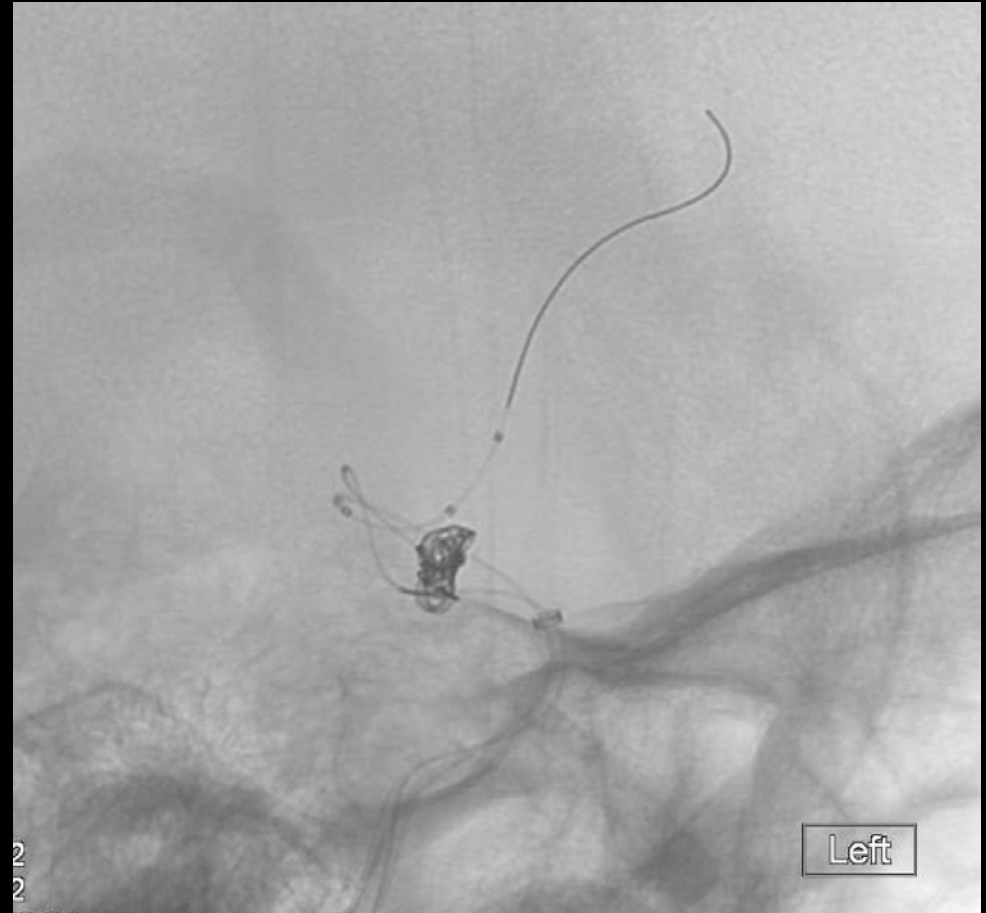
58 year old with incidentally discovered 7 mm ACOM aneurysm



DSA with 4 x 11 mm Scepter XC and Headway 17 in place



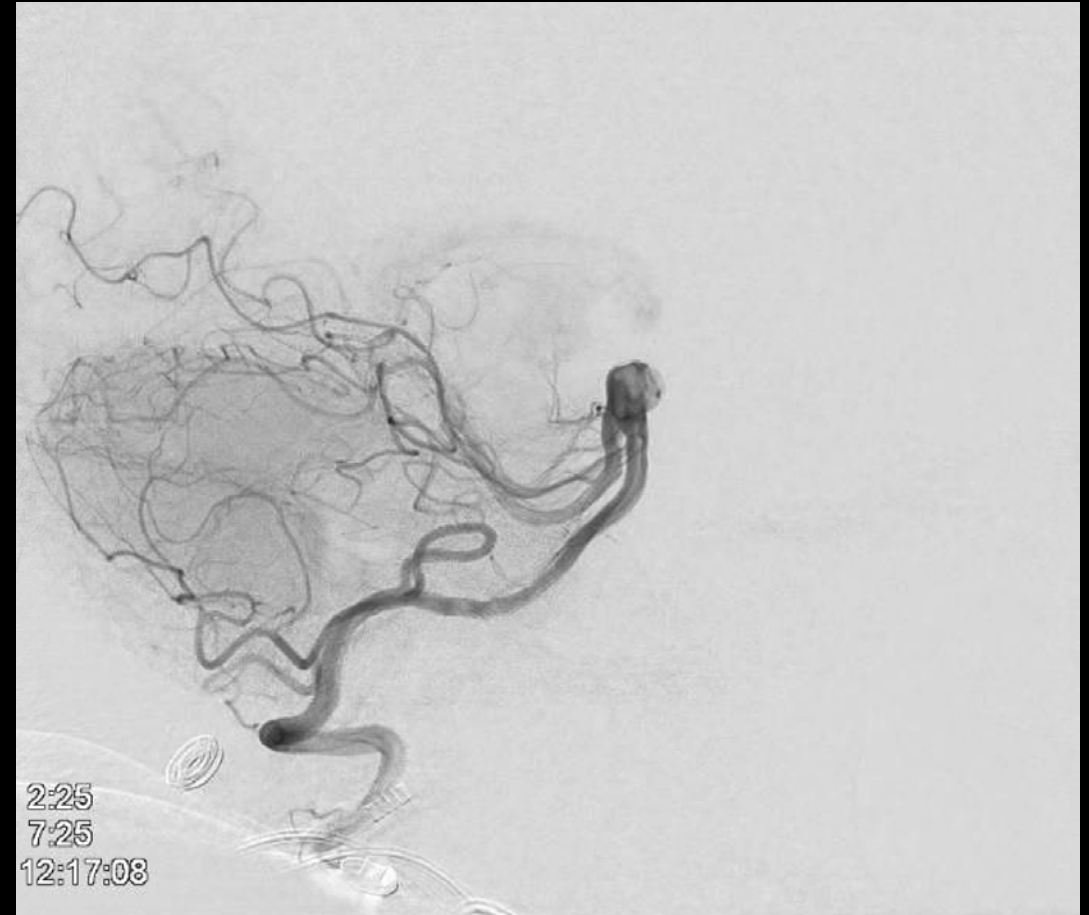
Balloon Assisted coiling



LVIS Jr placed through Scepter XC



Stent coiling with LVIS Jr: 56 year old with complex top of basilar SCA aneurysm



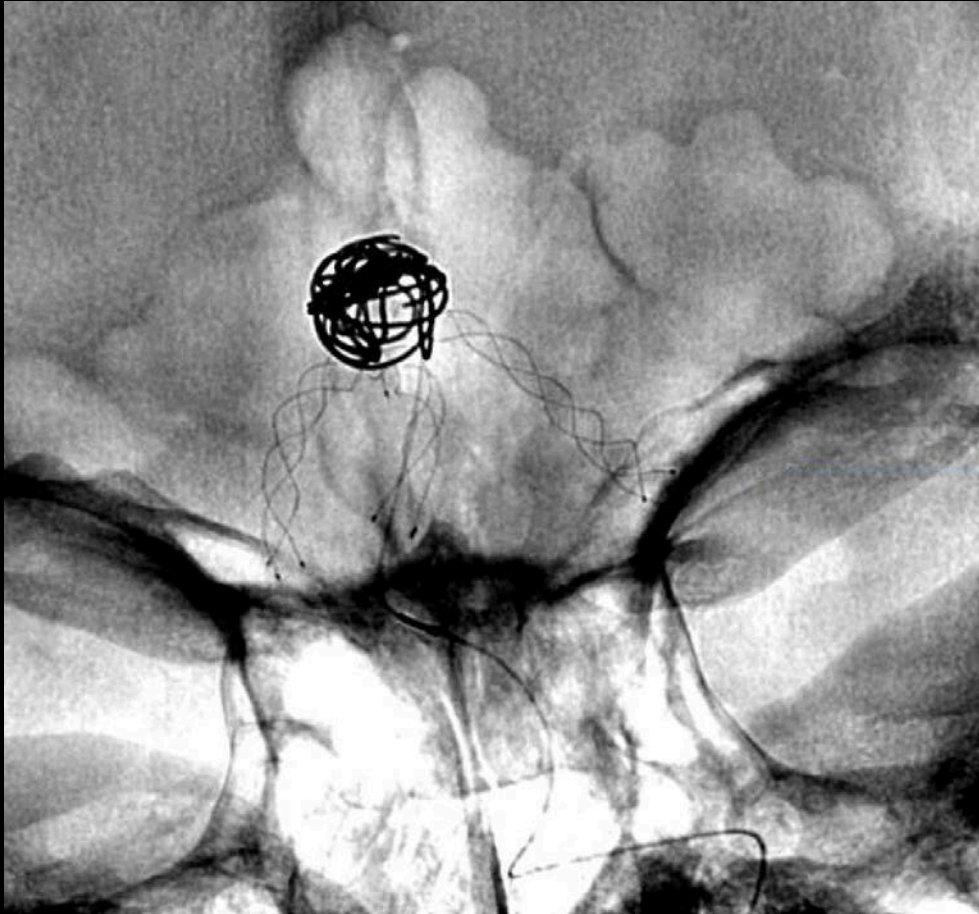
Placement of LVIS Jr in LEFT PCA



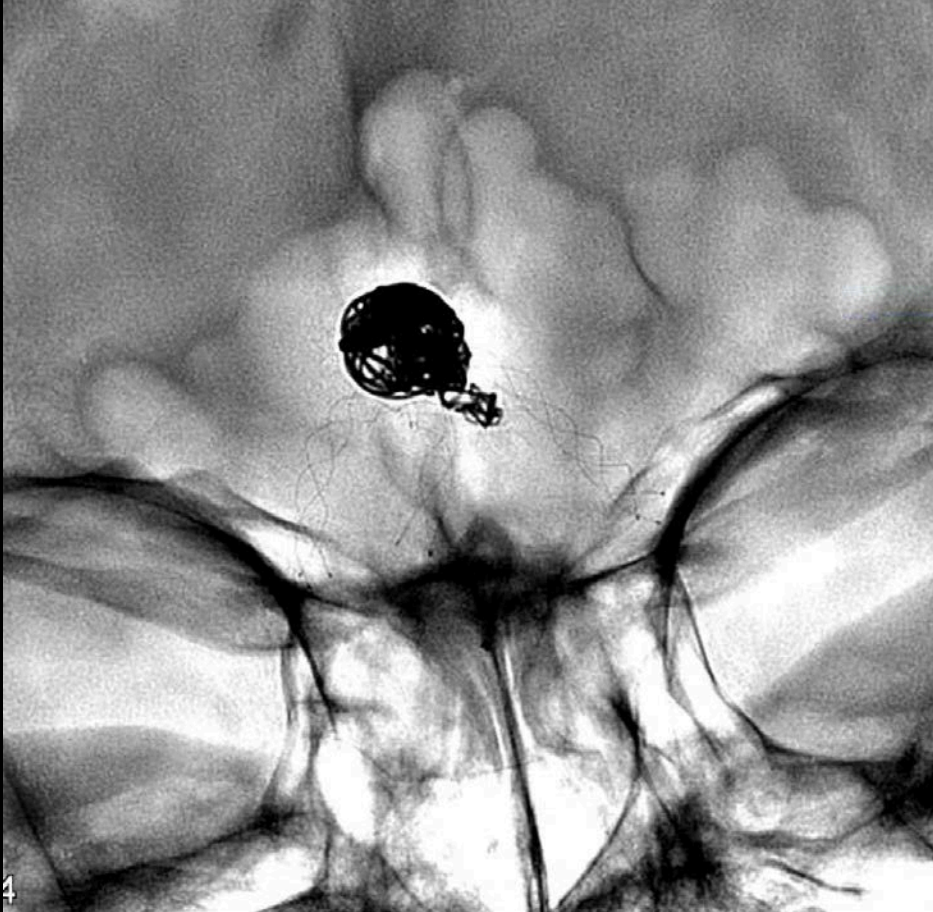
DSA S/P stent placement in left PCA



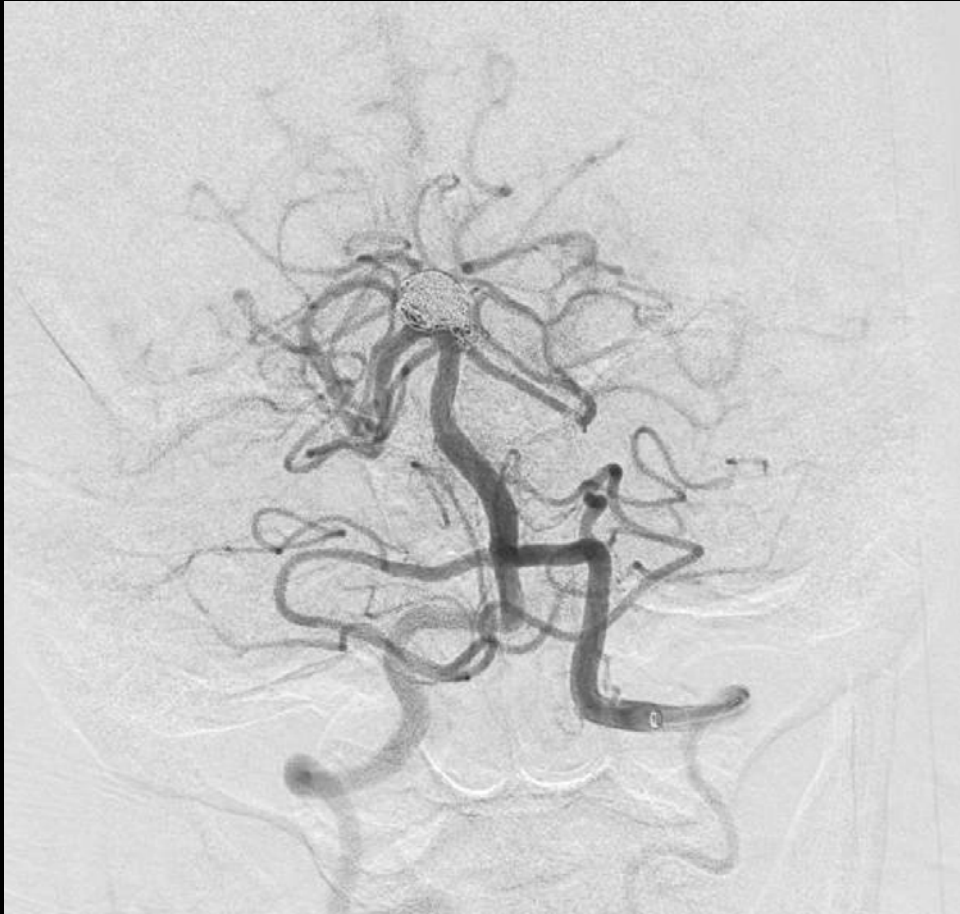
Y Stenting with second stent in Right PCA followed by coiling



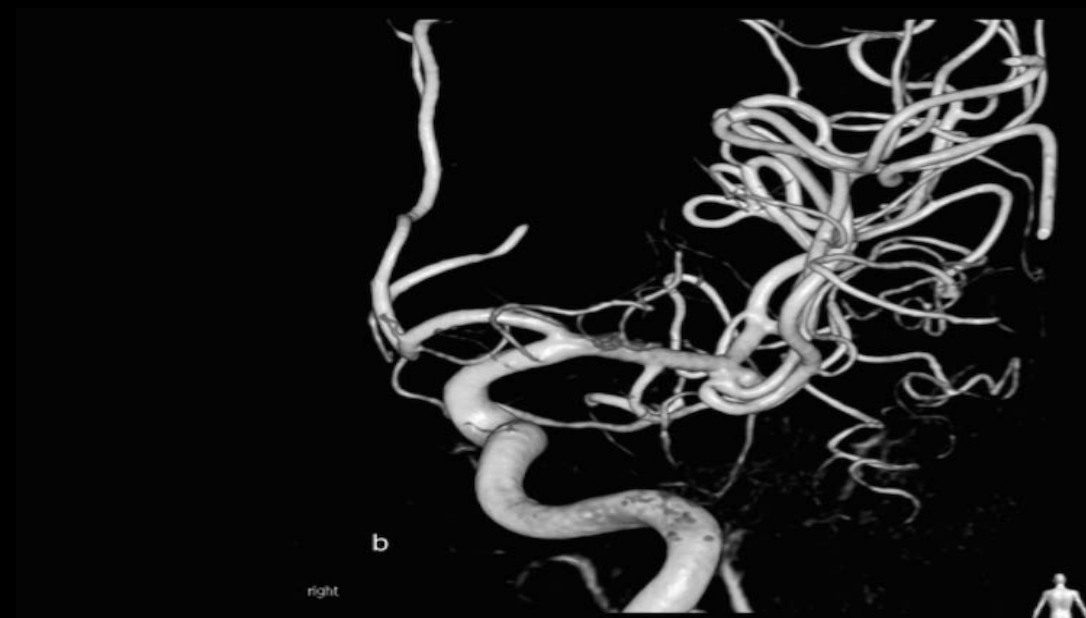
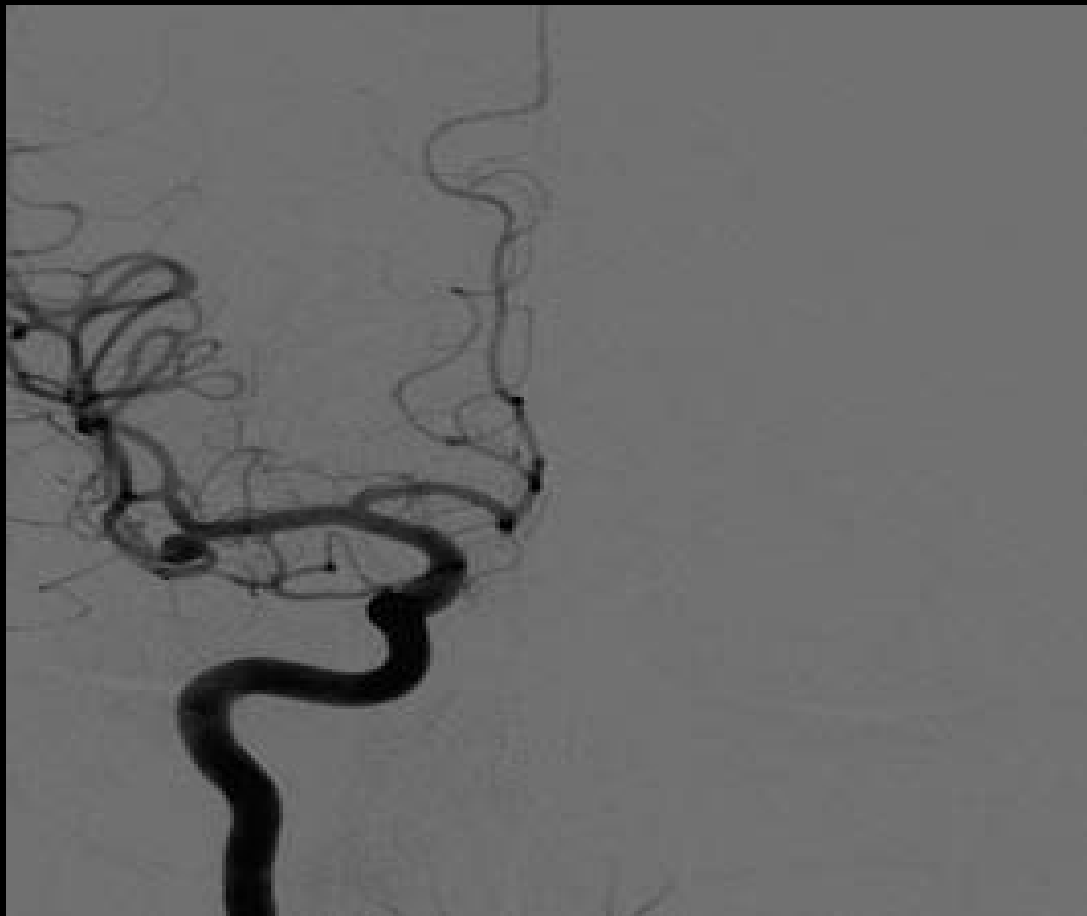
Y Stenting with second stent in Right PCA followed by coiling



Final DSA result



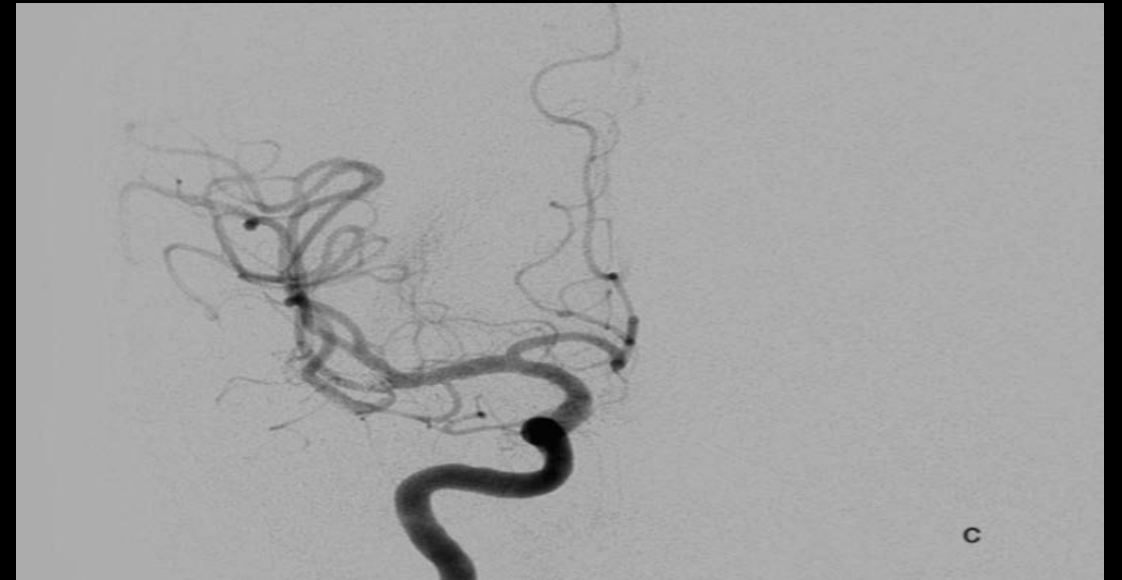
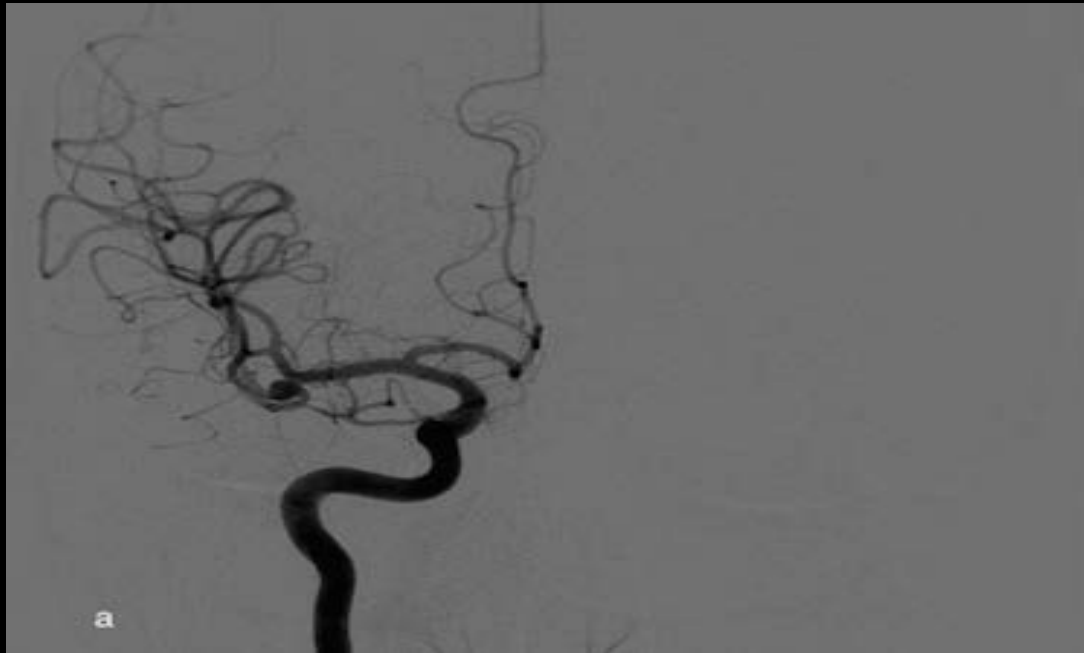
LVIS Jr: Y stent : 35 year old with HIV



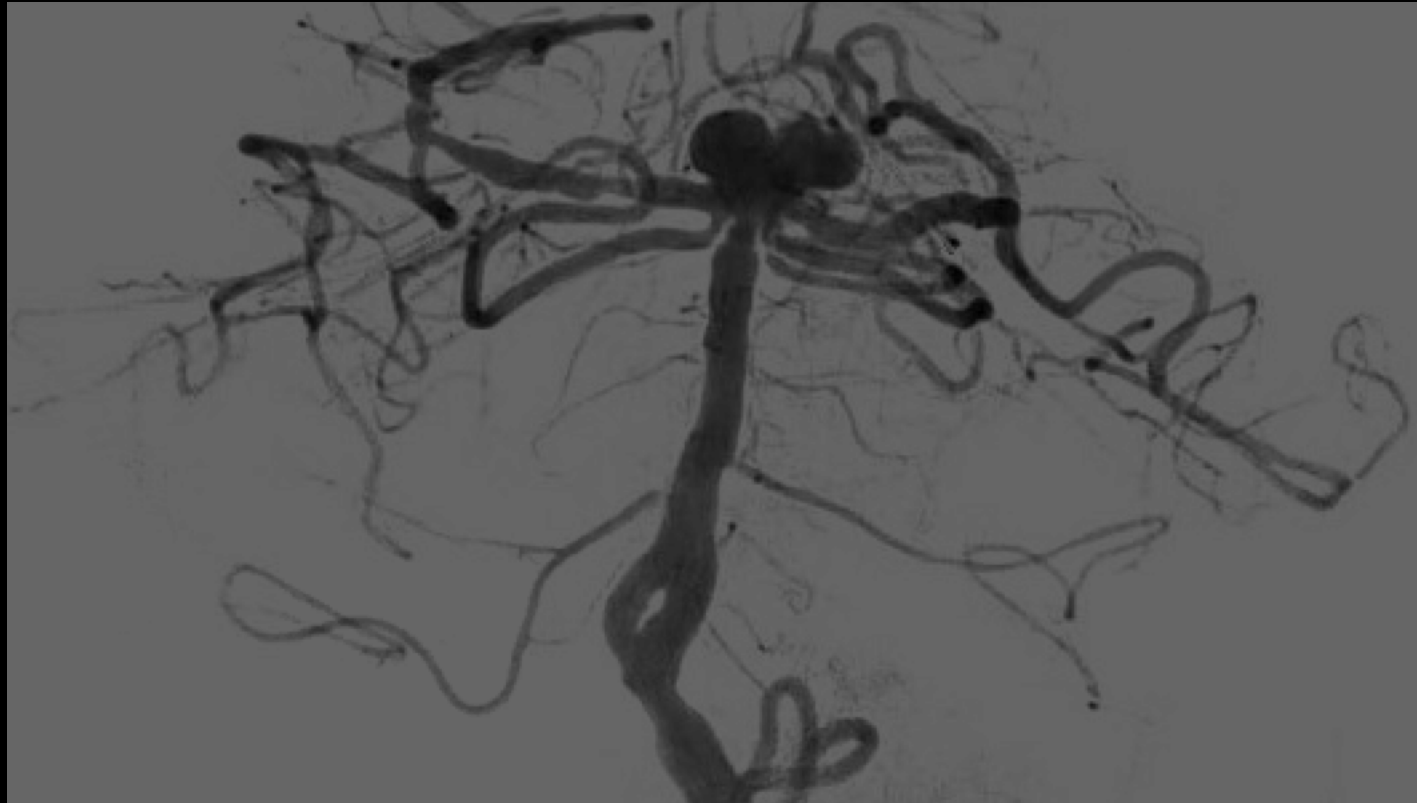
Stent coiling through the LVIS Jr

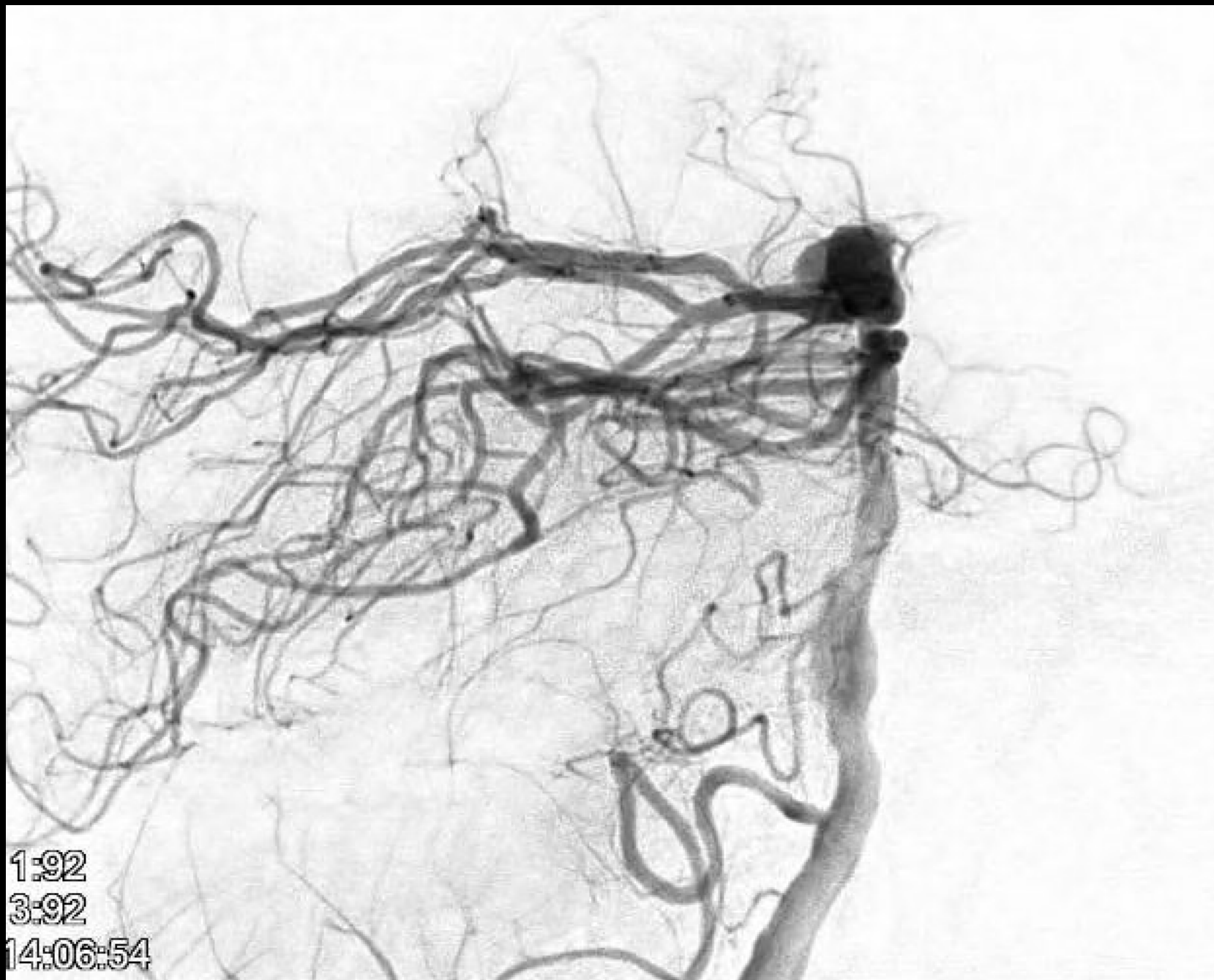


Pre and post



WEB + Coils: 63 year old with ruptured top of basilar aneurysm



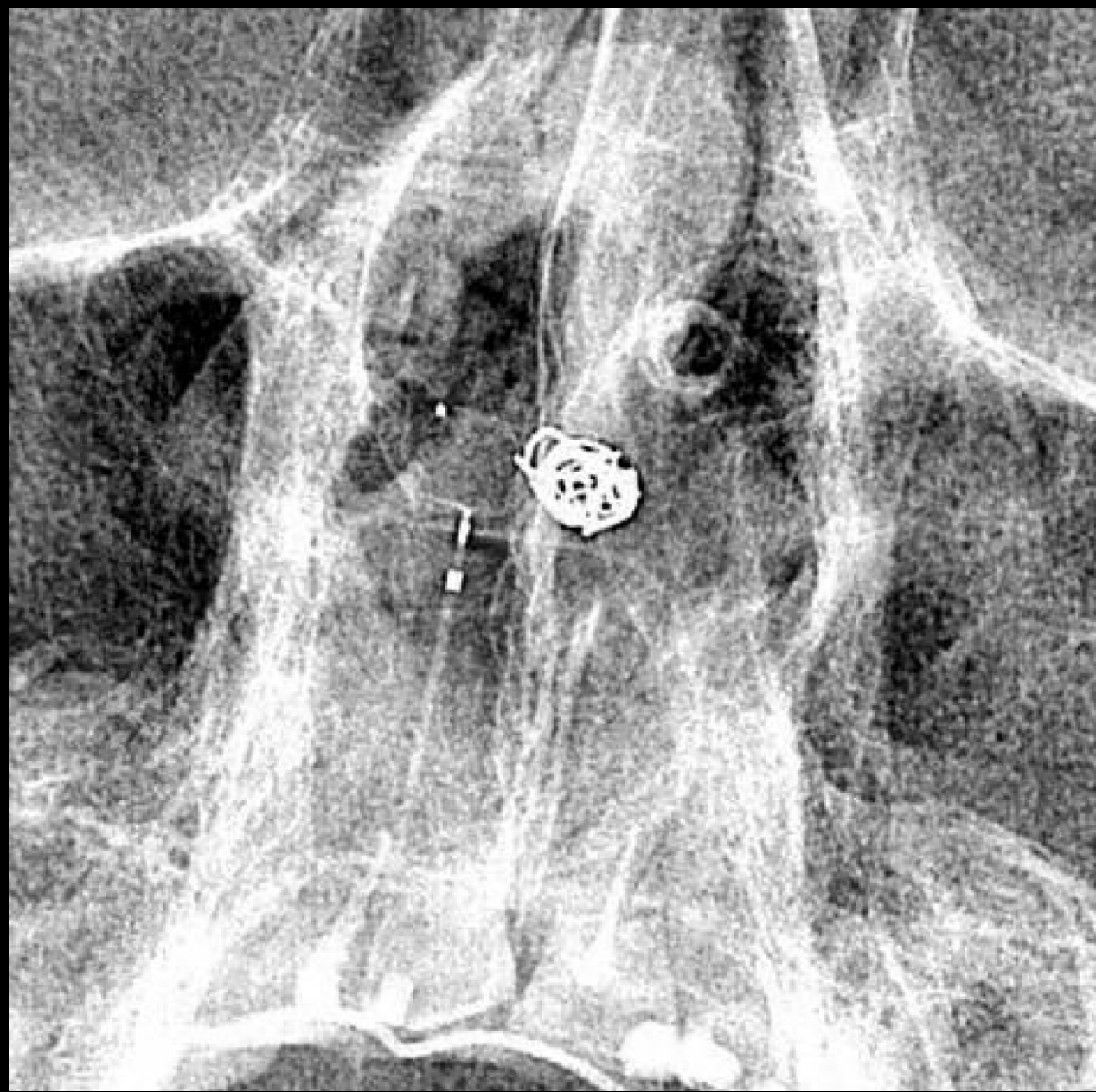


1:92

3:92

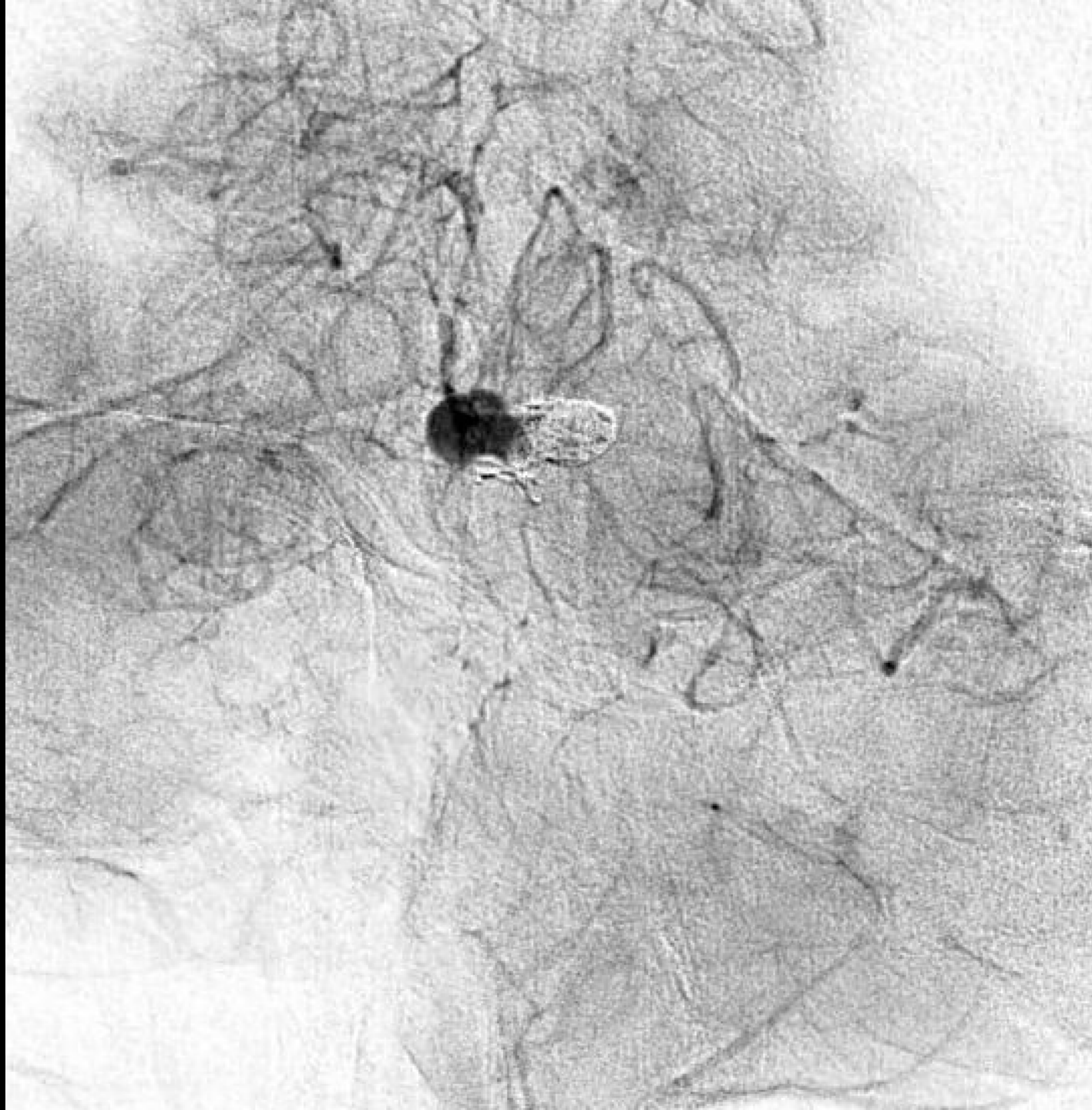
14:06:54

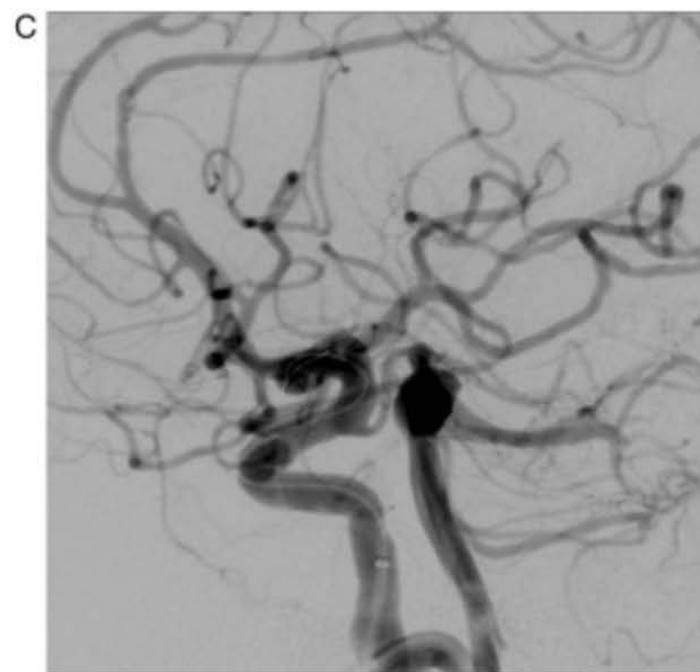
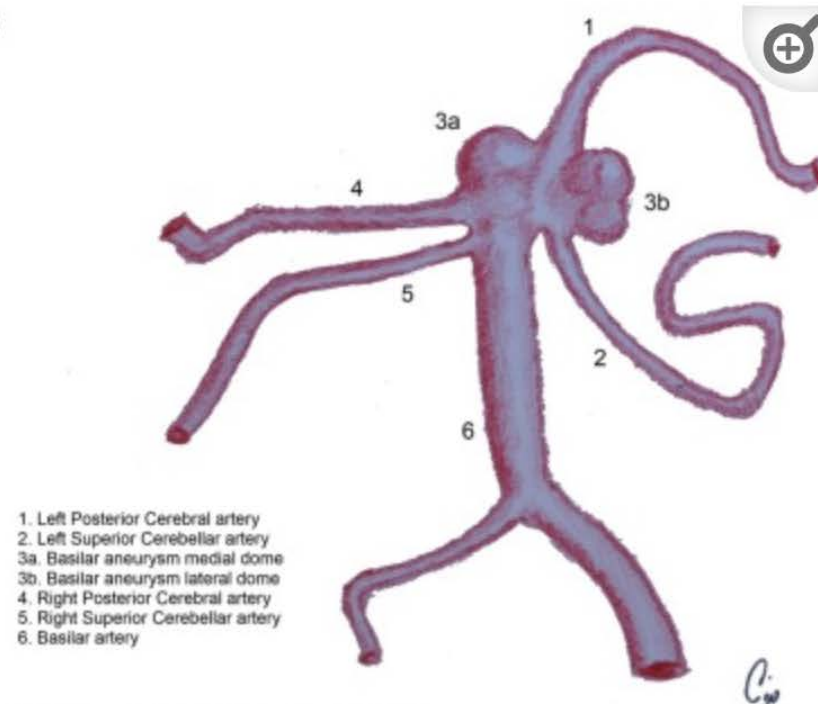




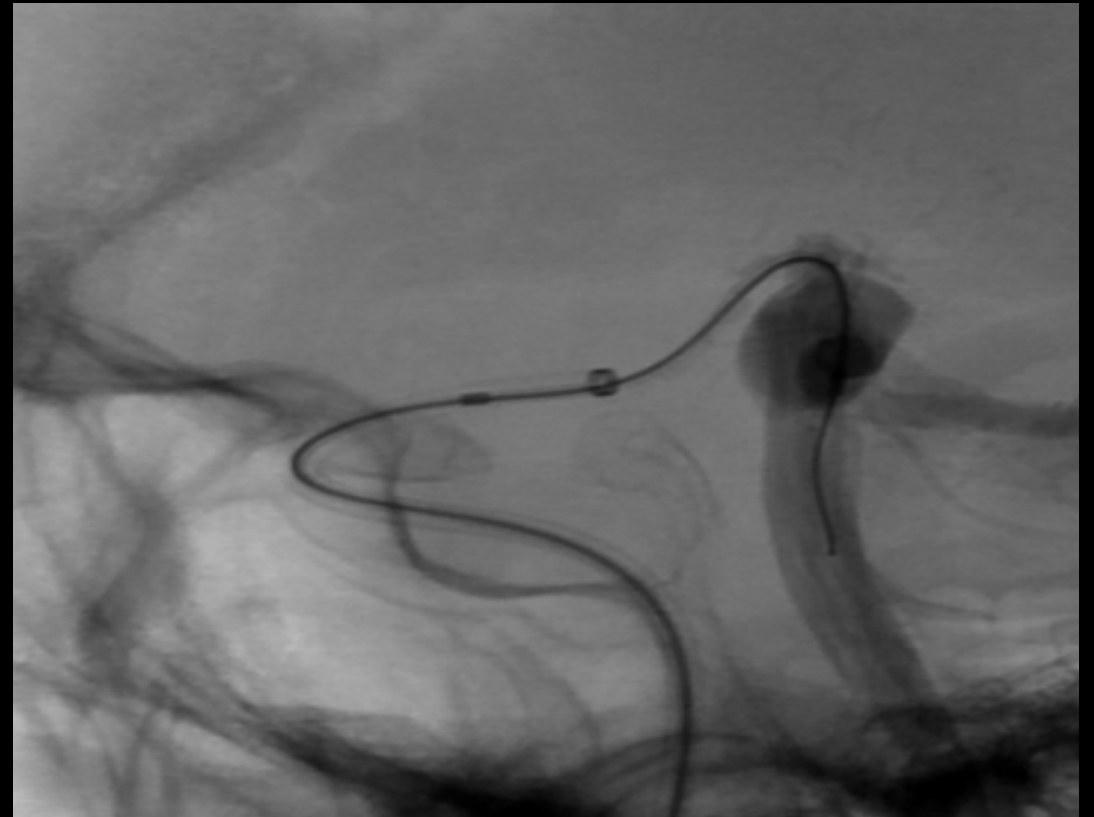
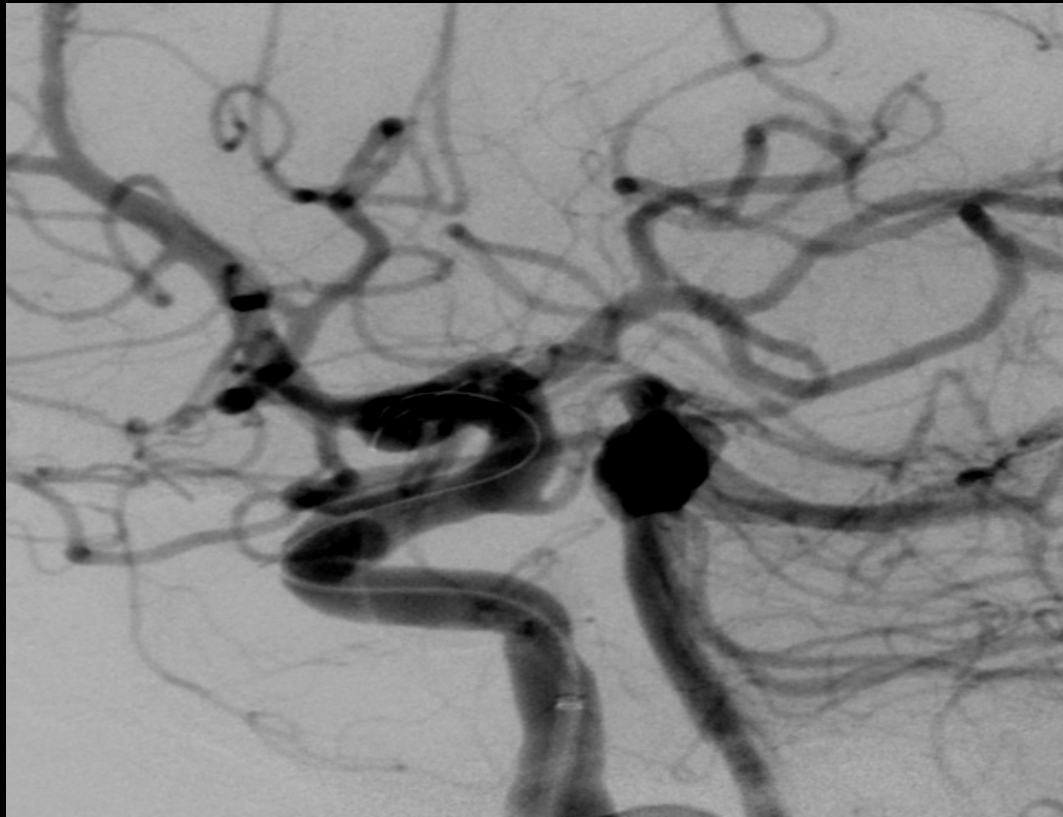




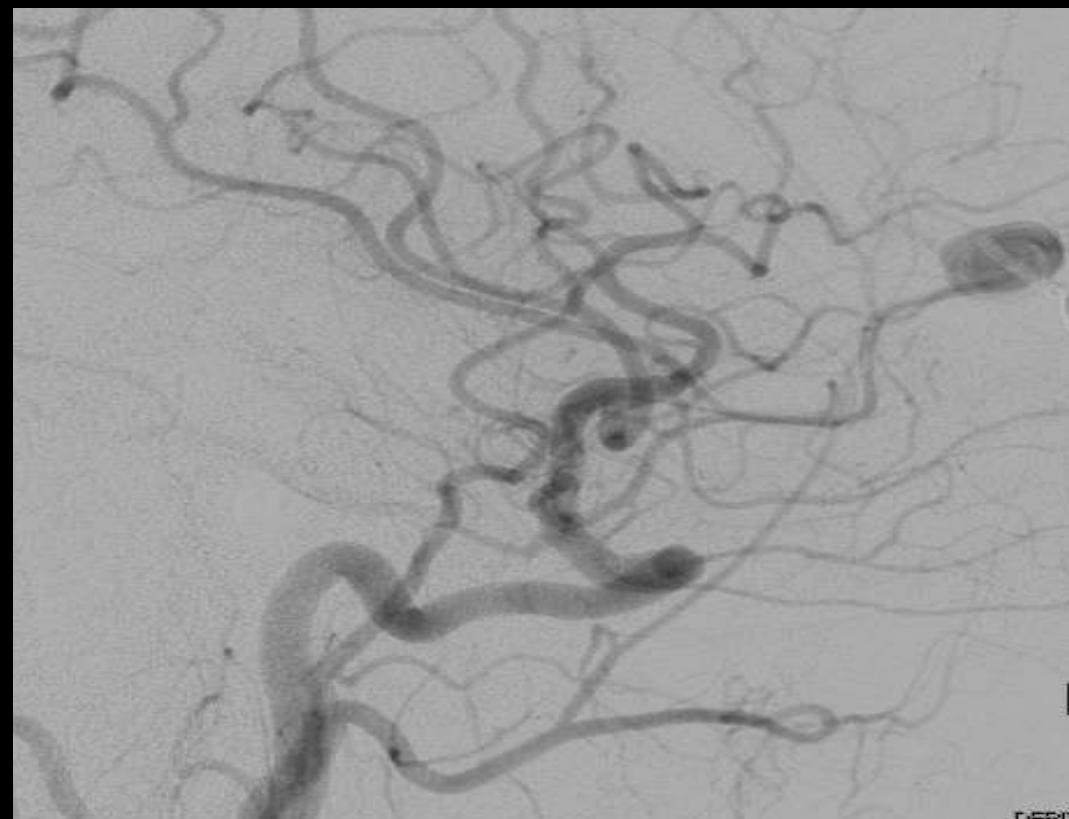


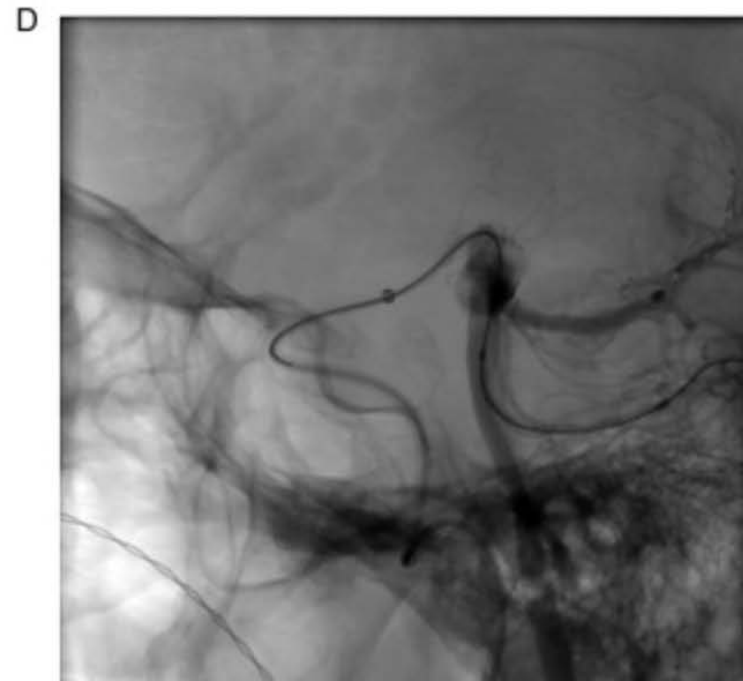
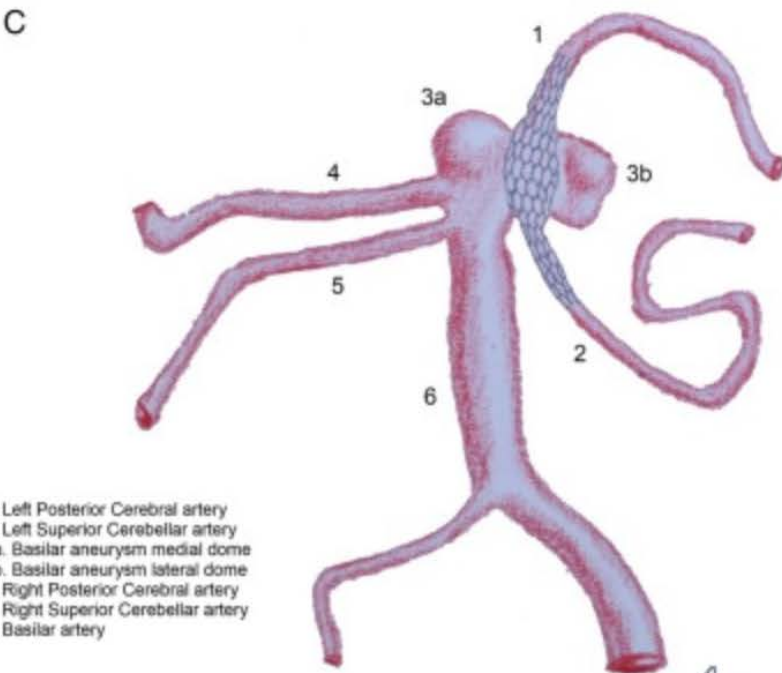
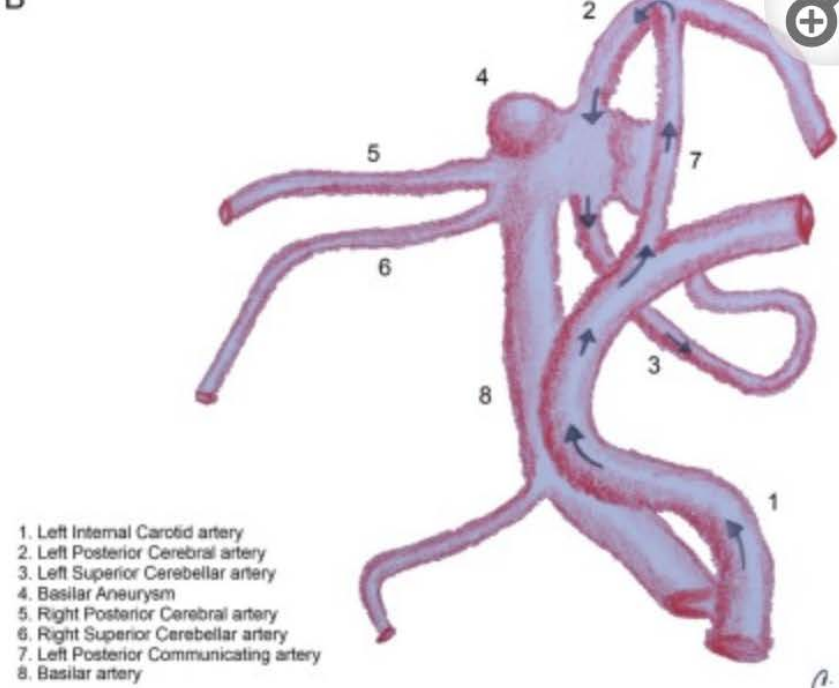


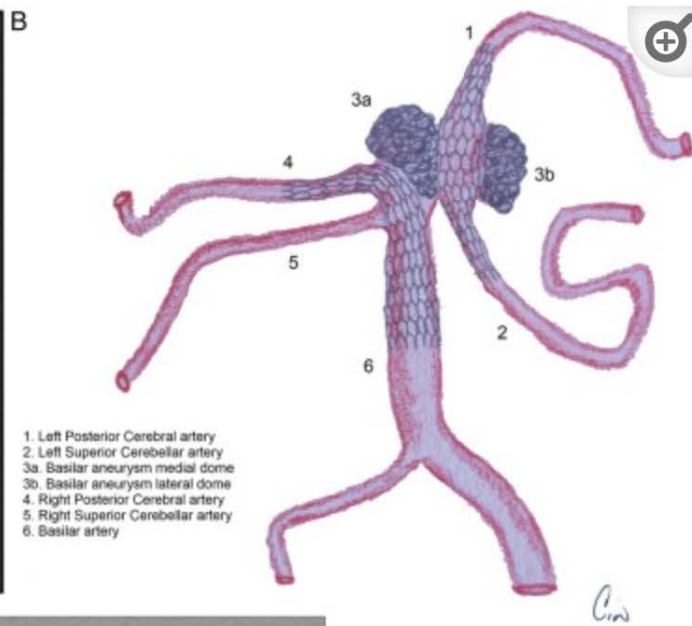
Sofia in PCOM origin from ICA



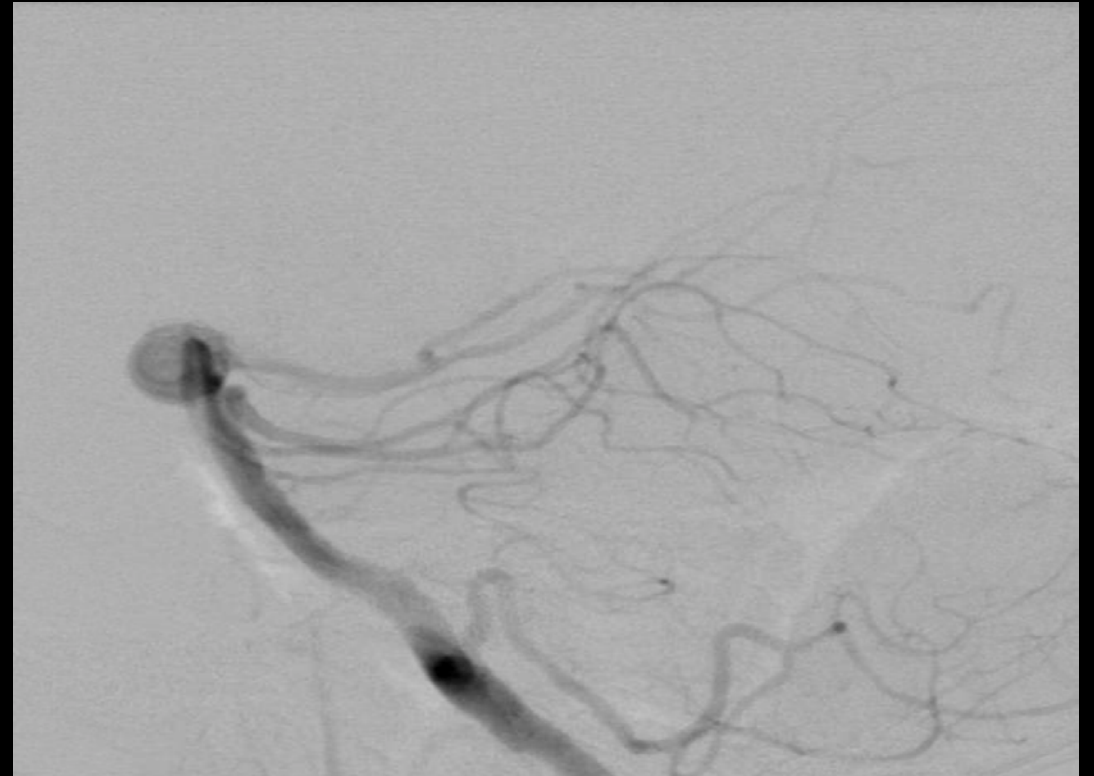
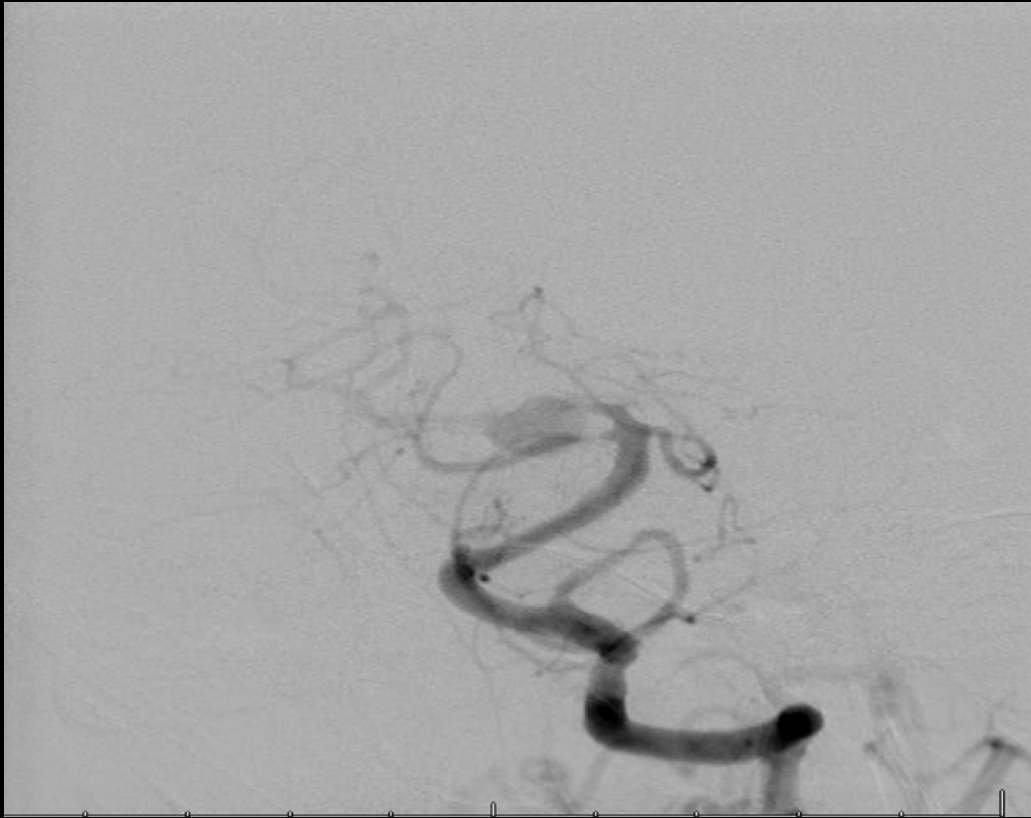
43 year old with recurrence of previously clipped aneurysm







Fusiform Aneurysms : 75 y/o with Right P1 aneurysm



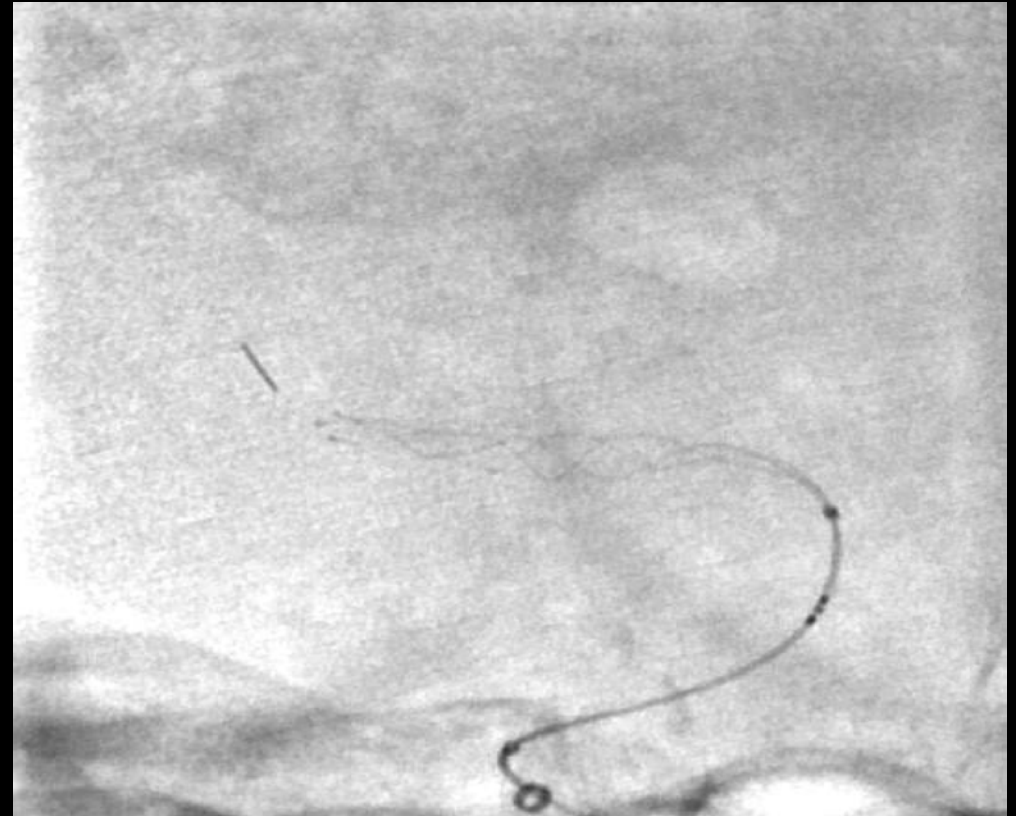
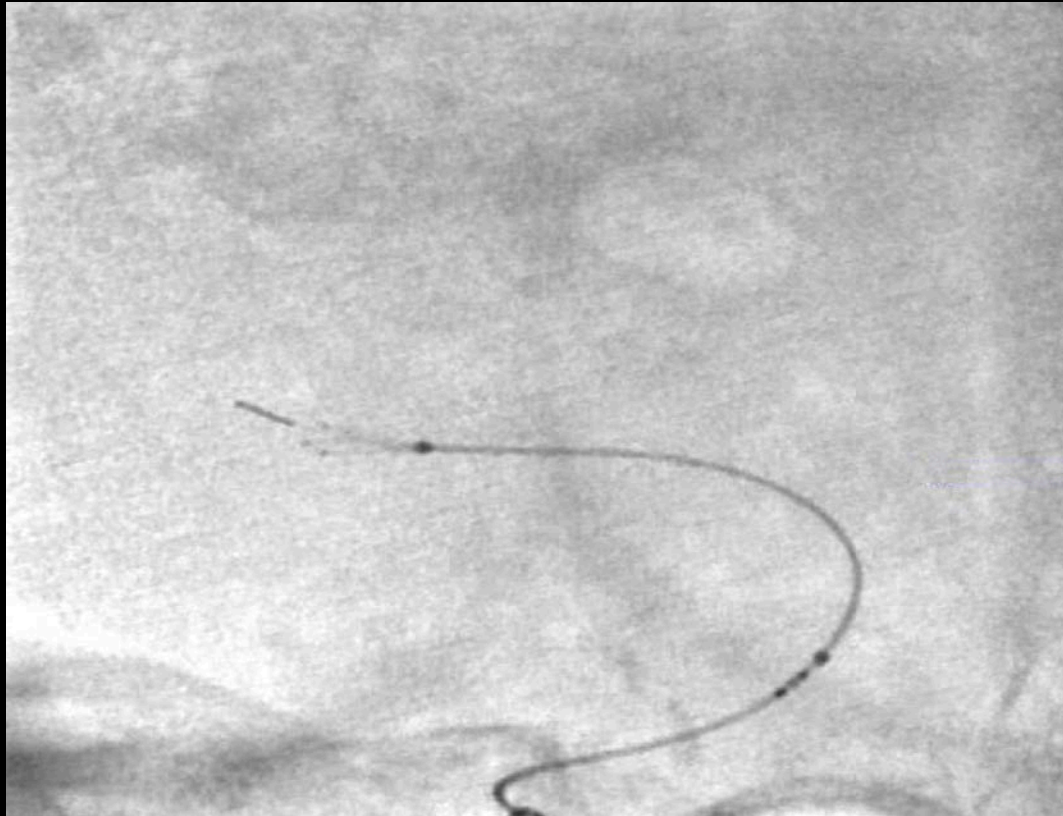
Left vertebral artery



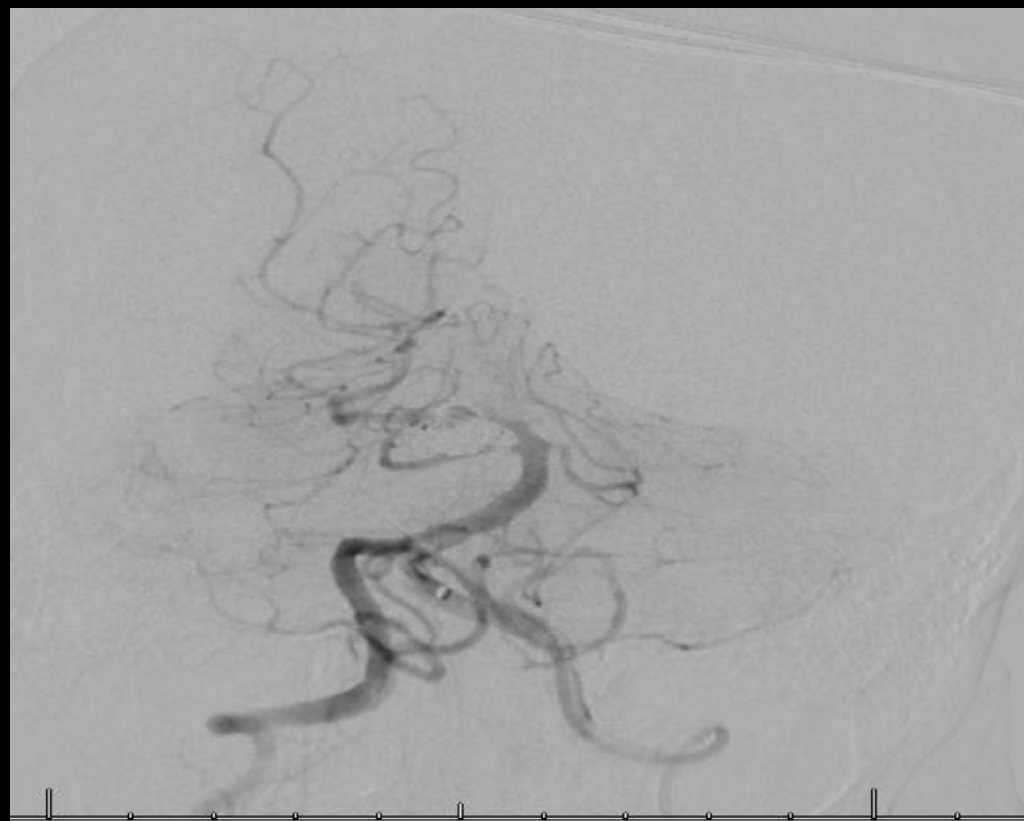
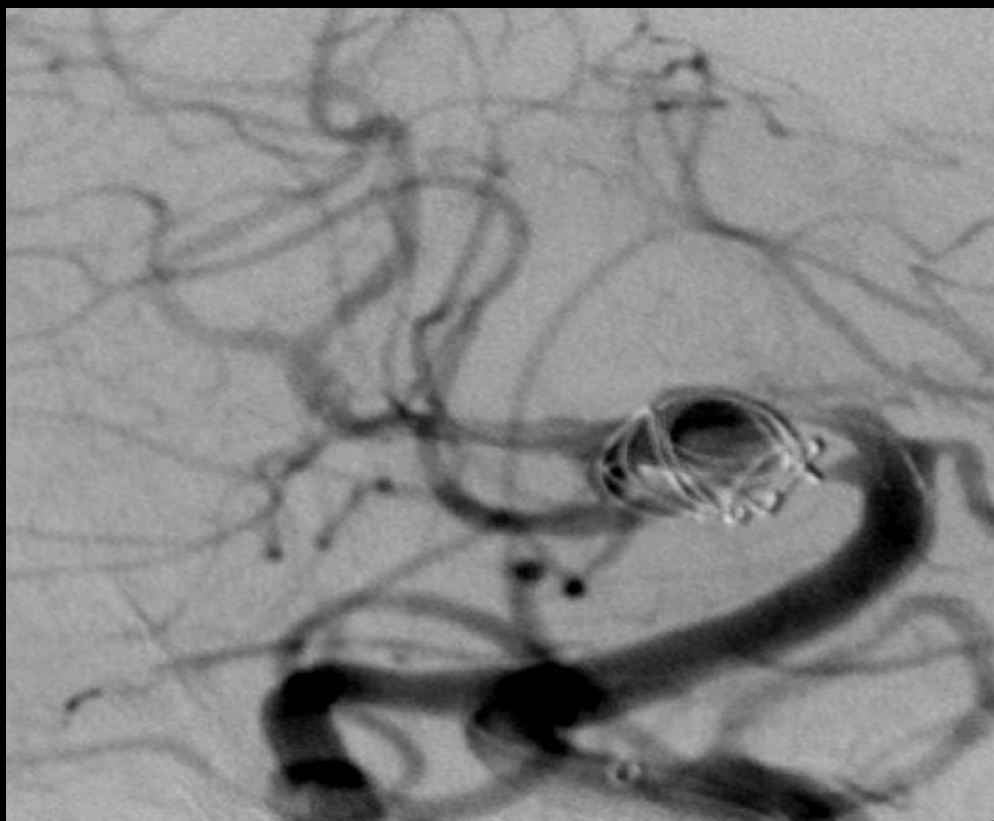
5 F Sofia



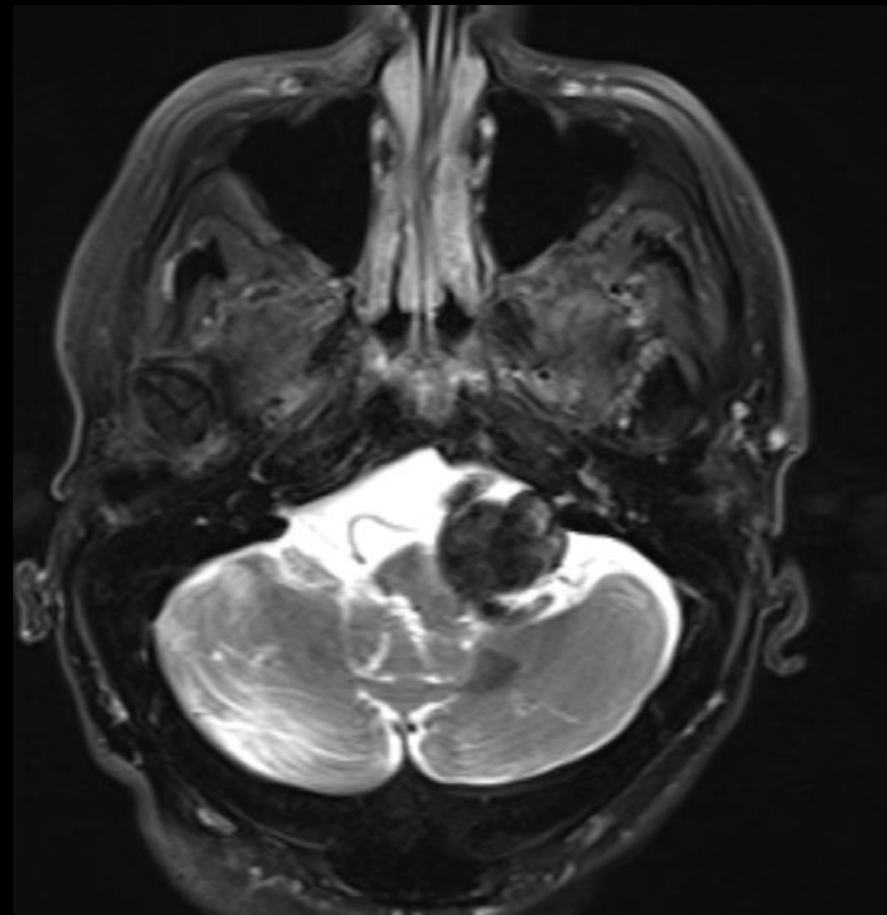
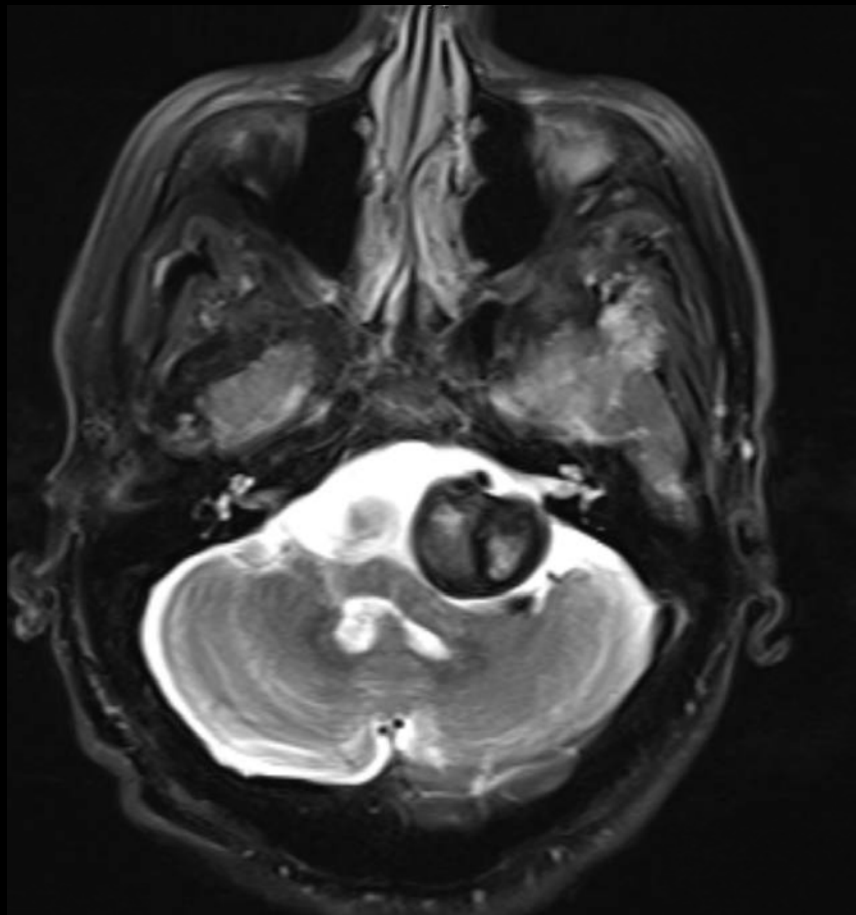
LVIS Jr



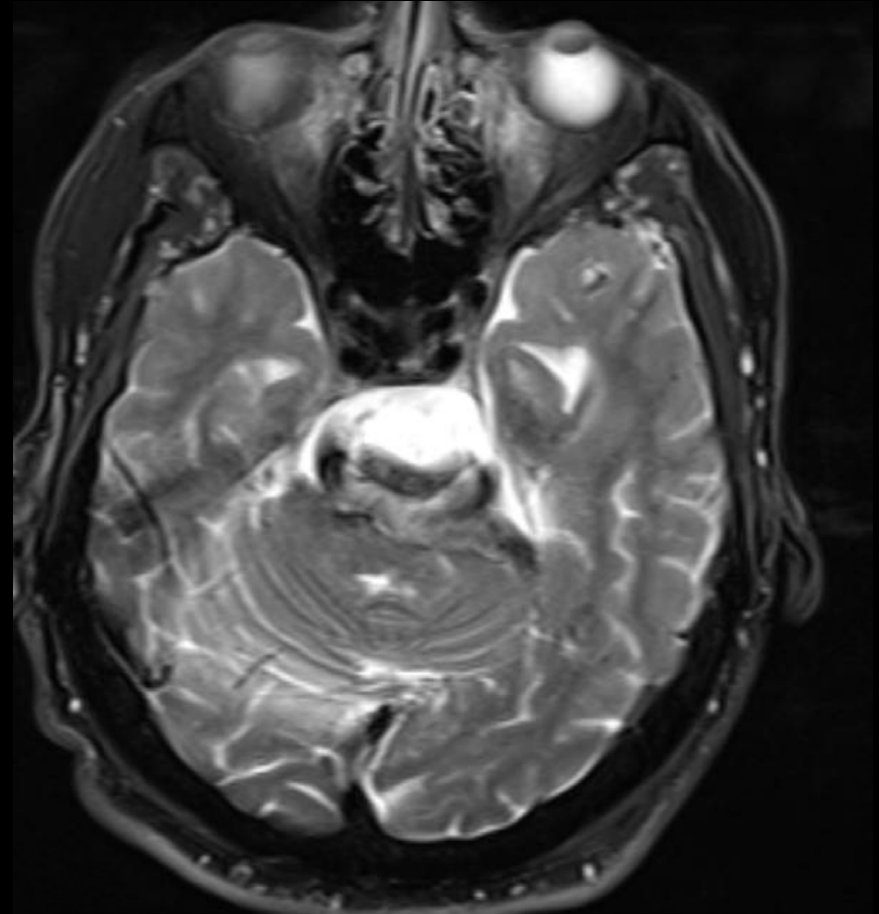
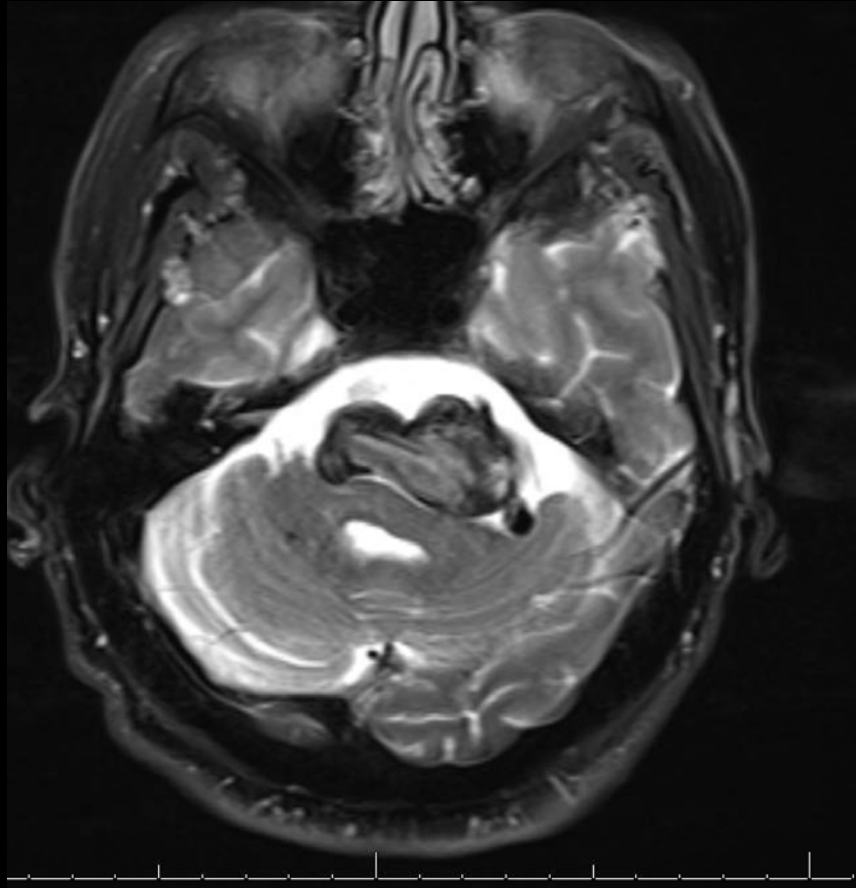
Stent assisted coil embolization



Stent coil with LVIS Blue: 63 year old with ataxia and dysphagia



Giant partially thrombosed VBJ aneurysm



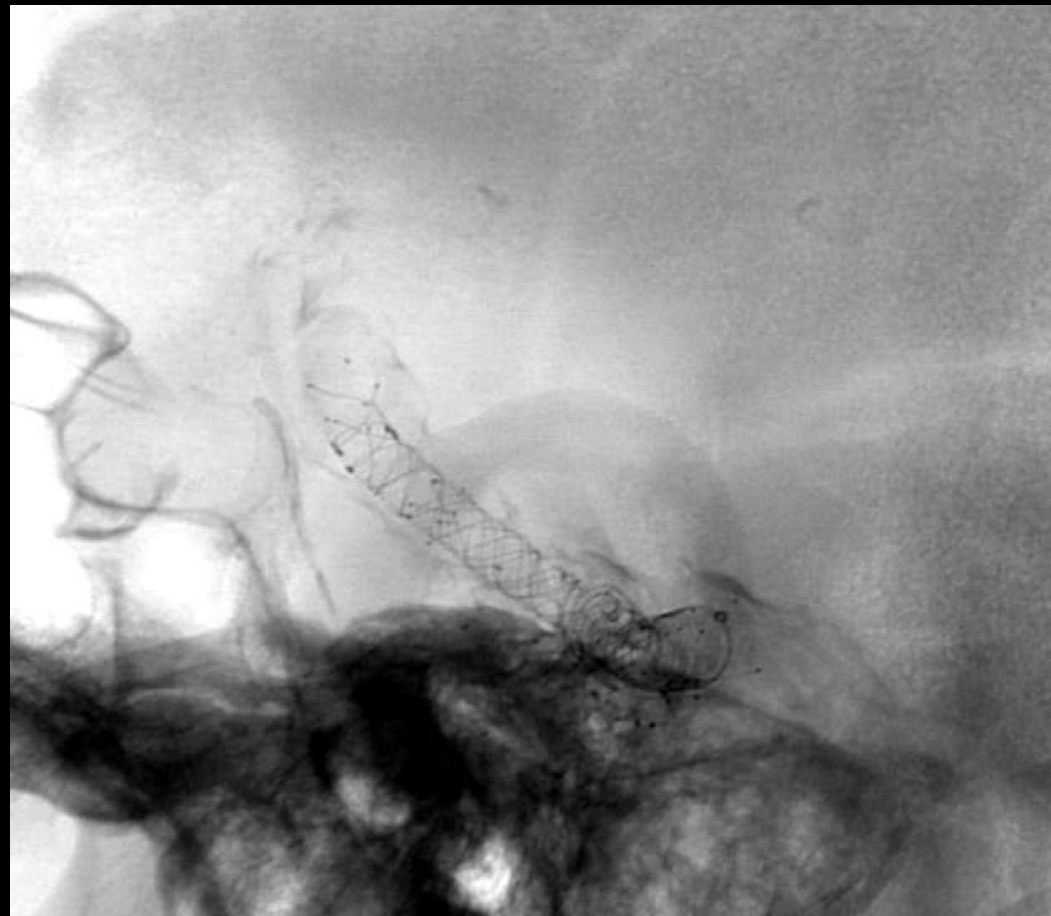
DSA with bilateral vertebral artery injection



Six overlapping 5.5 x 33 mm LVIS Blue Stents



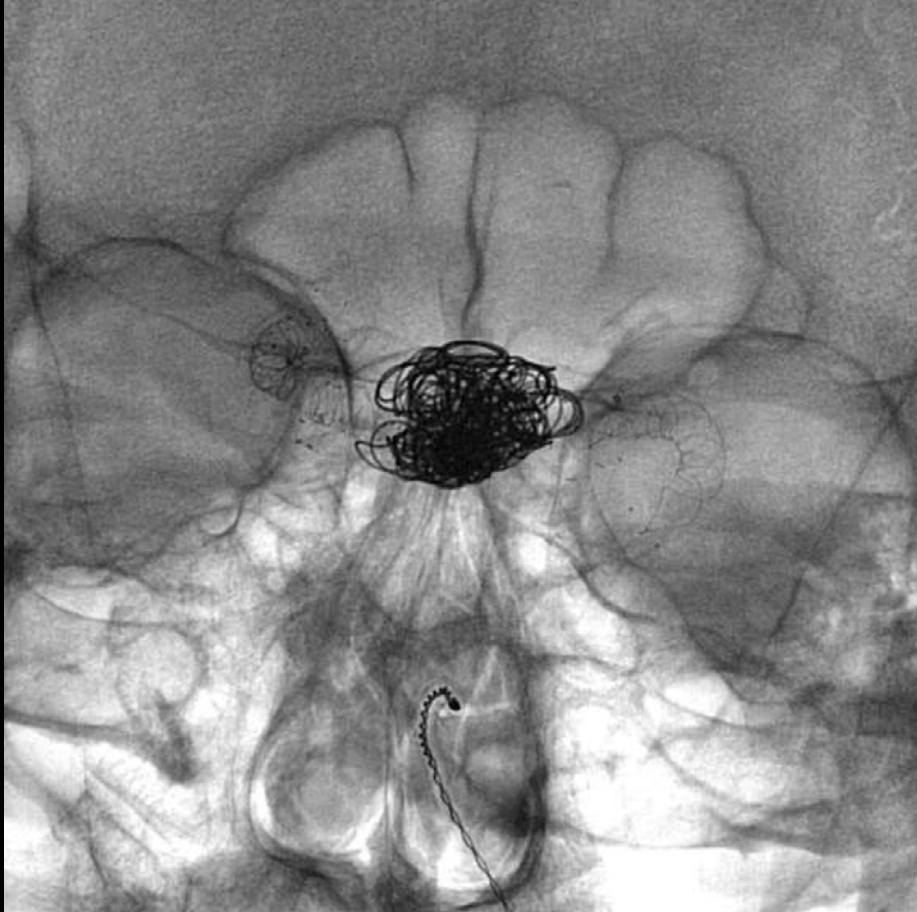
Six overlapping 5.5 x 33 mm LVIS Blue Stents



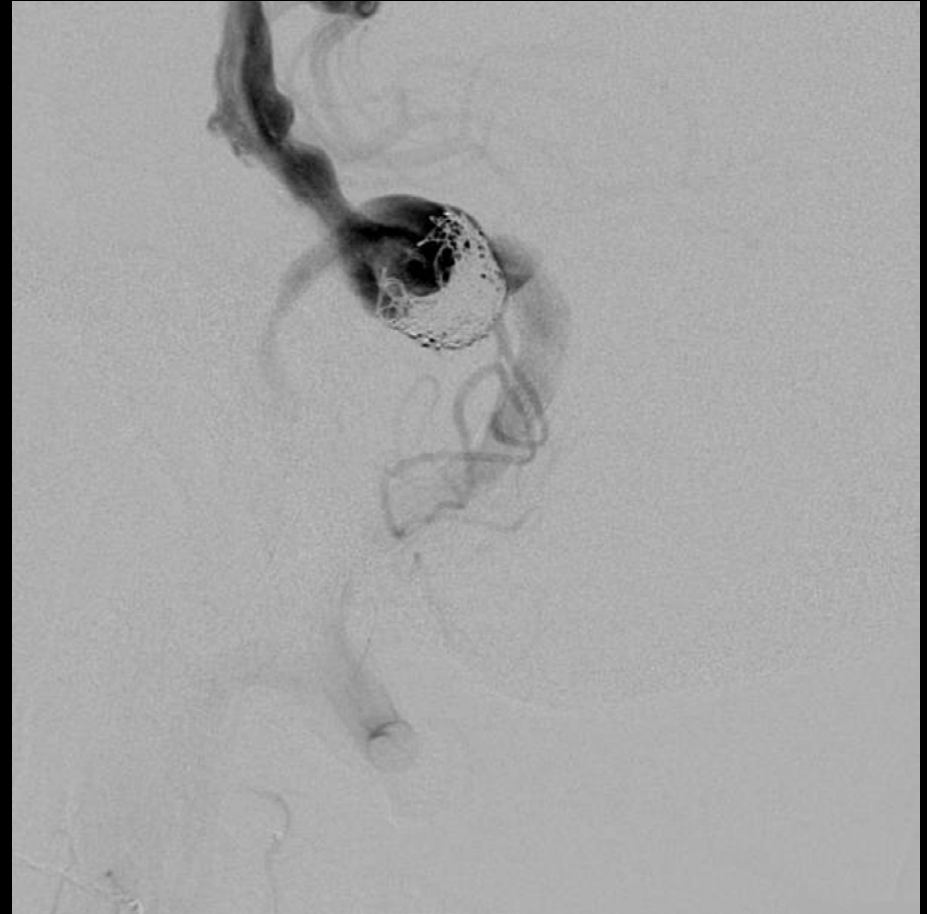
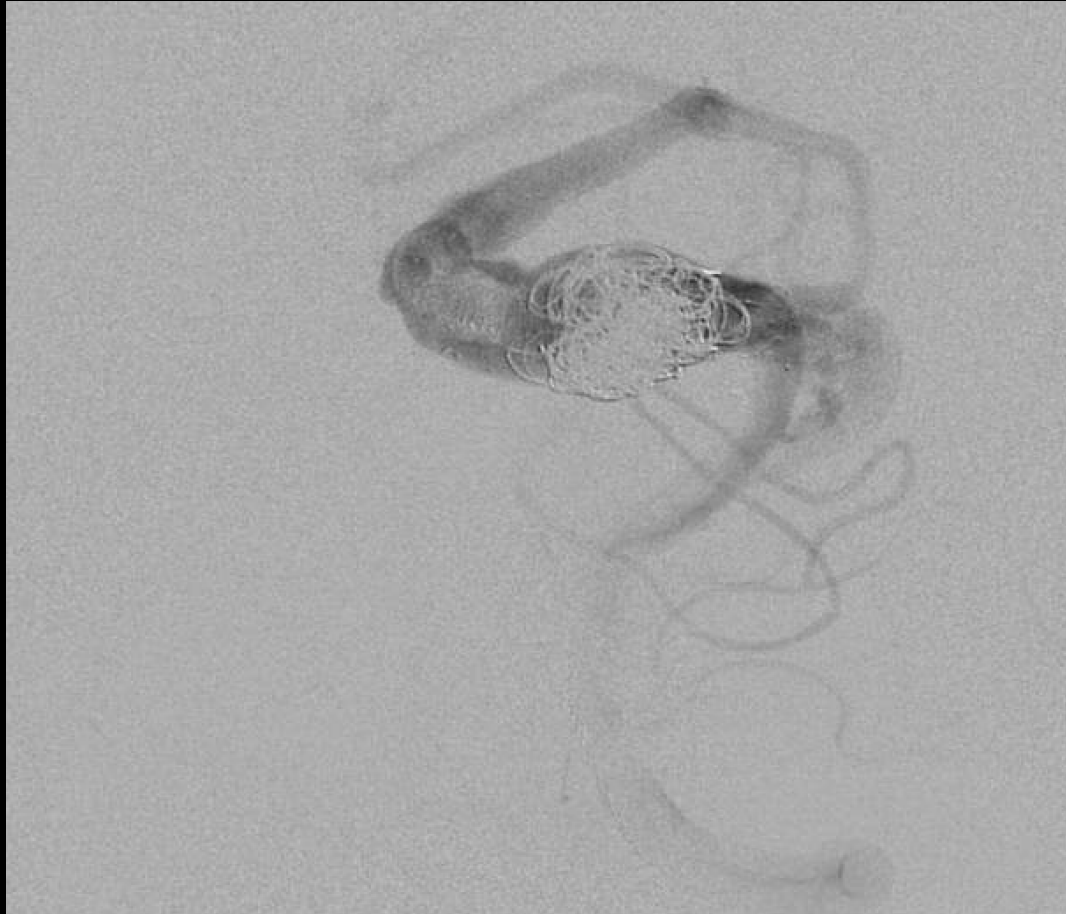
Coil Embolization through Scepter XC

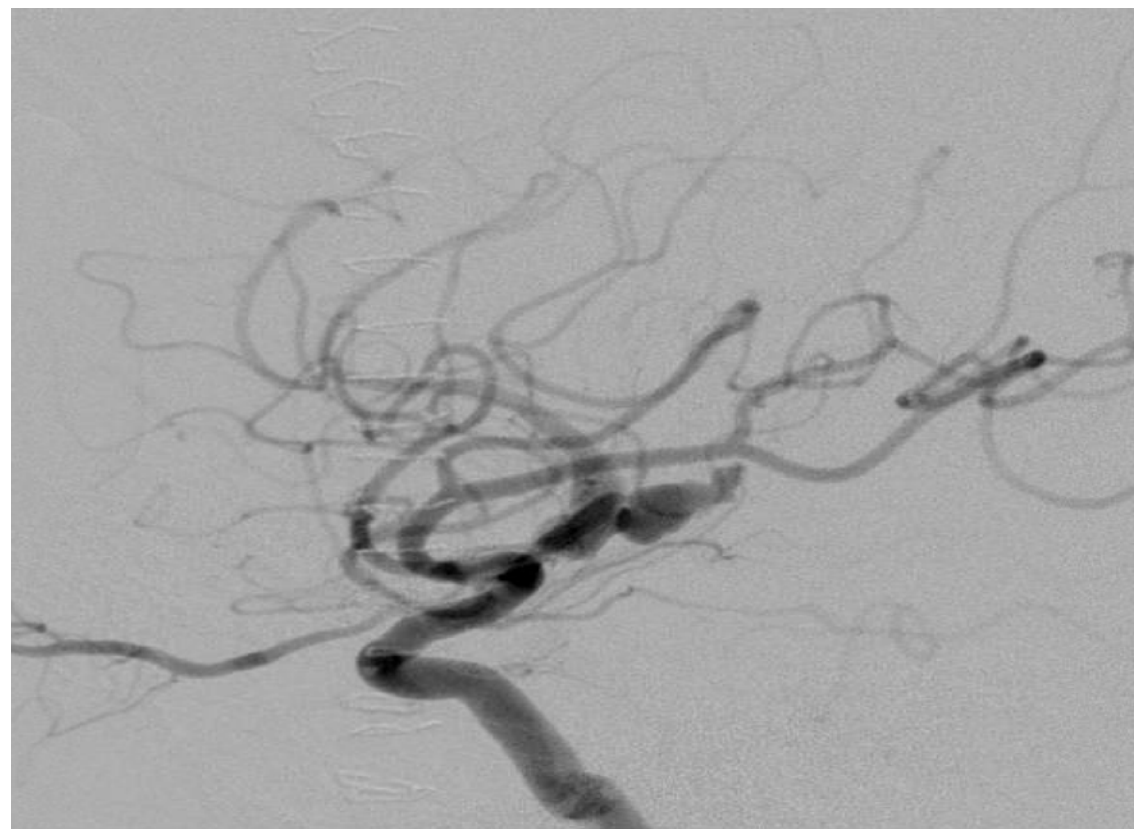
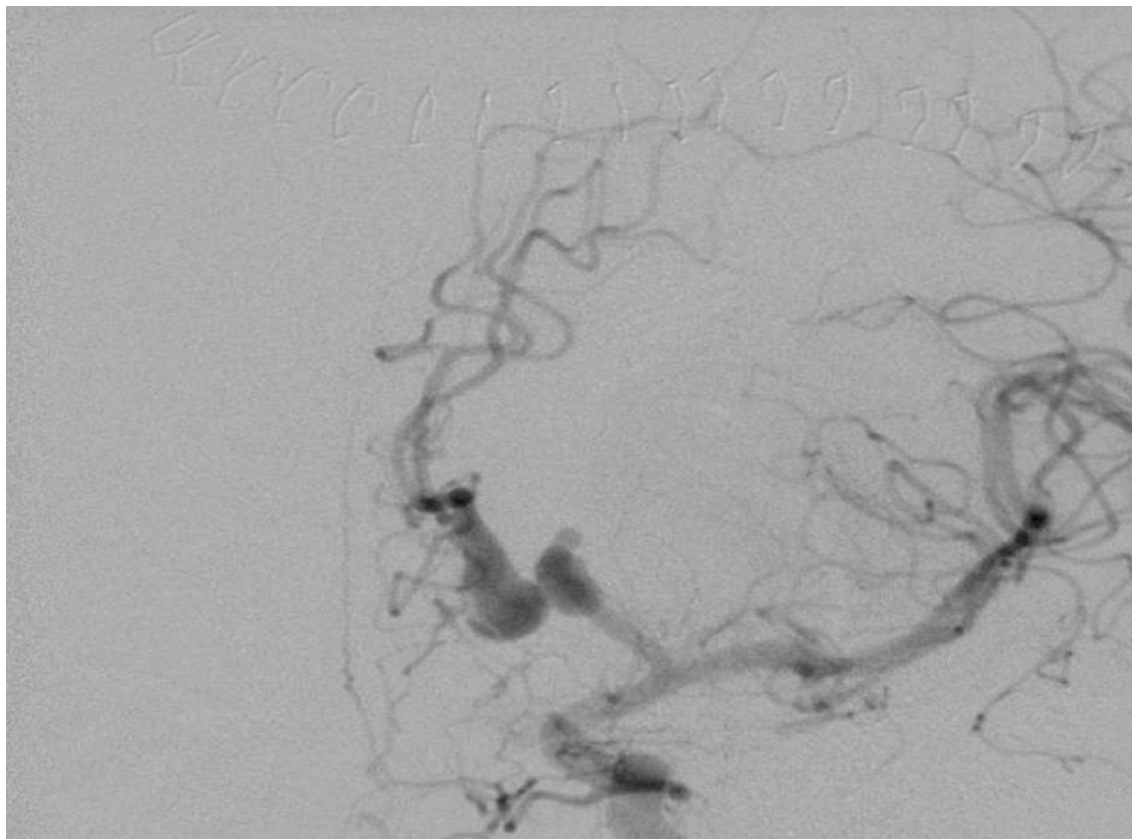


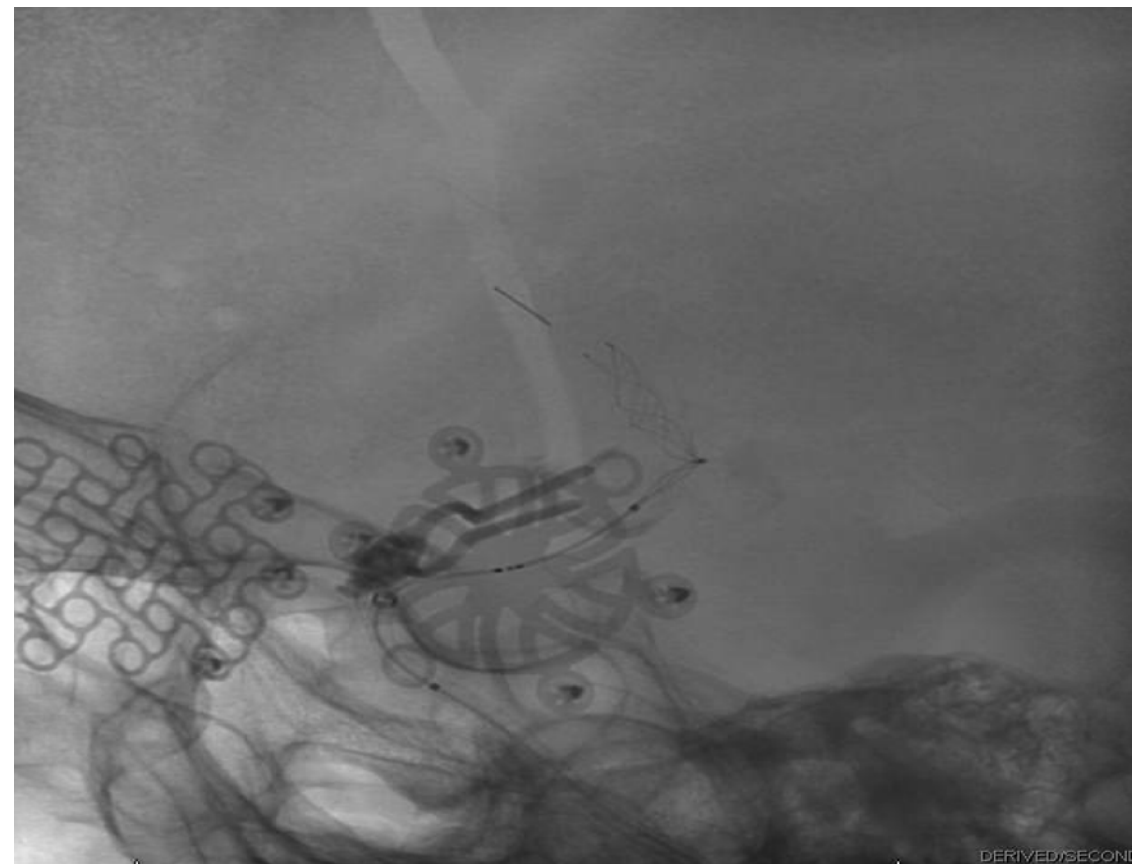
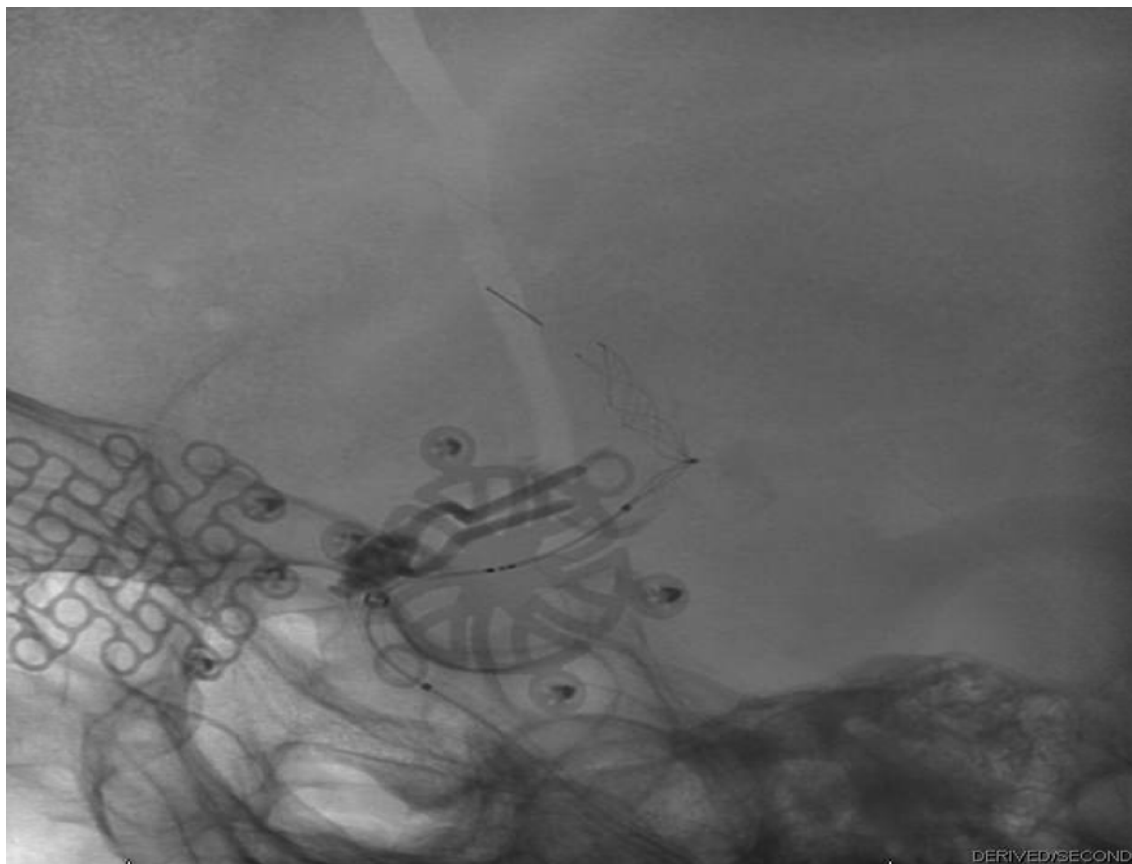
Final Construct

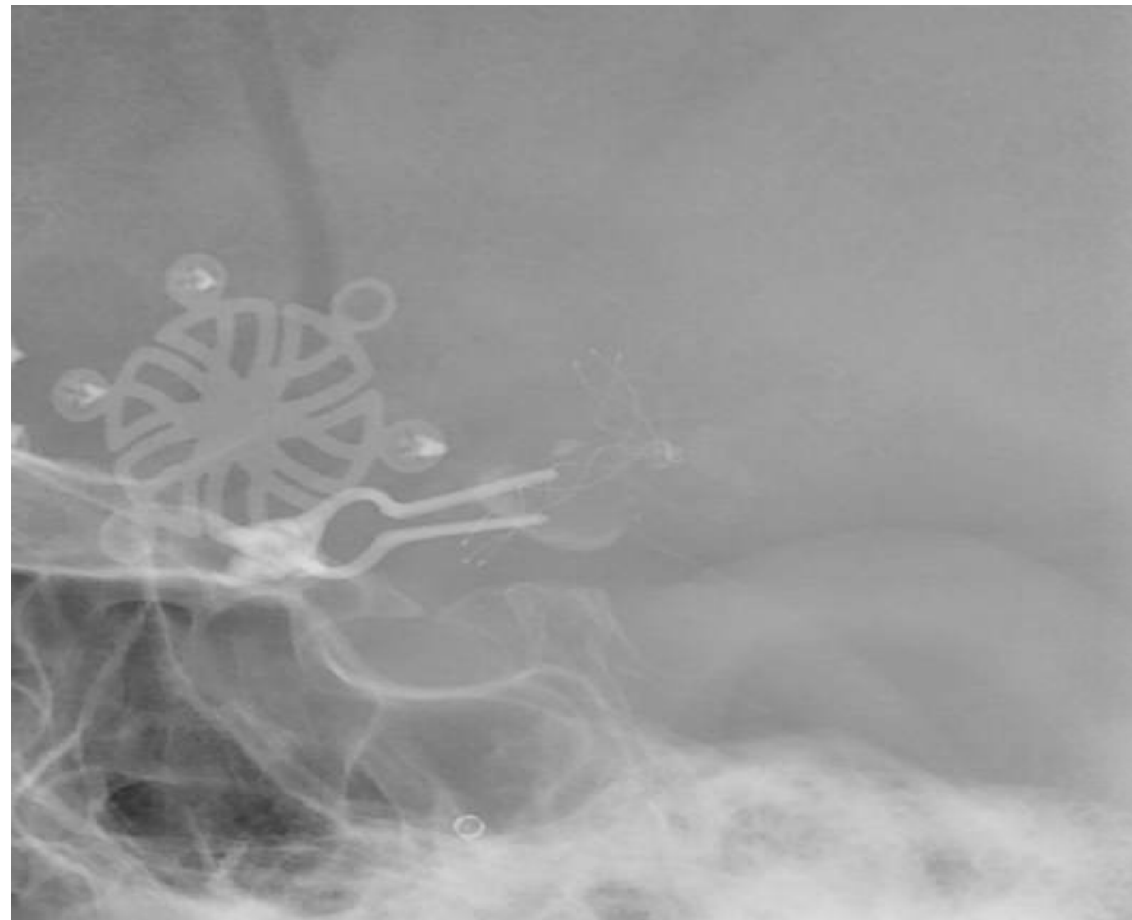
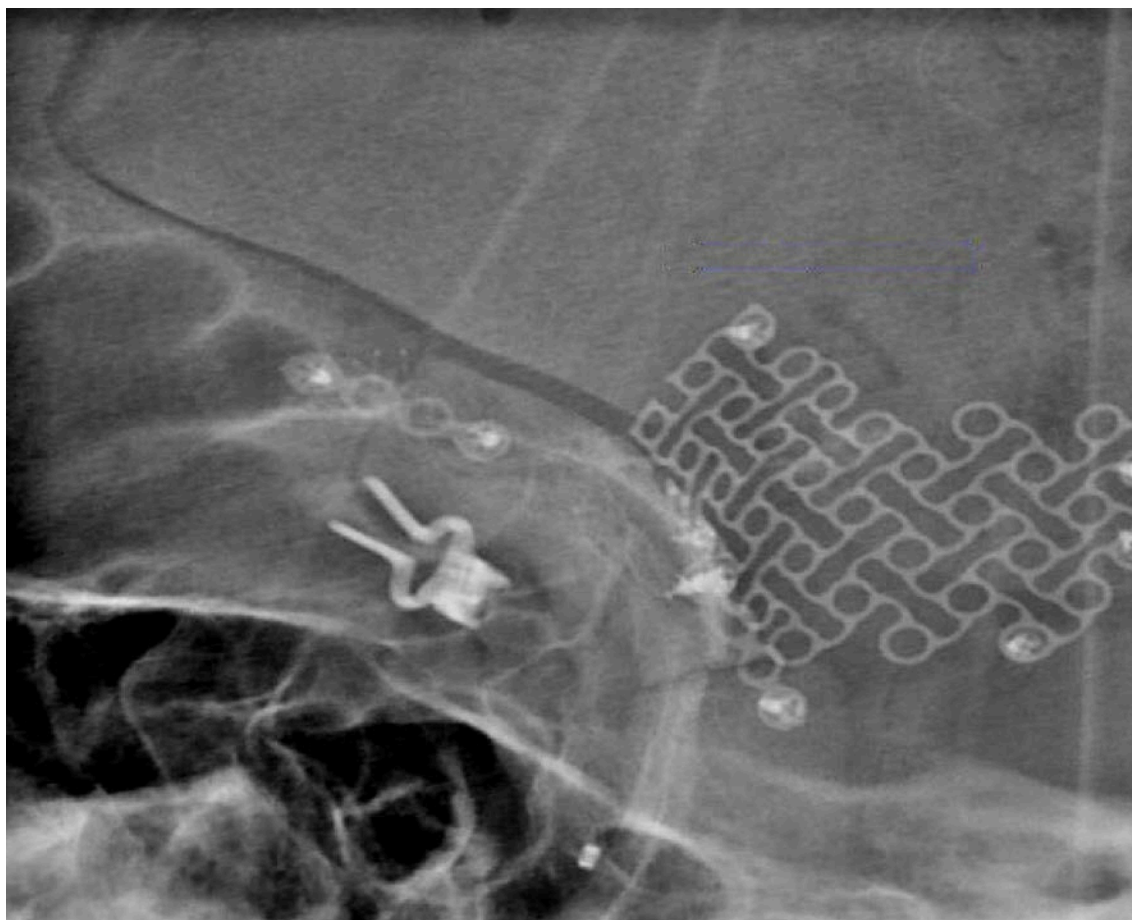


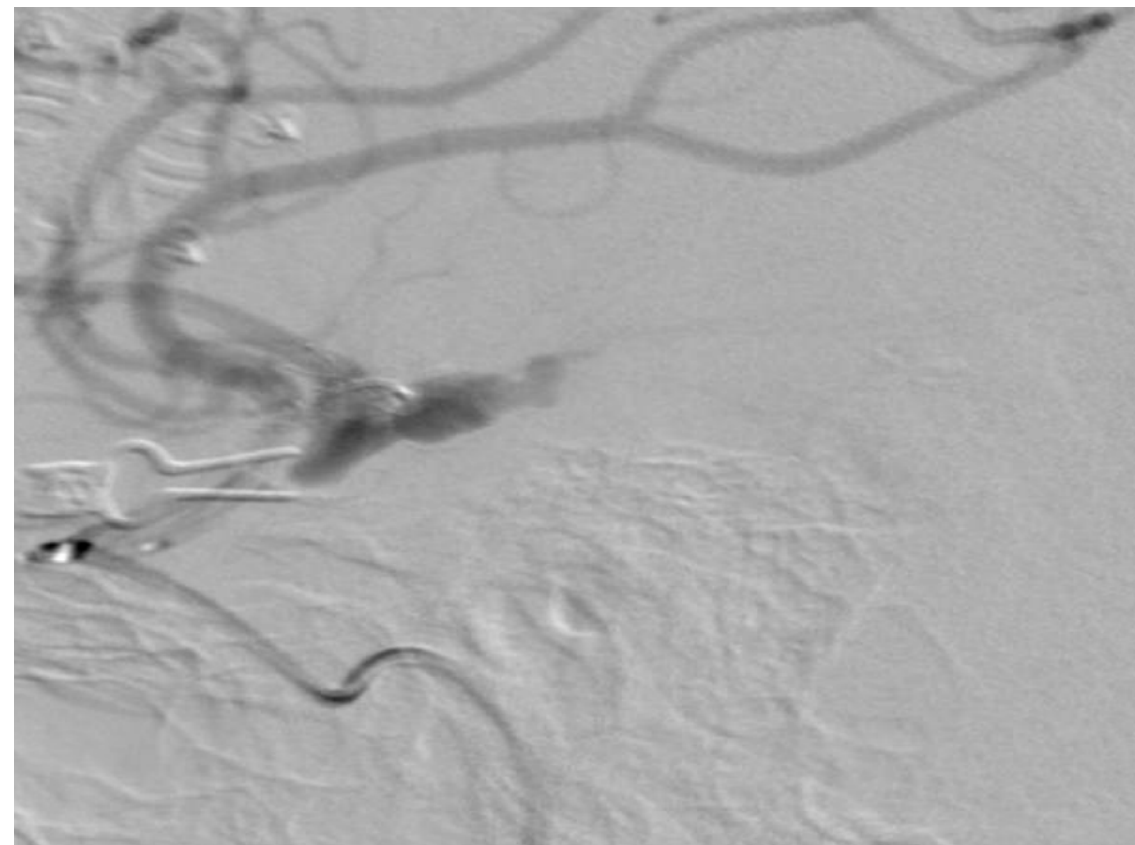
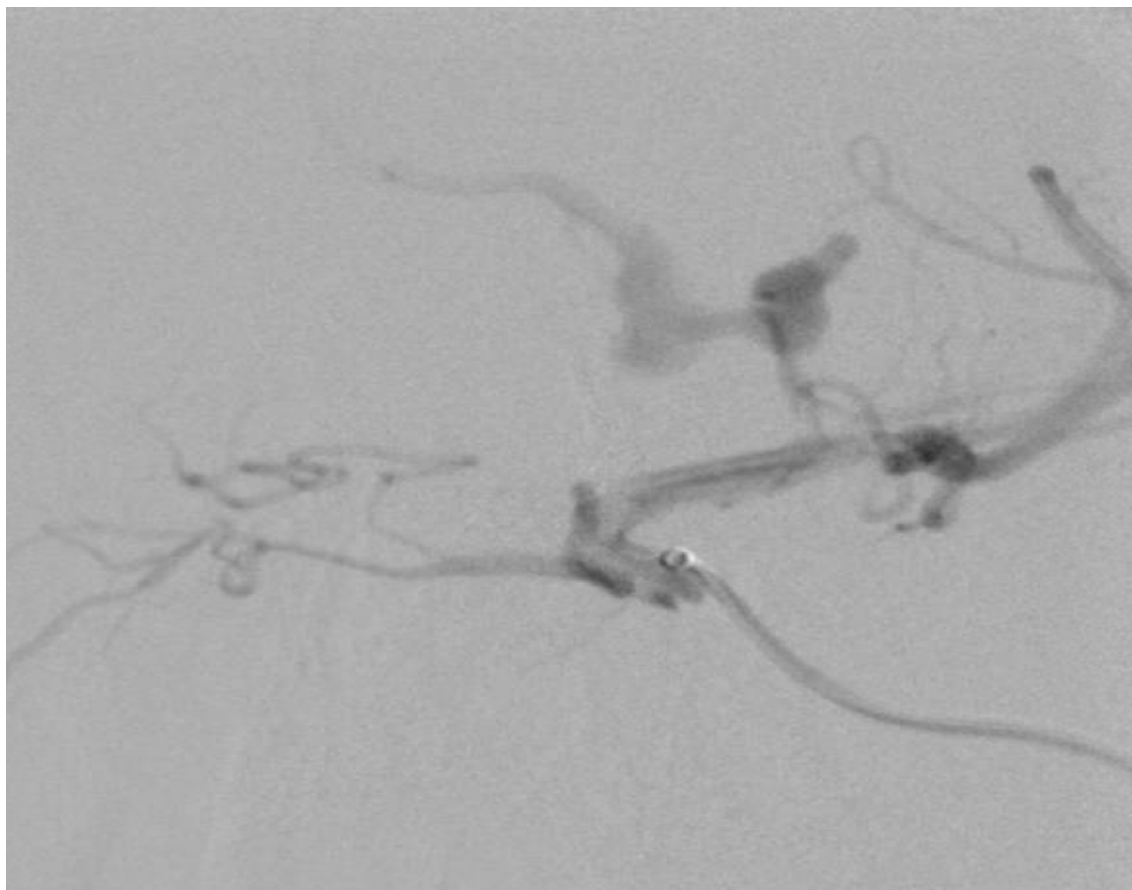
Post Embolization DSA

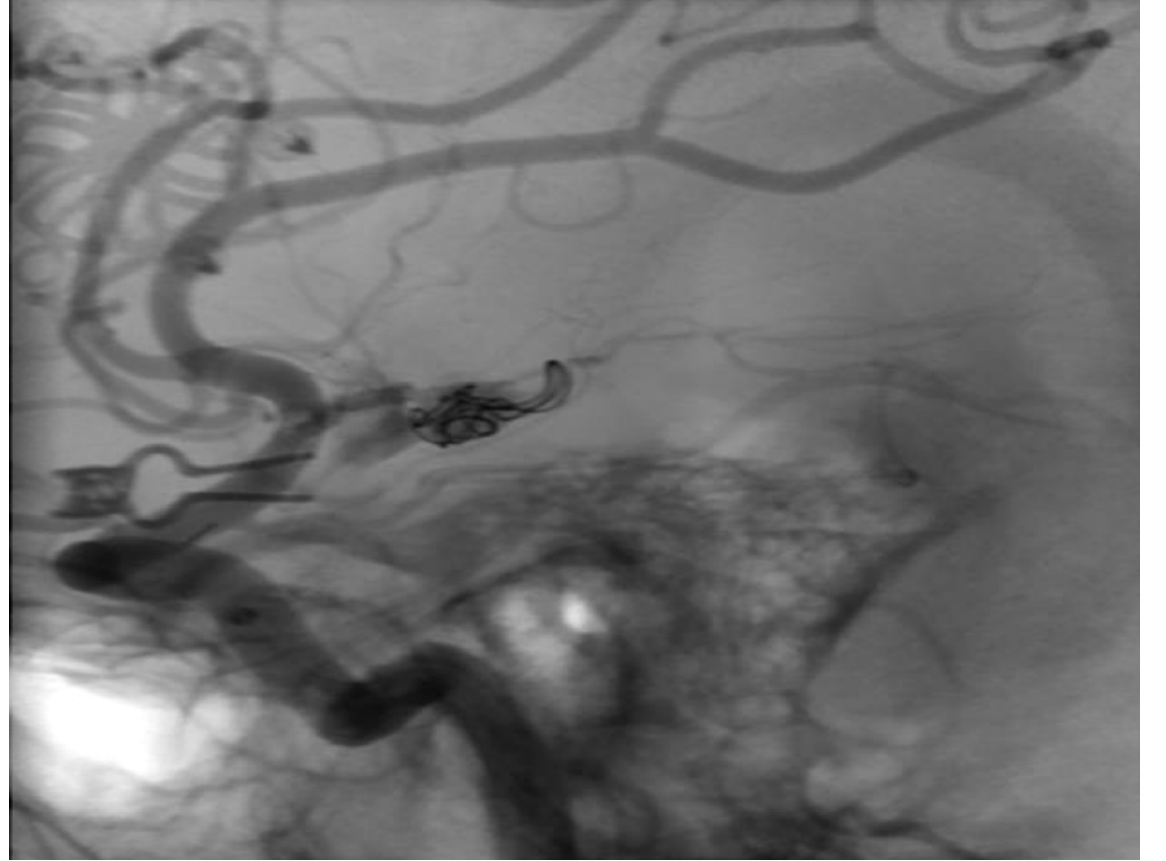
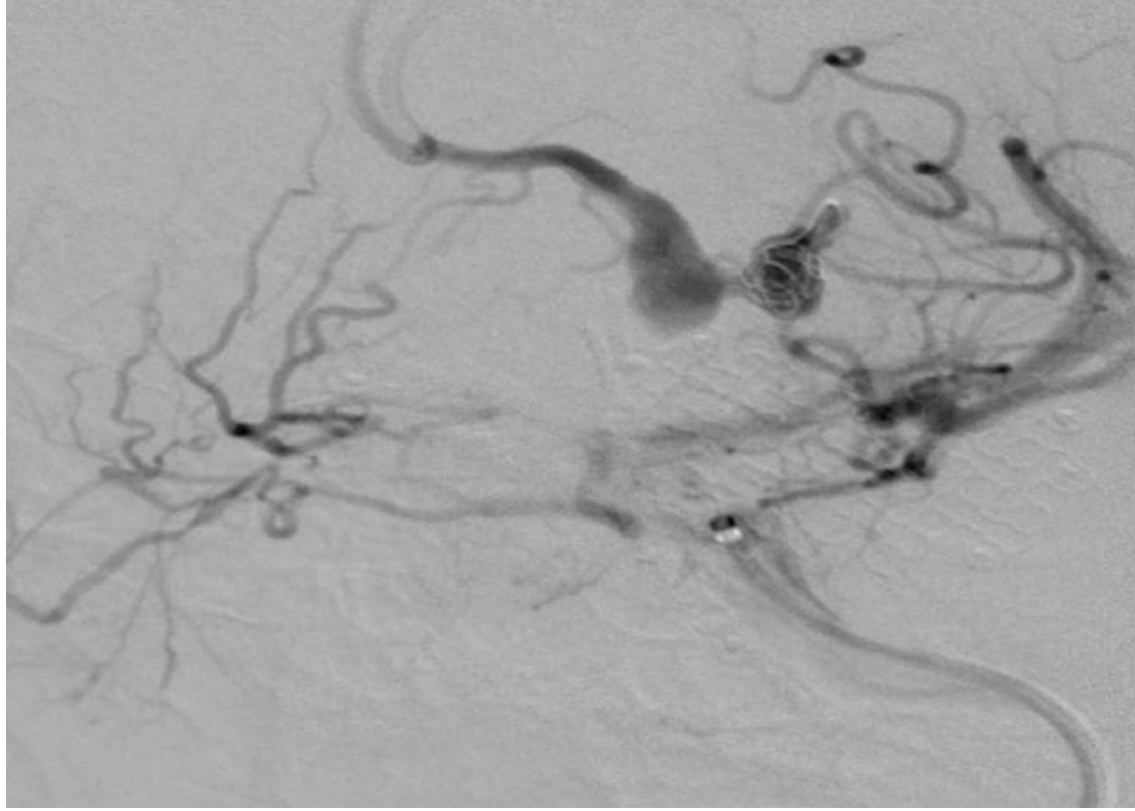


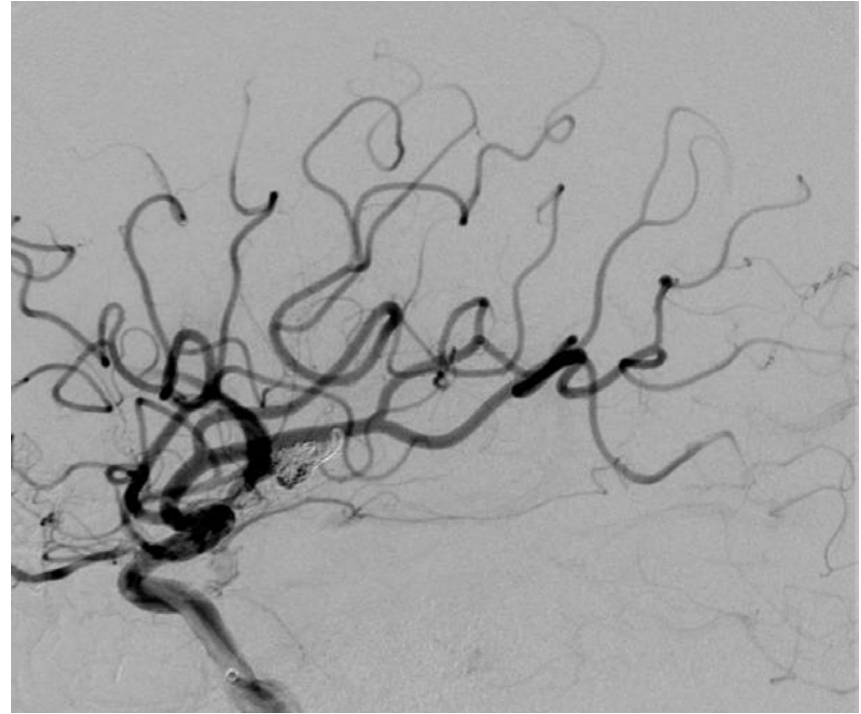
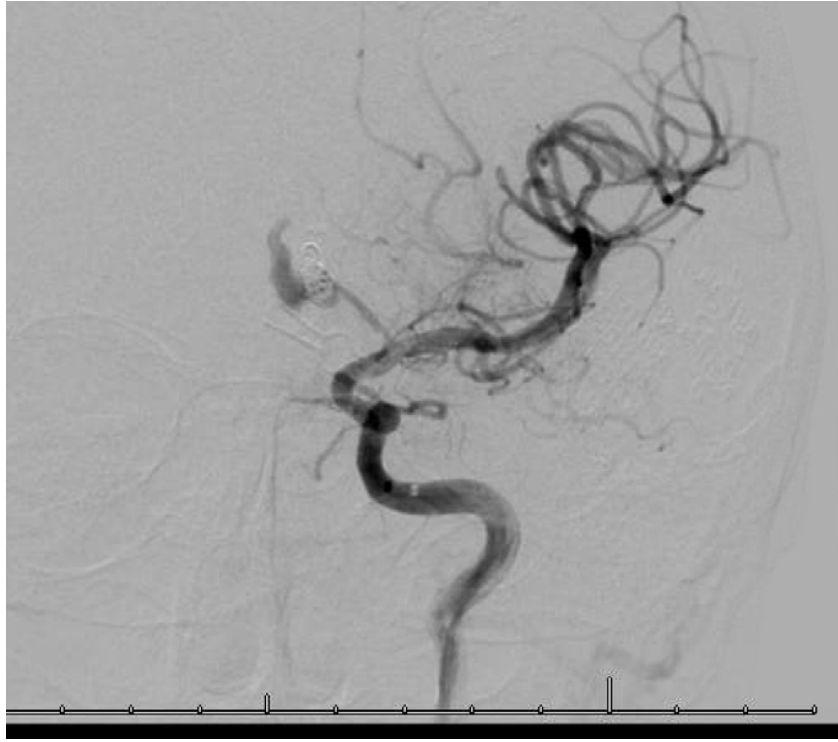










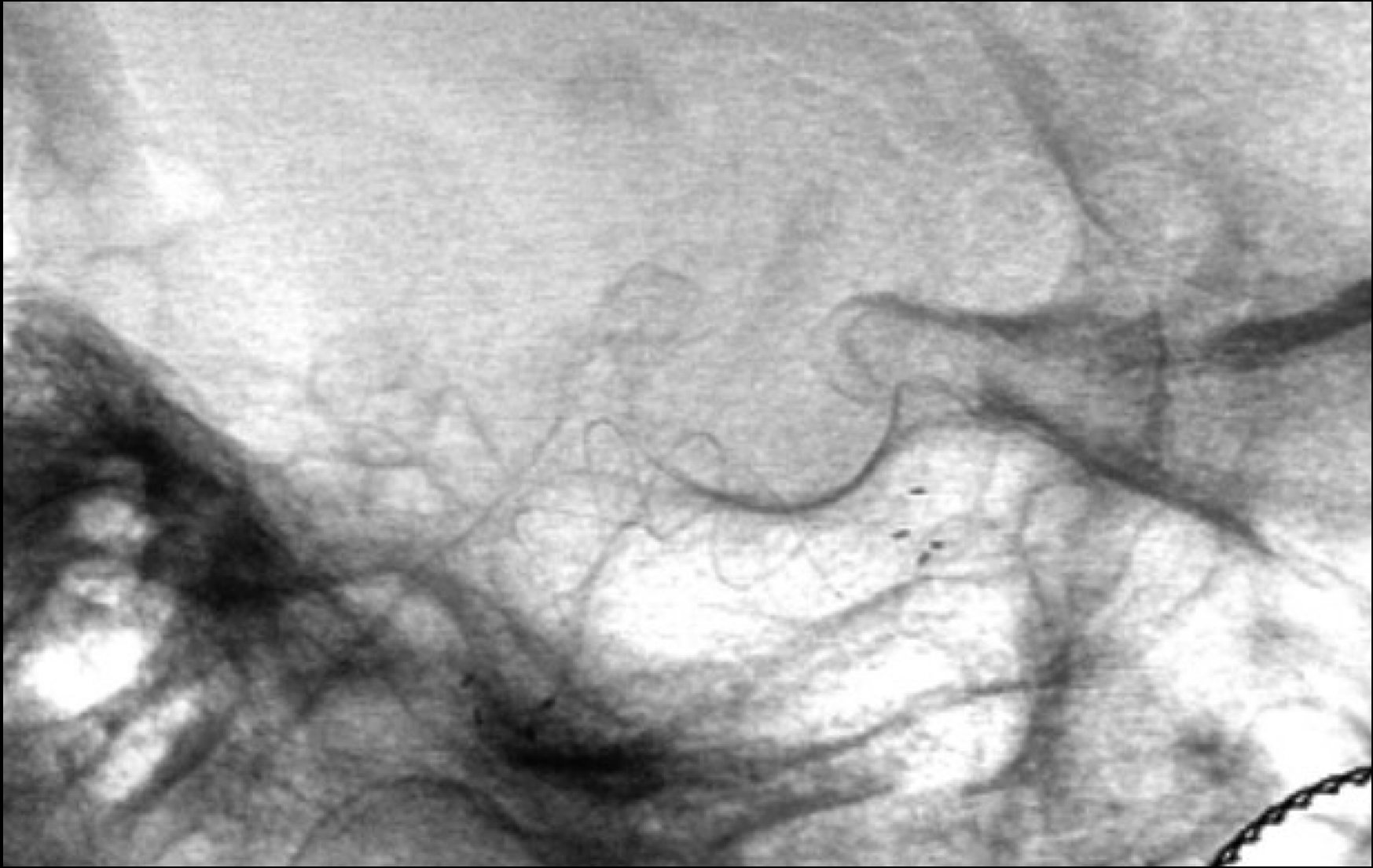


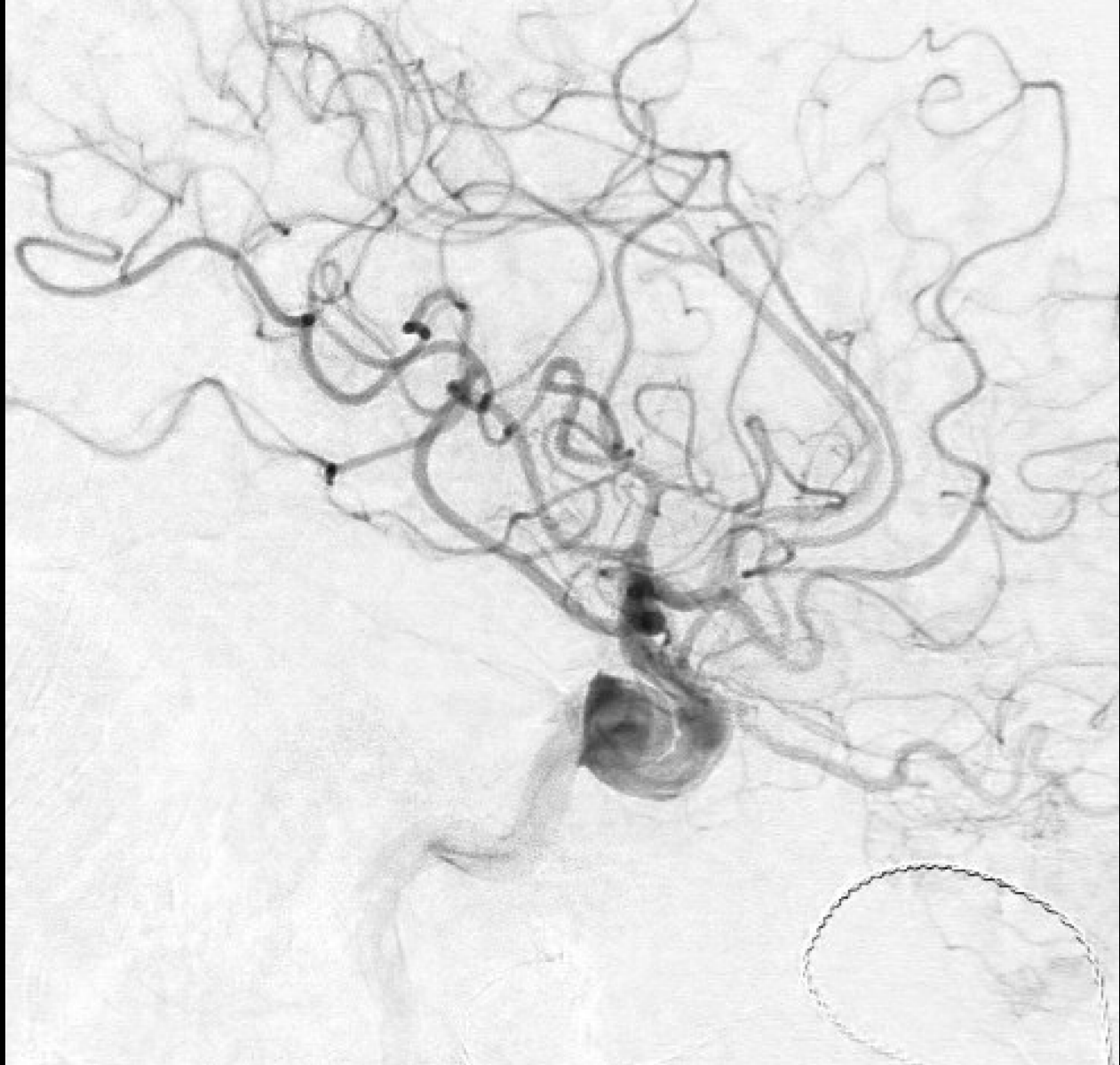


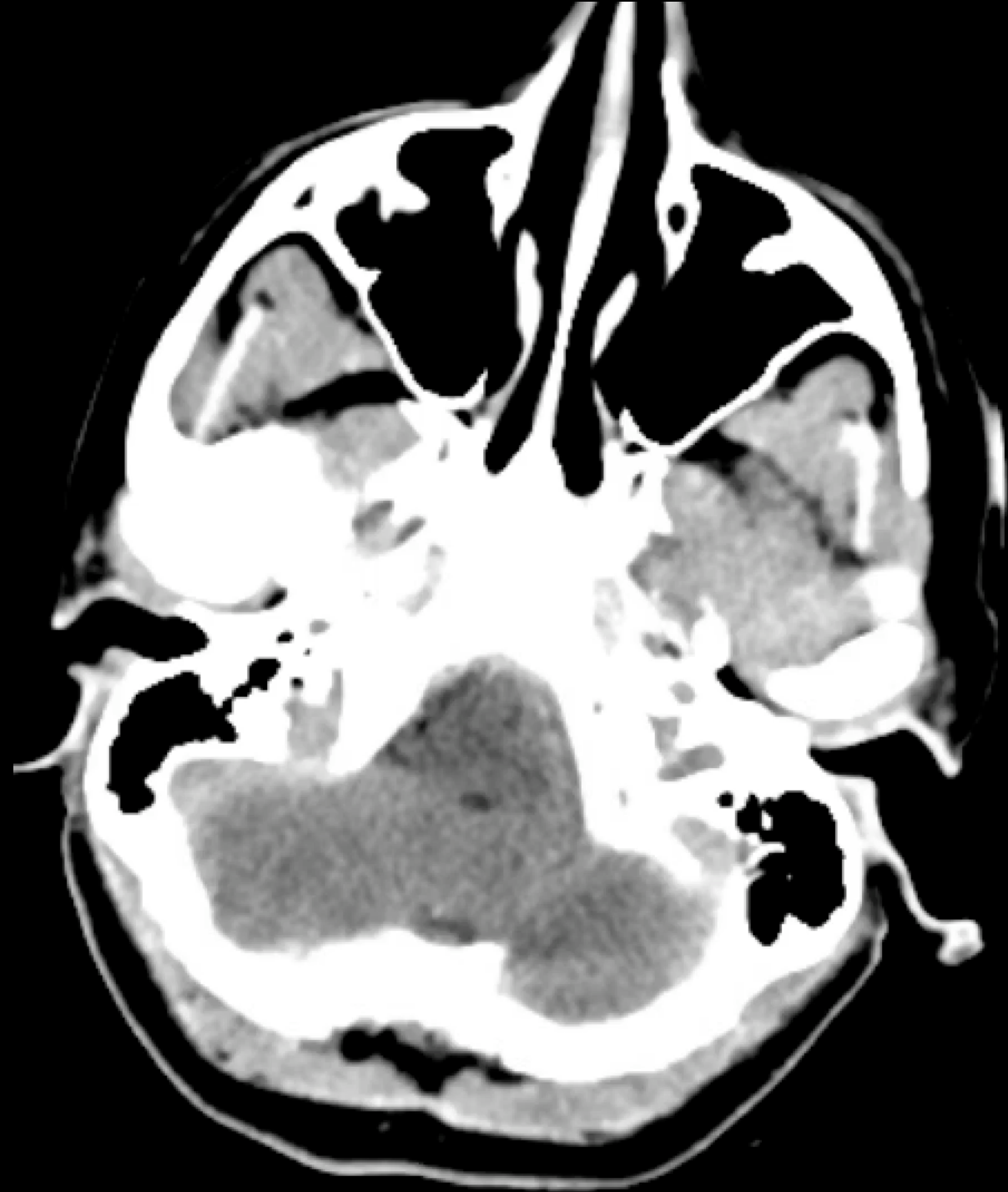






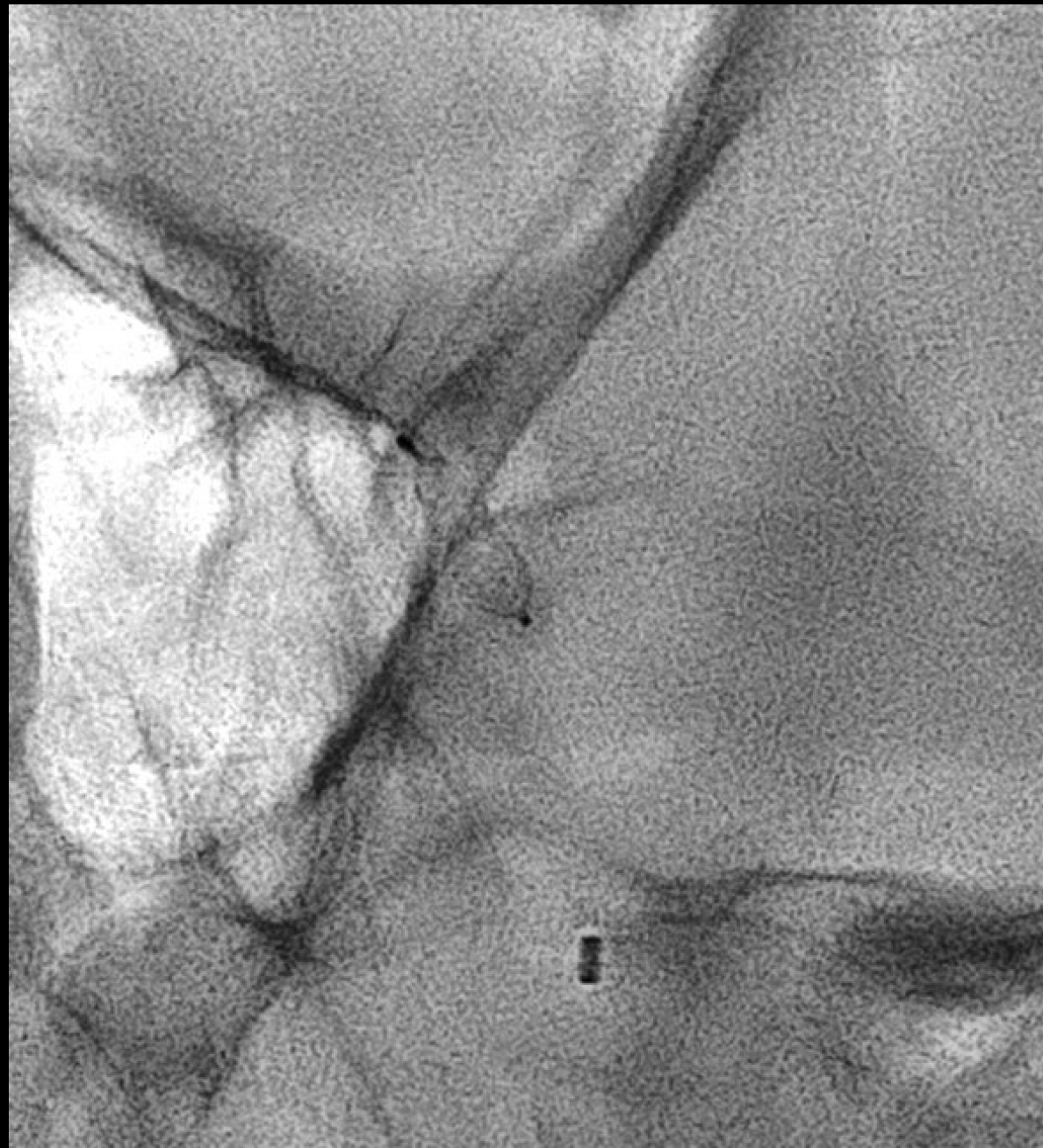


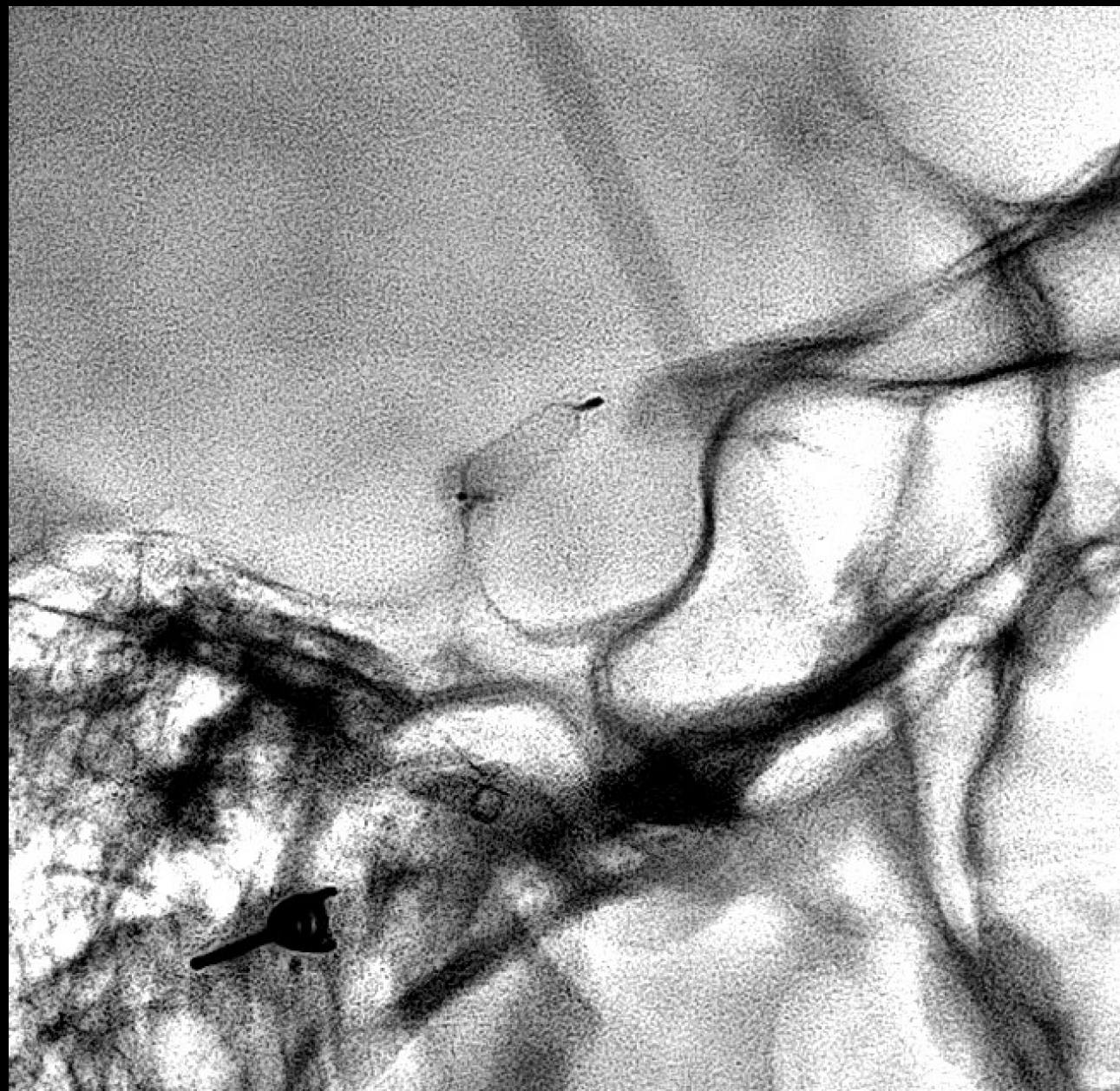




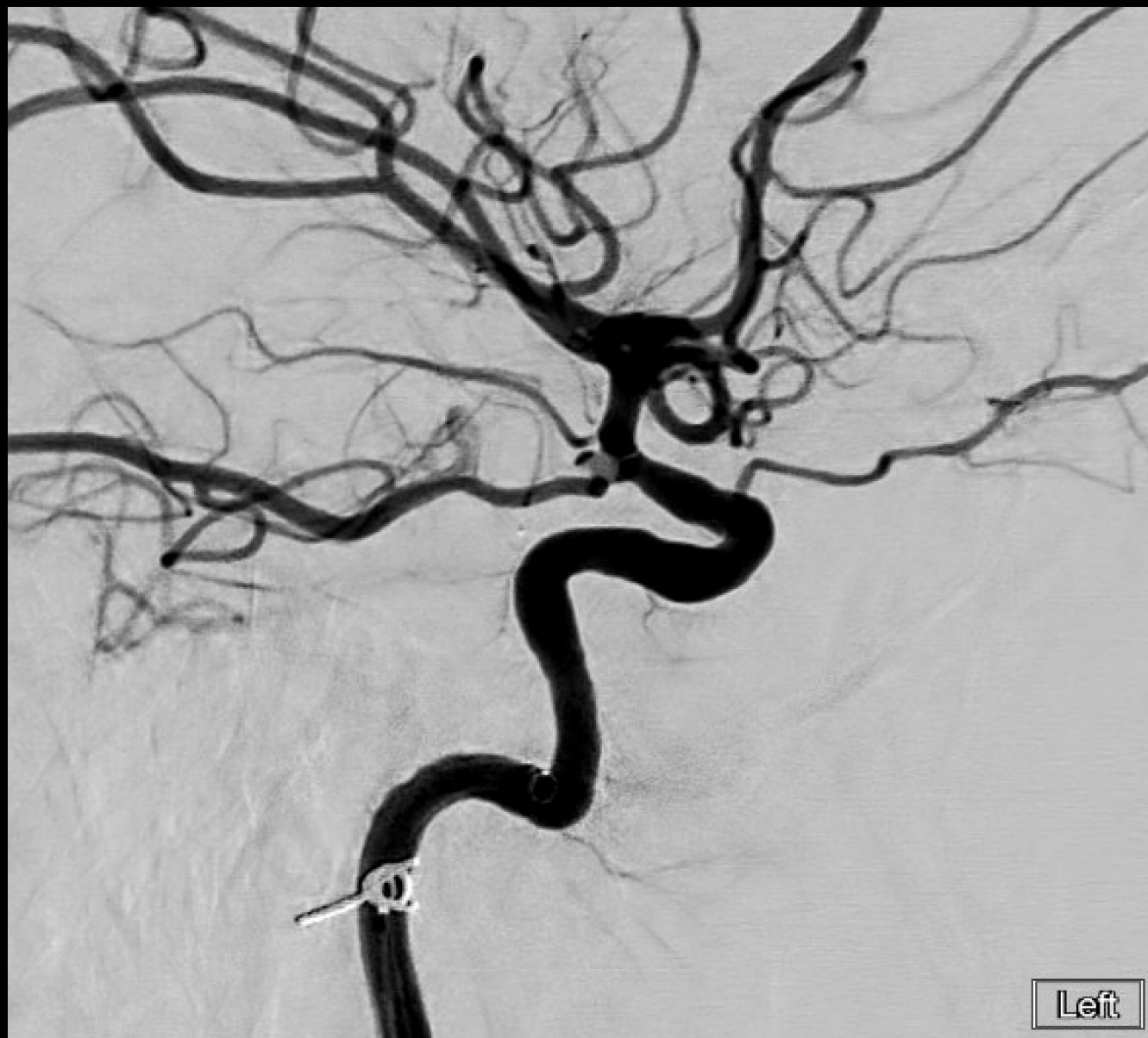








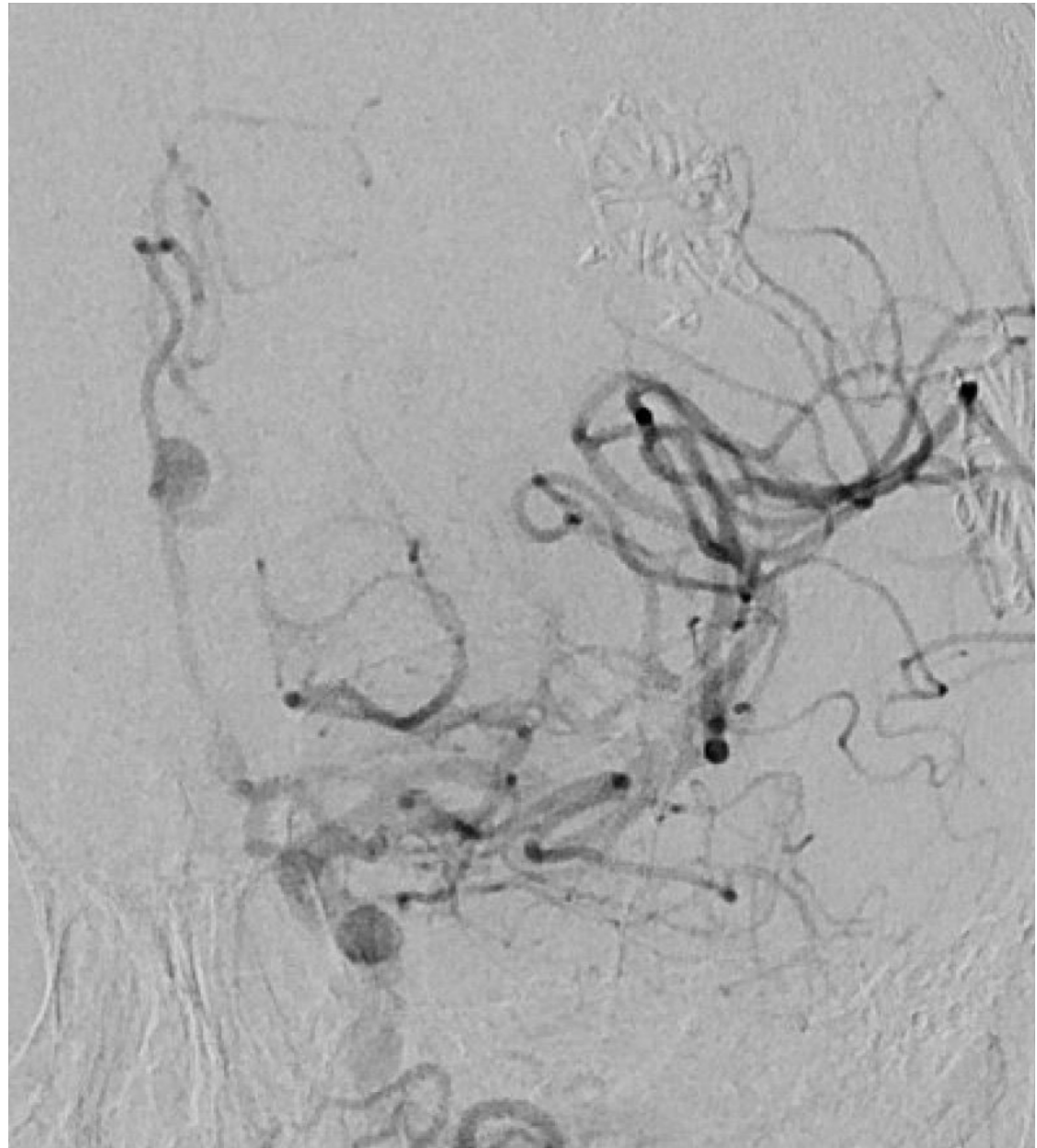




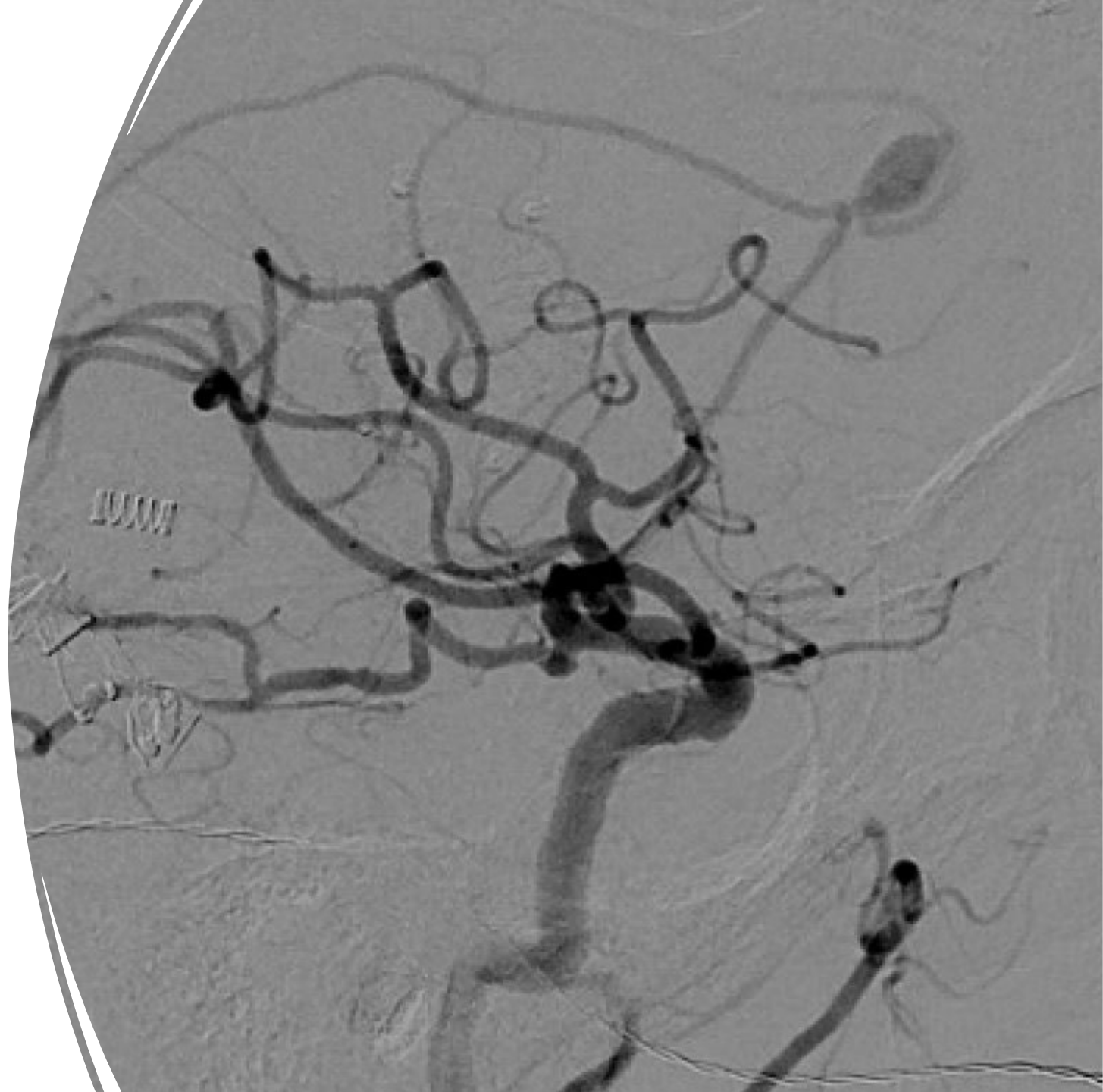
Left

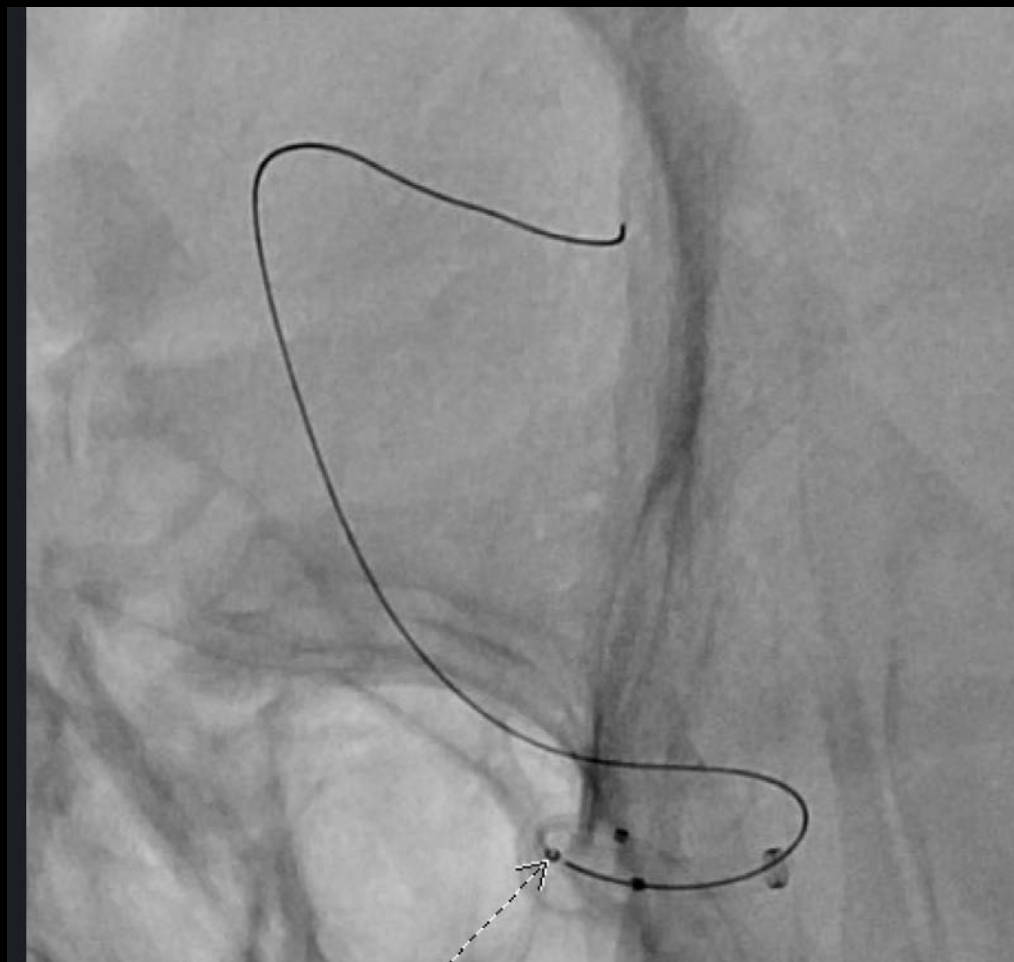
WEB

treatment for
distal
intracranial
aneurysms



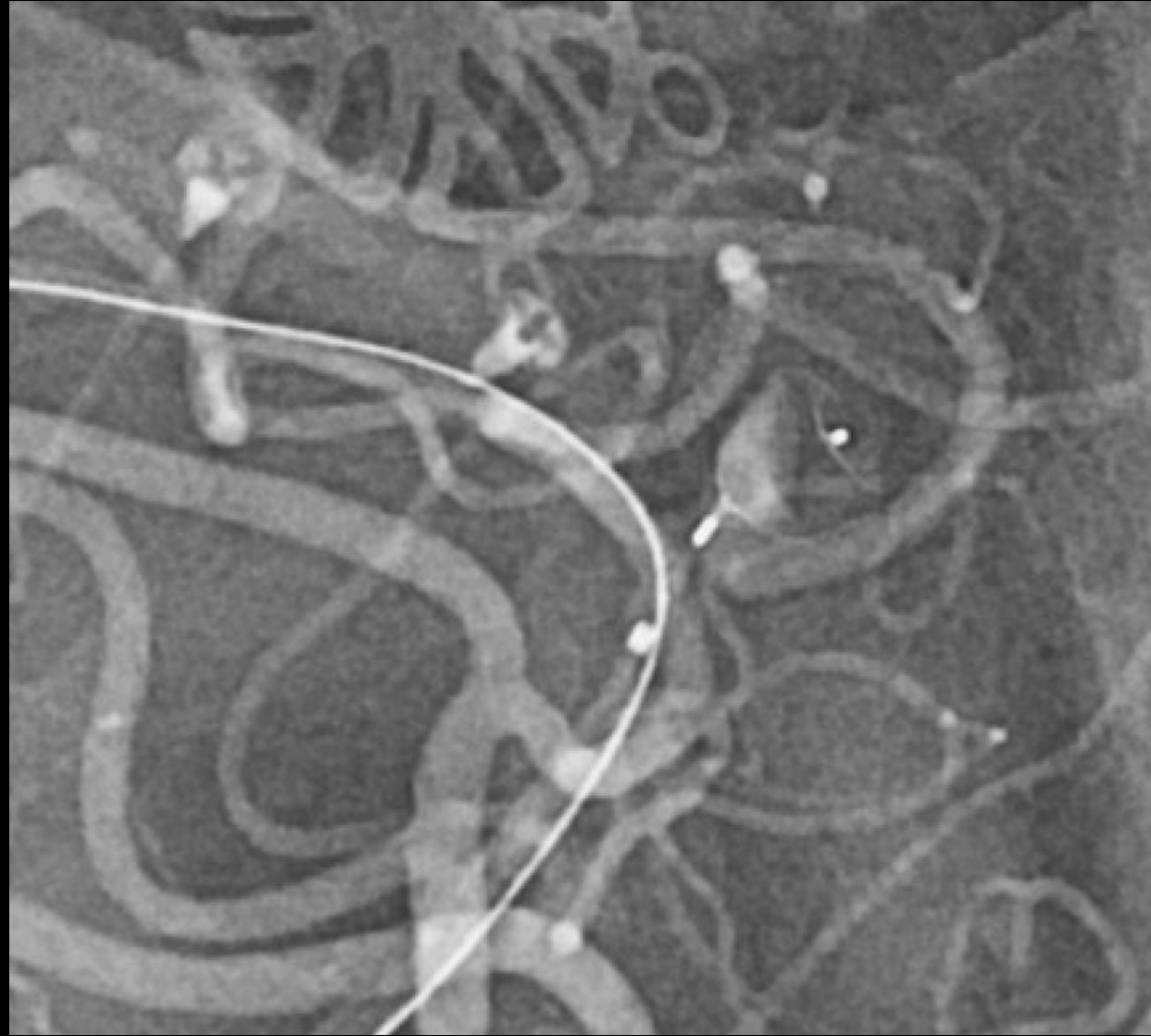
82 year old
with
pericallosal
aneurysm

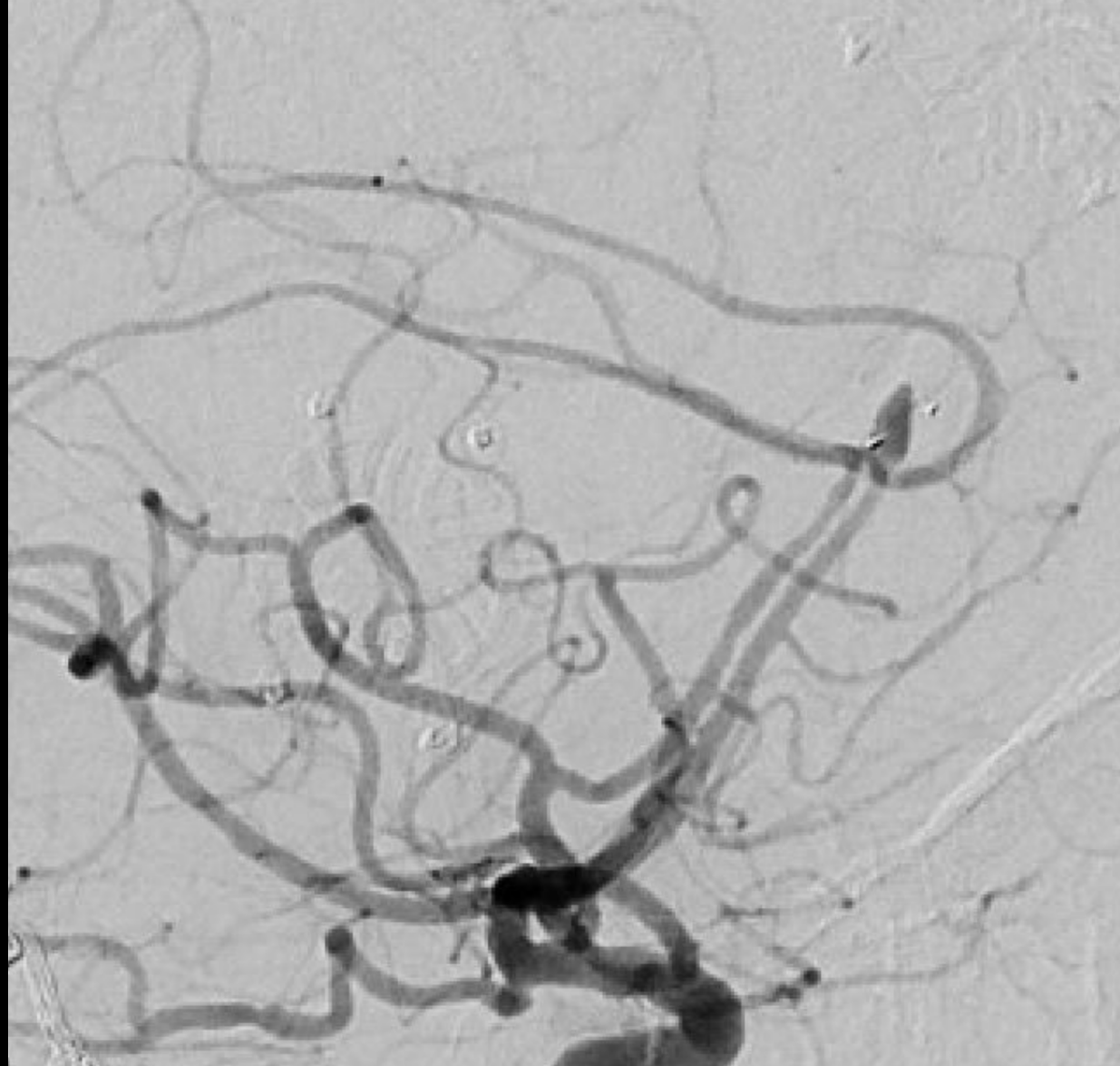




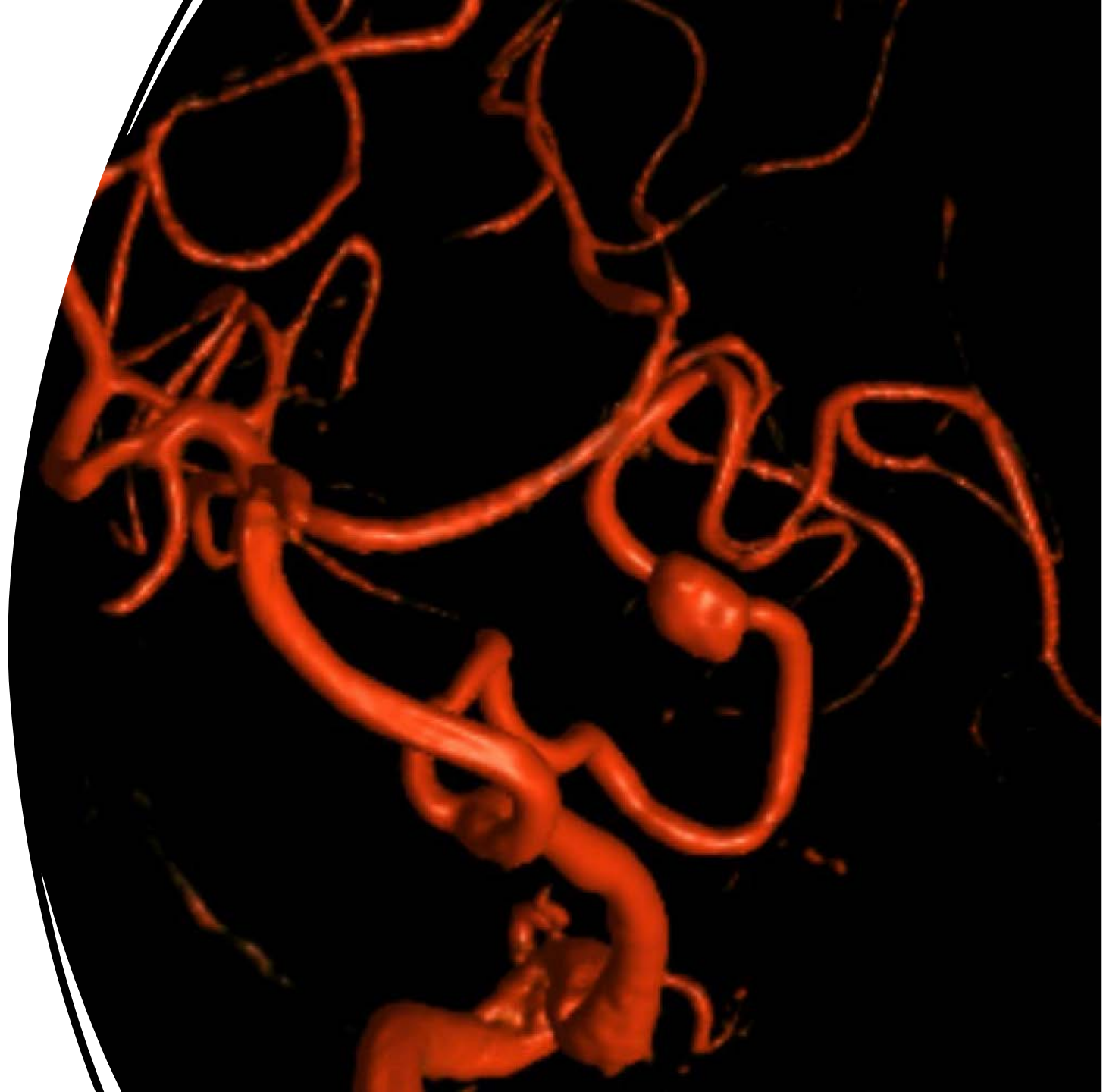


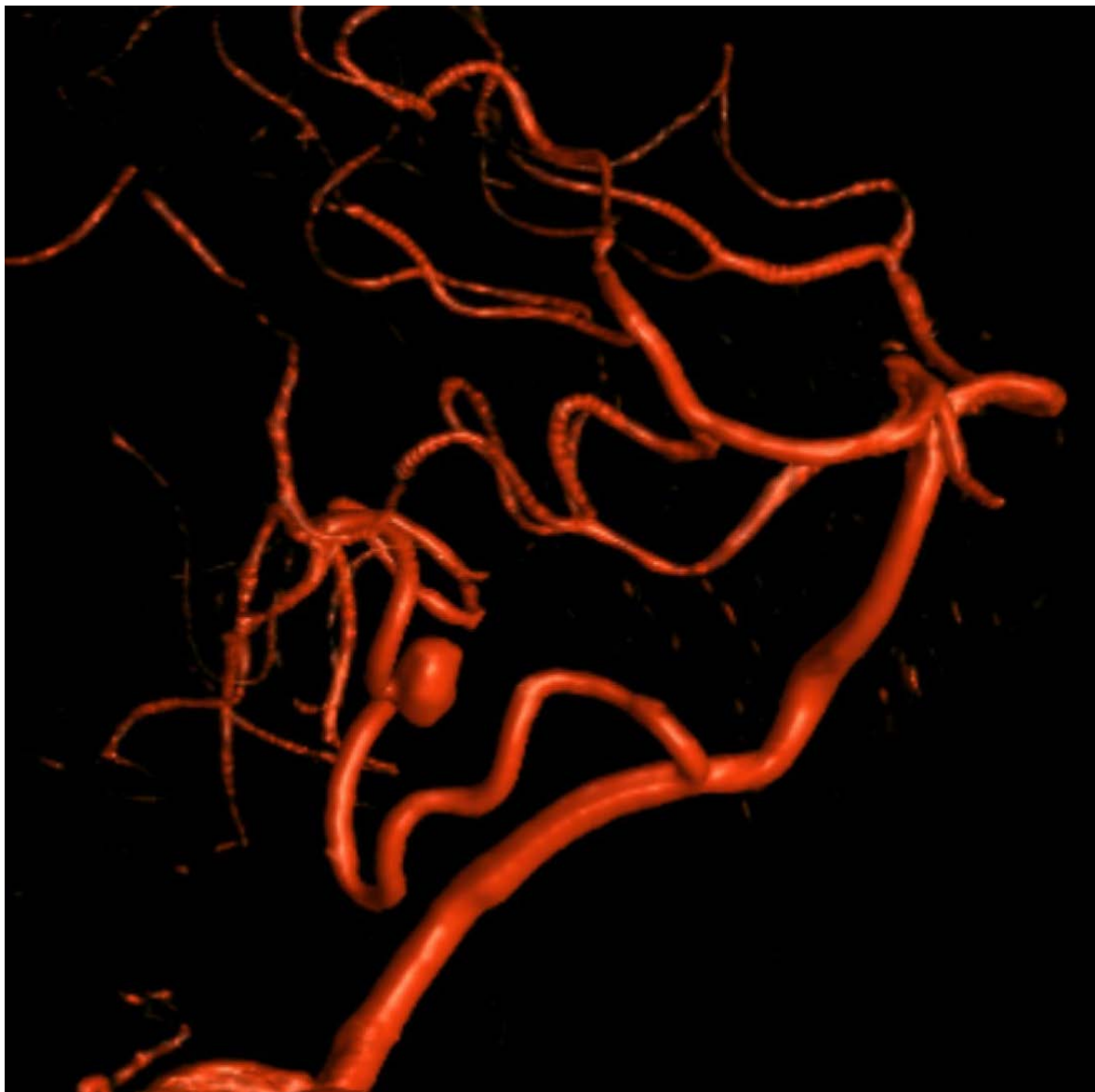




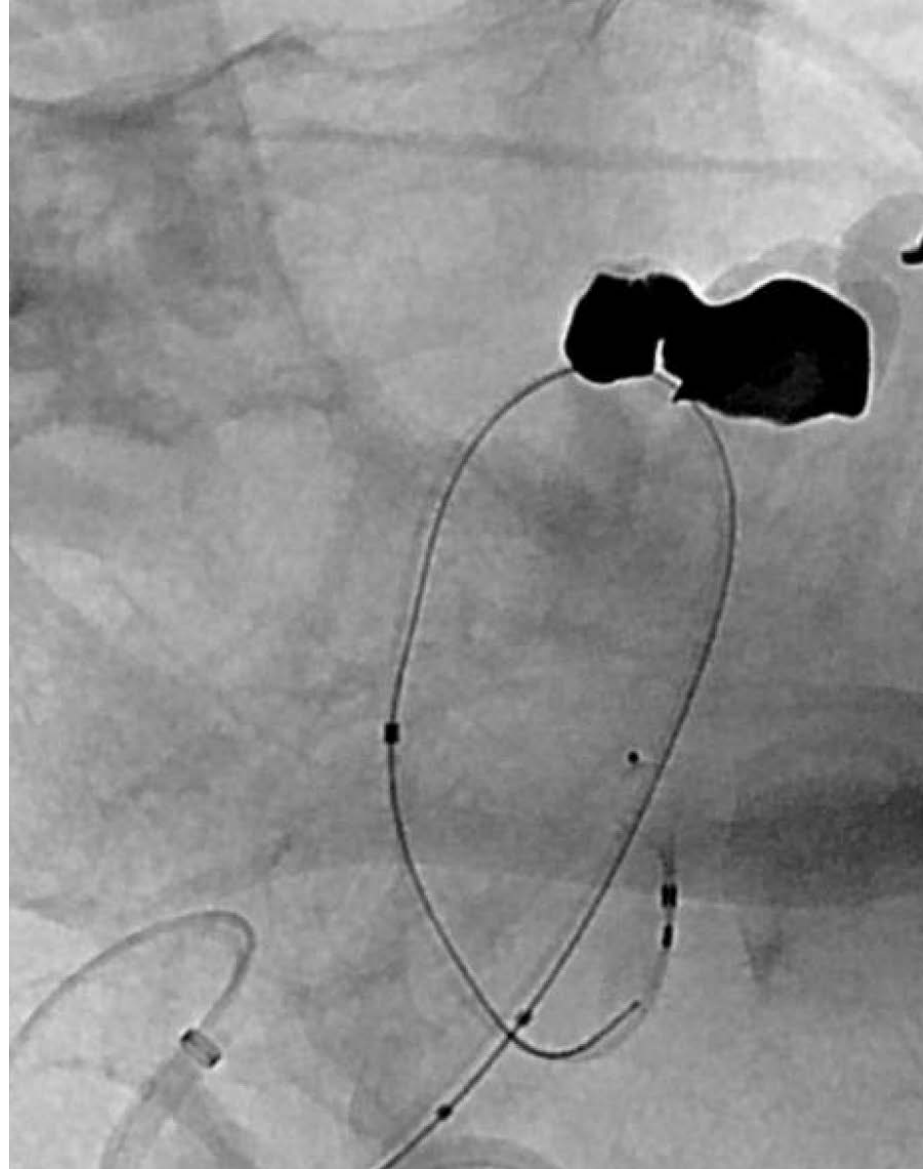


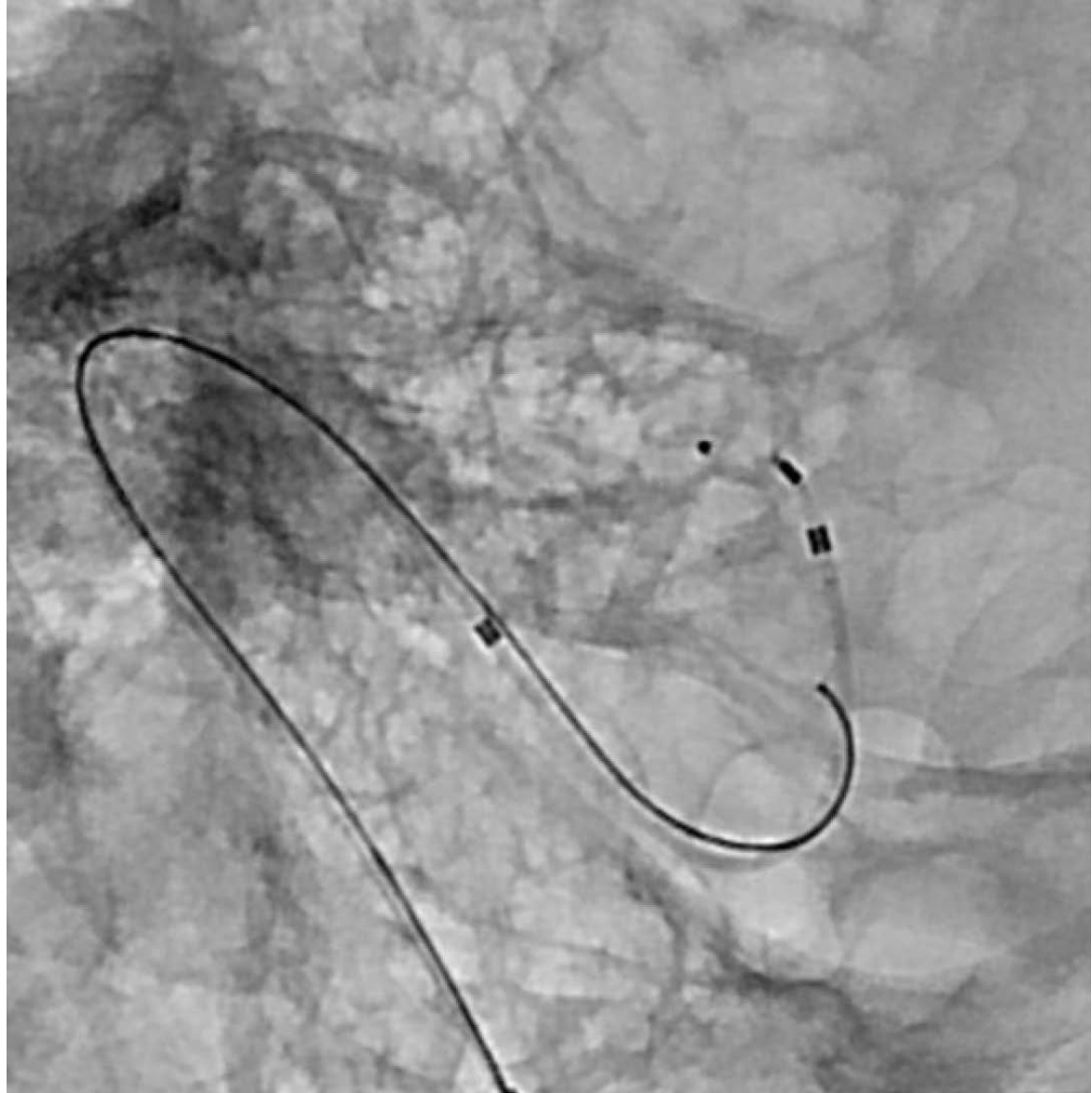
77 year old
with PICA
aneurysm

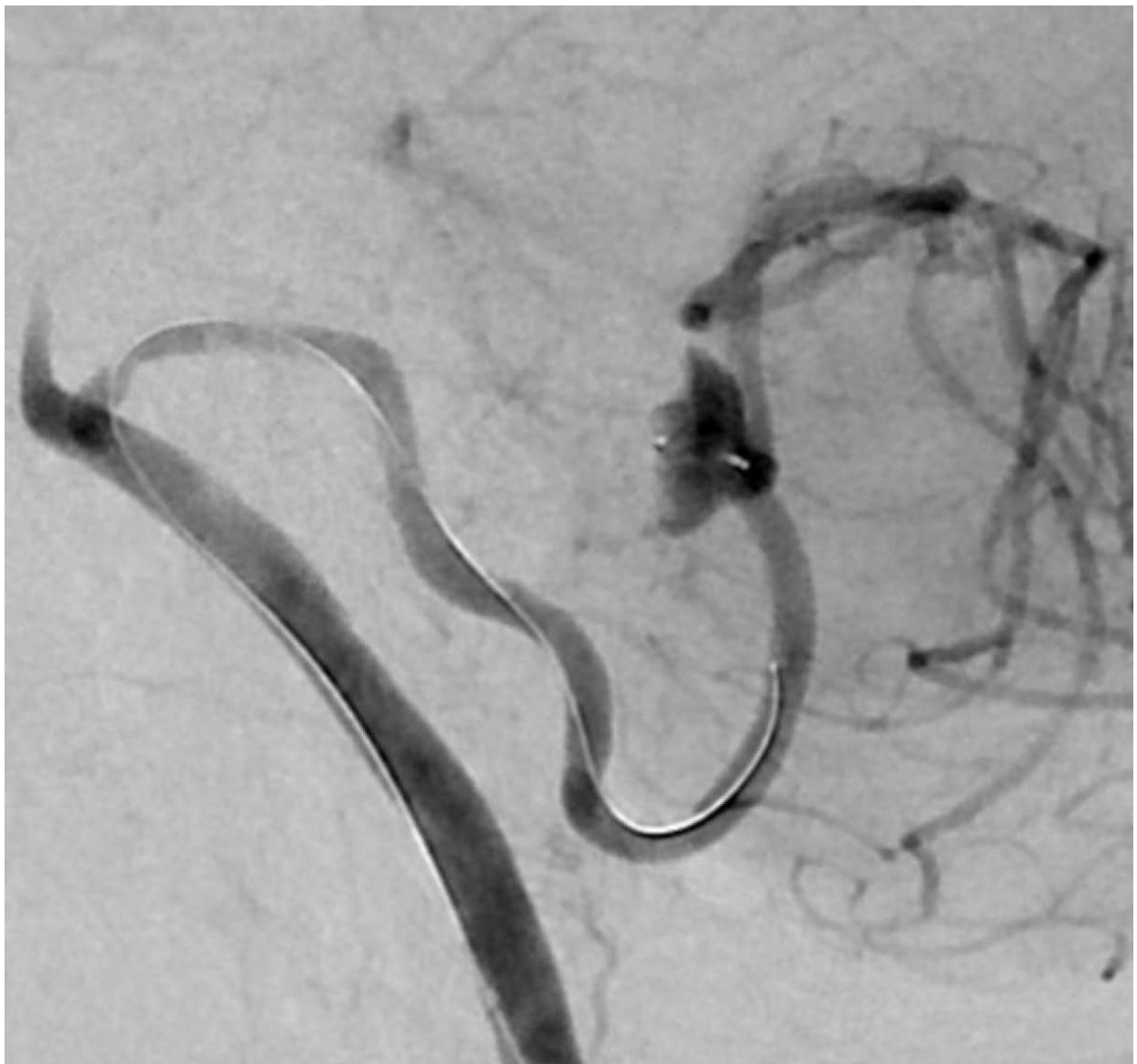










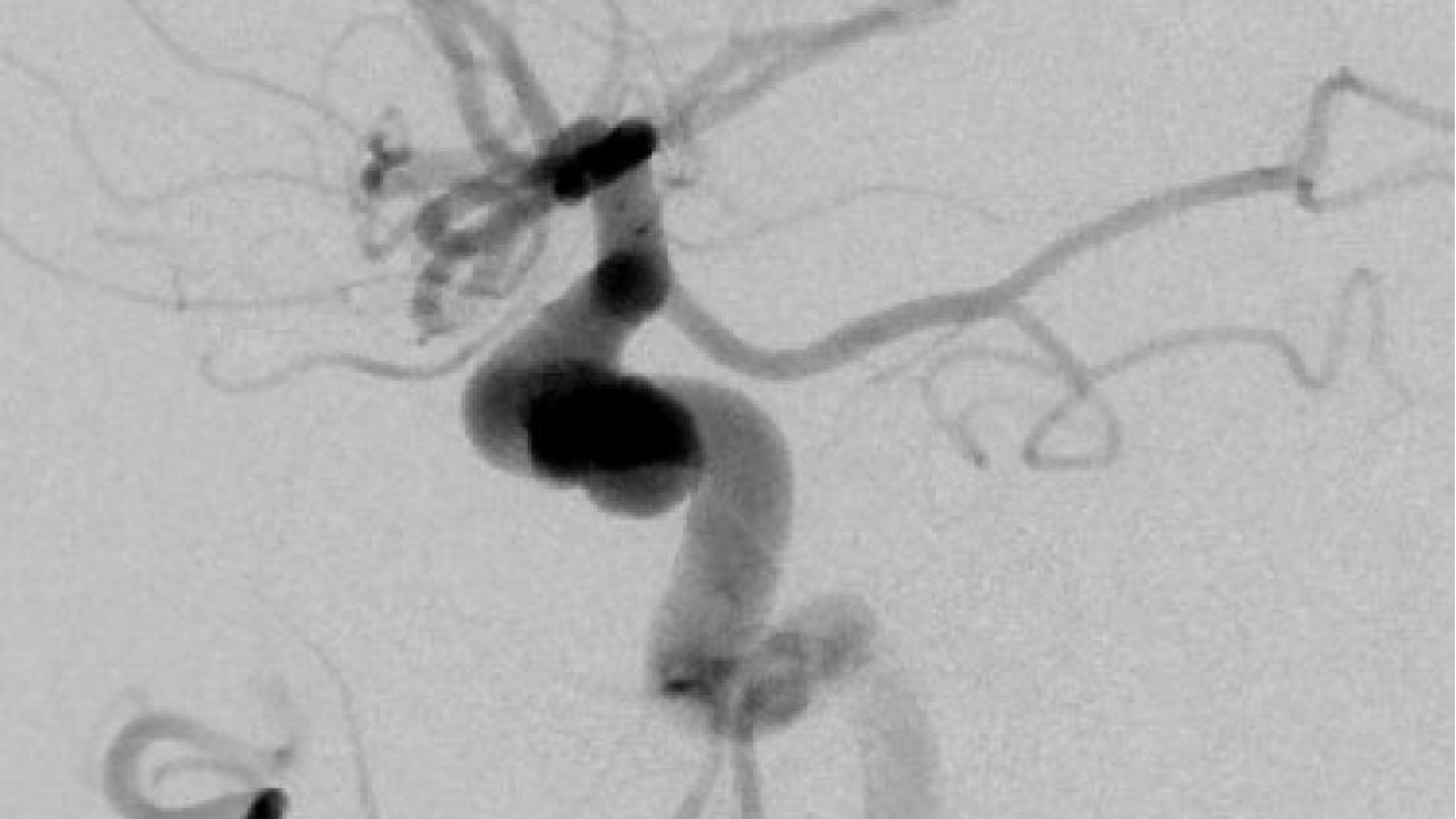


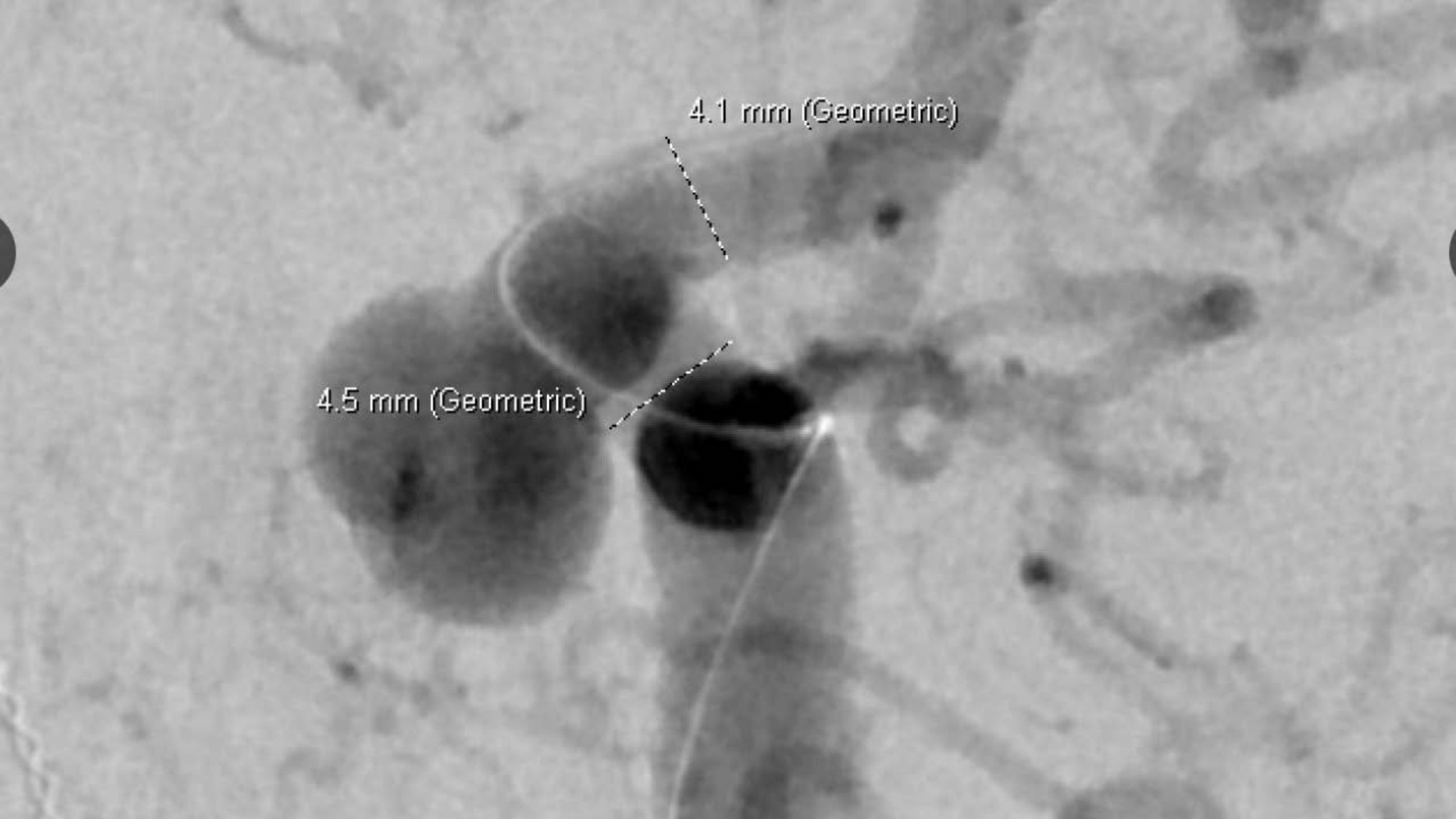




WEB device for side wall aneurysms







4.1 mm (Geometric)

This is a grayscale ultrasound image showing a fetal head in profile. Two measurement lines are drawn across the image. The first line, labeled '4.1 mm (Geometric)', is a dashed line that passes through the upper part of the fetal head. The second line, labeled '4.5 mm (Geometric)', is a solid line that passes through the lower part of the fetal head. The background is a mottled gray, typical of medical ultrasound.

4.5 mm (Geometric)



3.8 mm (Geometric)

This is a grayscale medical scan, likely a CT or MRI, showing a cross-section of a brain. Three measurement lines are drawn across the image, each with a corresponding label. The first line is a dashed line extending from the top-left towards the center, labeled '3.8 mm (Geometric)'. The second line is a dashed line extending from the middle-left towards the center, labeled '6.6 mm (Geometric)'. The third line is a vertical dashed line located in the lower-right quadrant, labeled '5.2 mm (Geometric)'. The background shows various shades of gray representing different brain tissues.

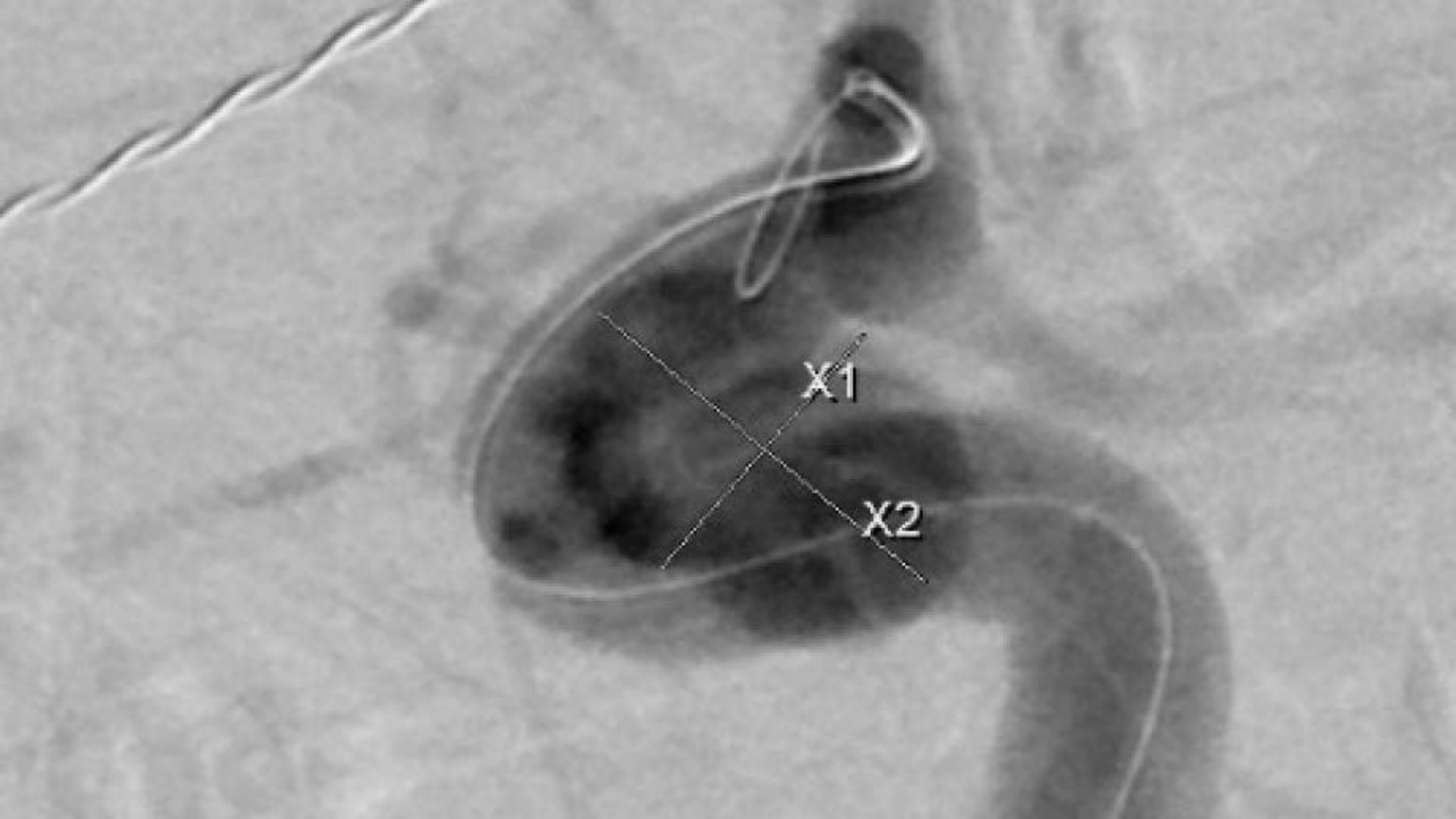
6.6 mm (Geometric)

5.2 mm (Geometric)



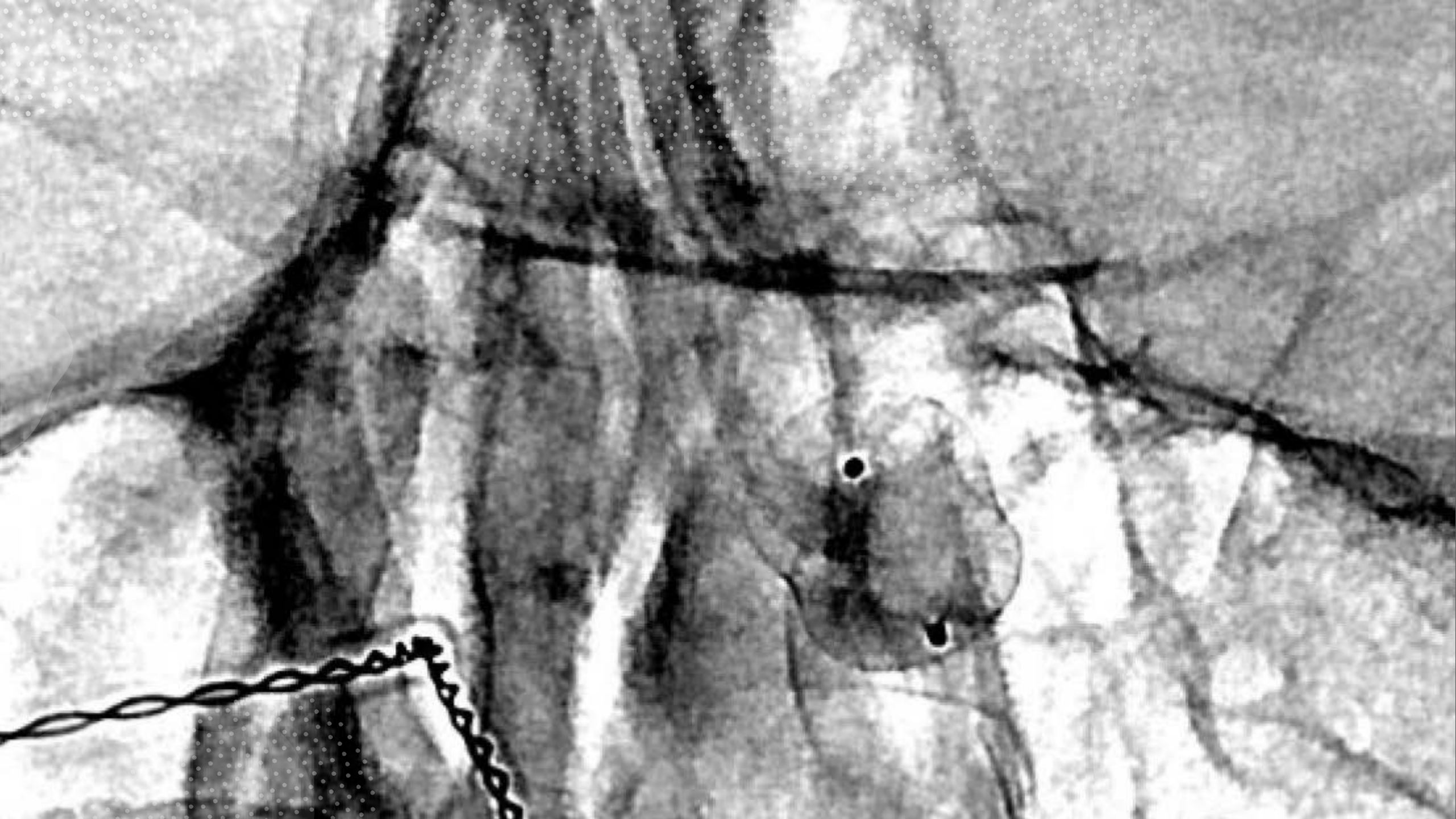
10.6 mm (Geometric)

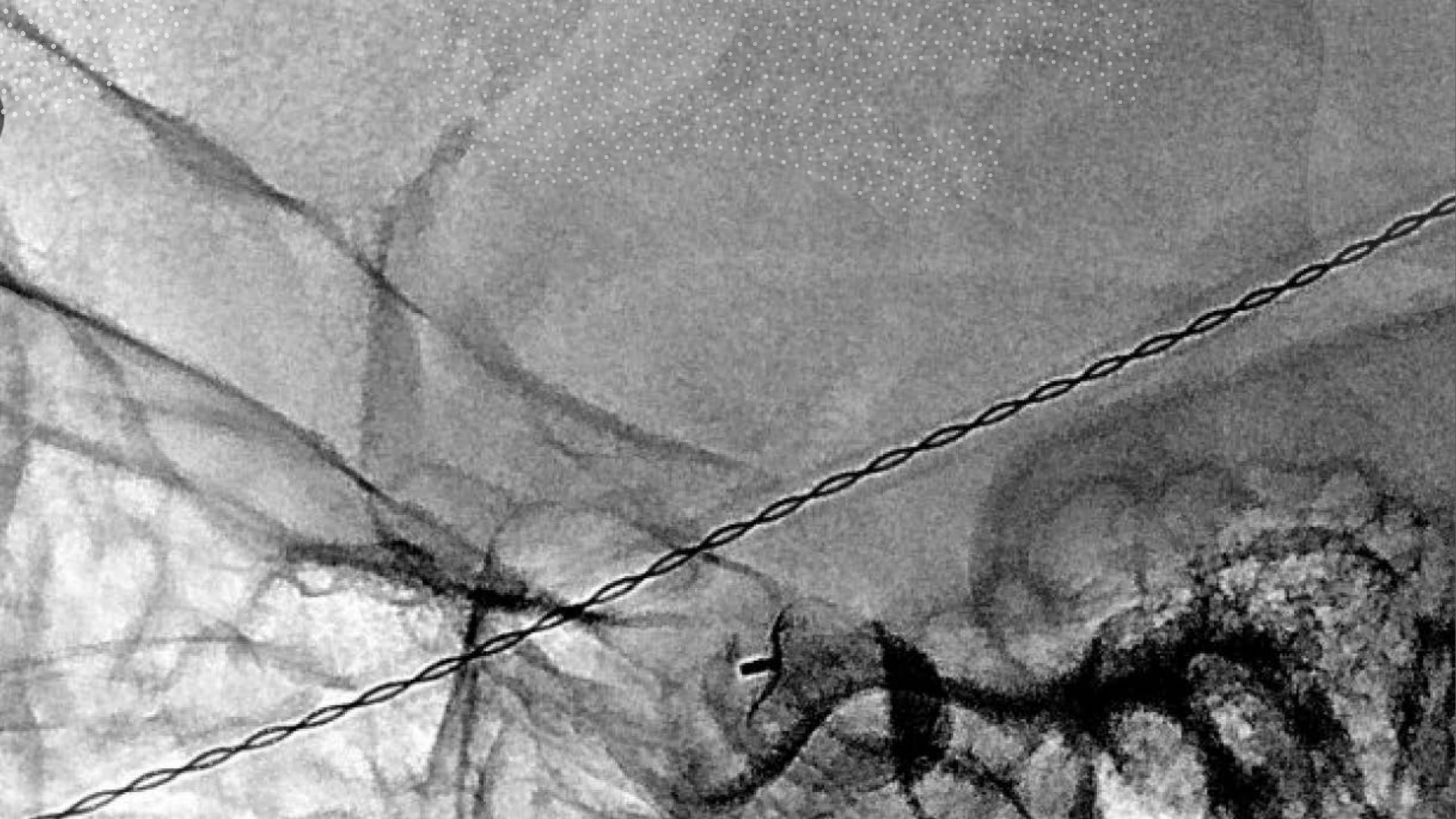
7.4 mm (Geometric)



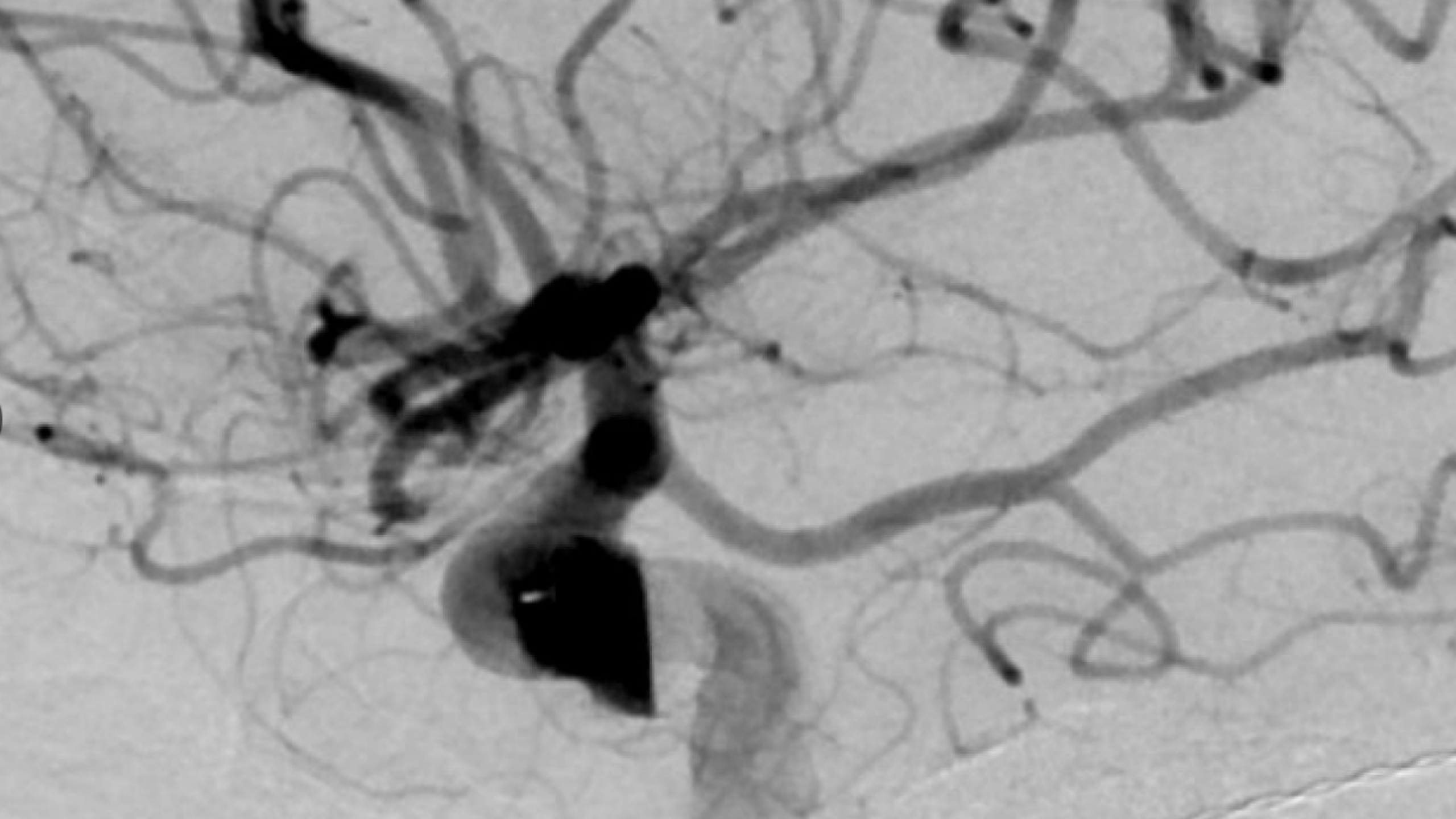
X1

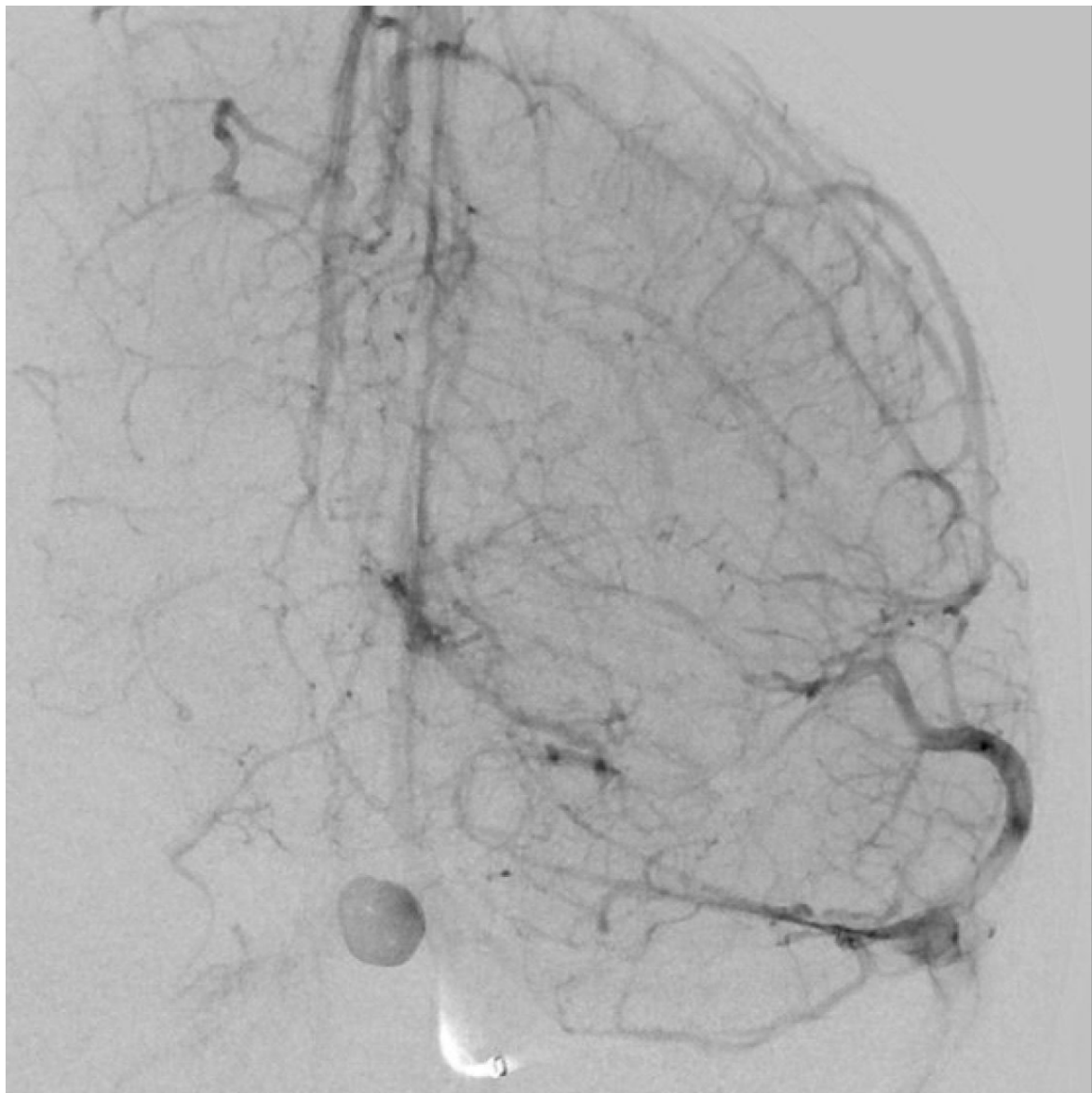
X2



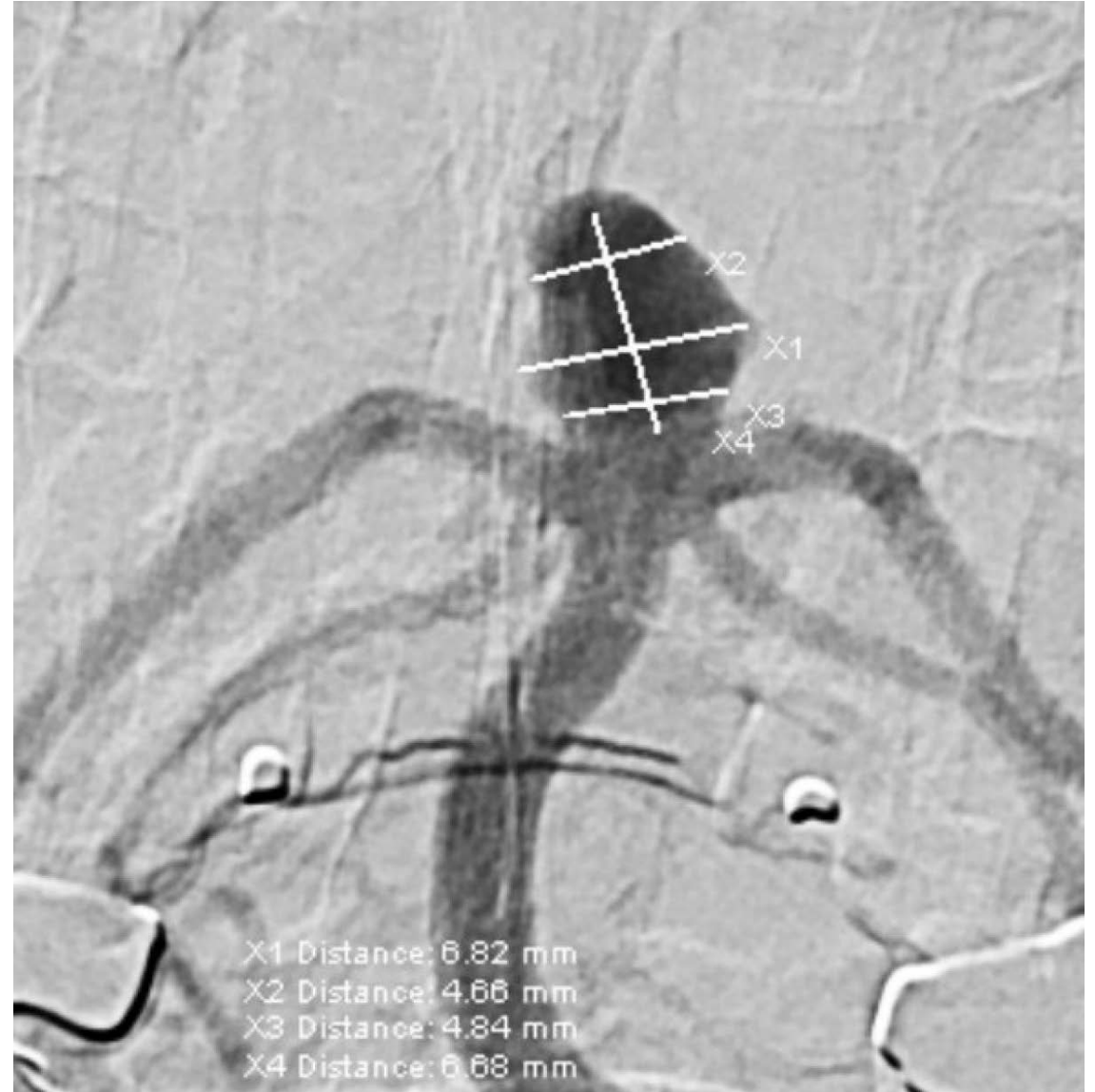




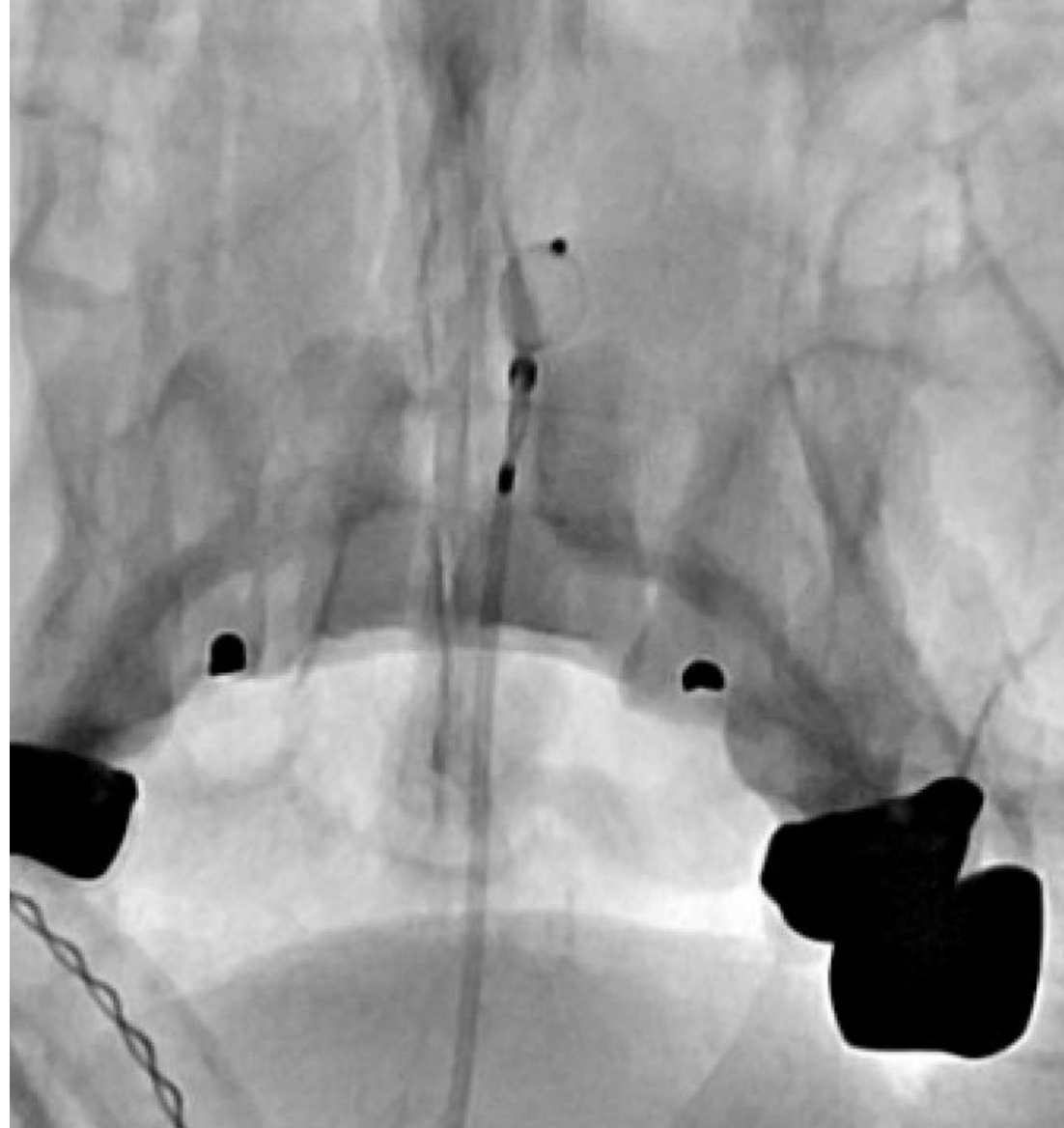


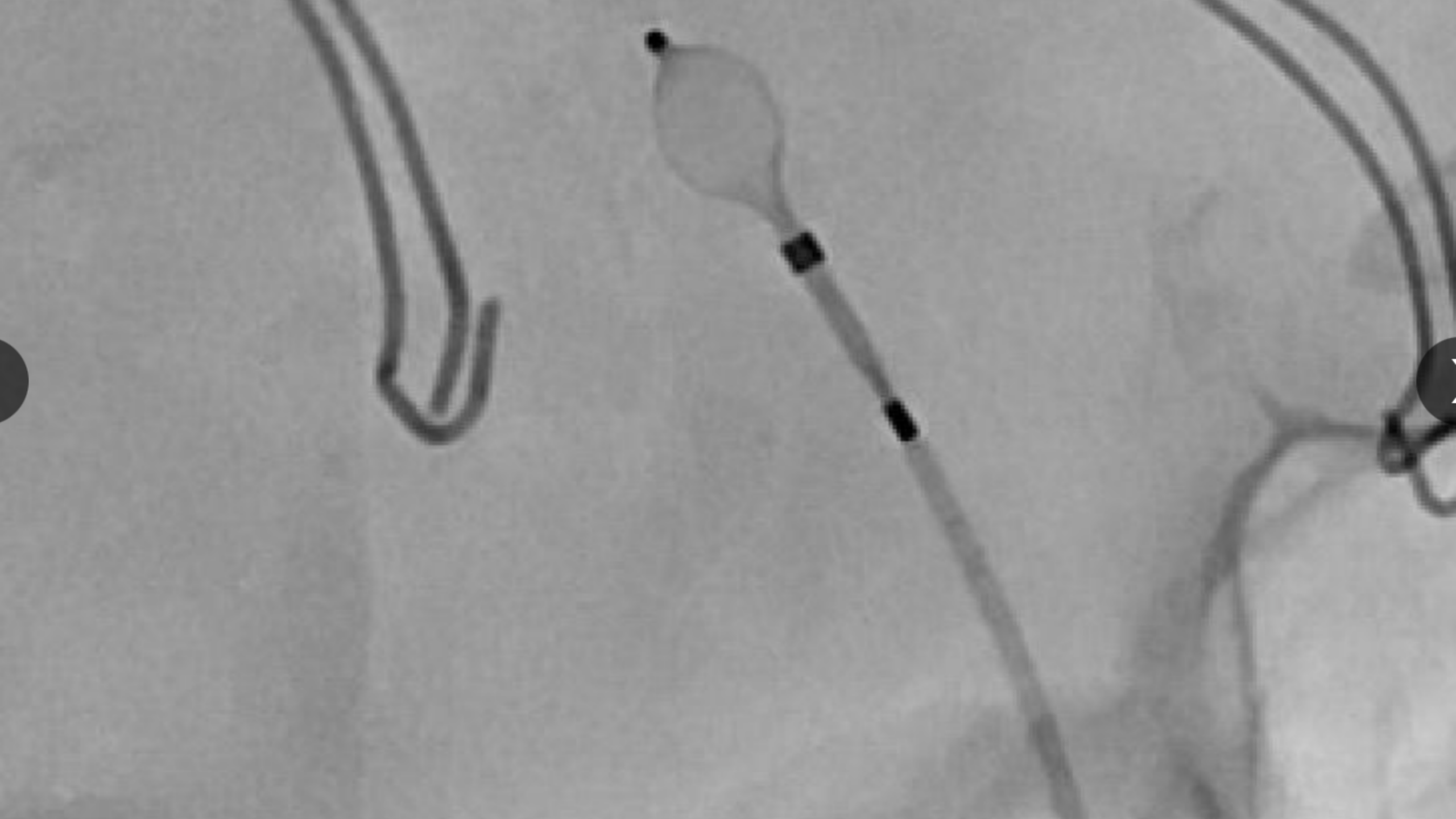


Salvage for intra-procedural rupture

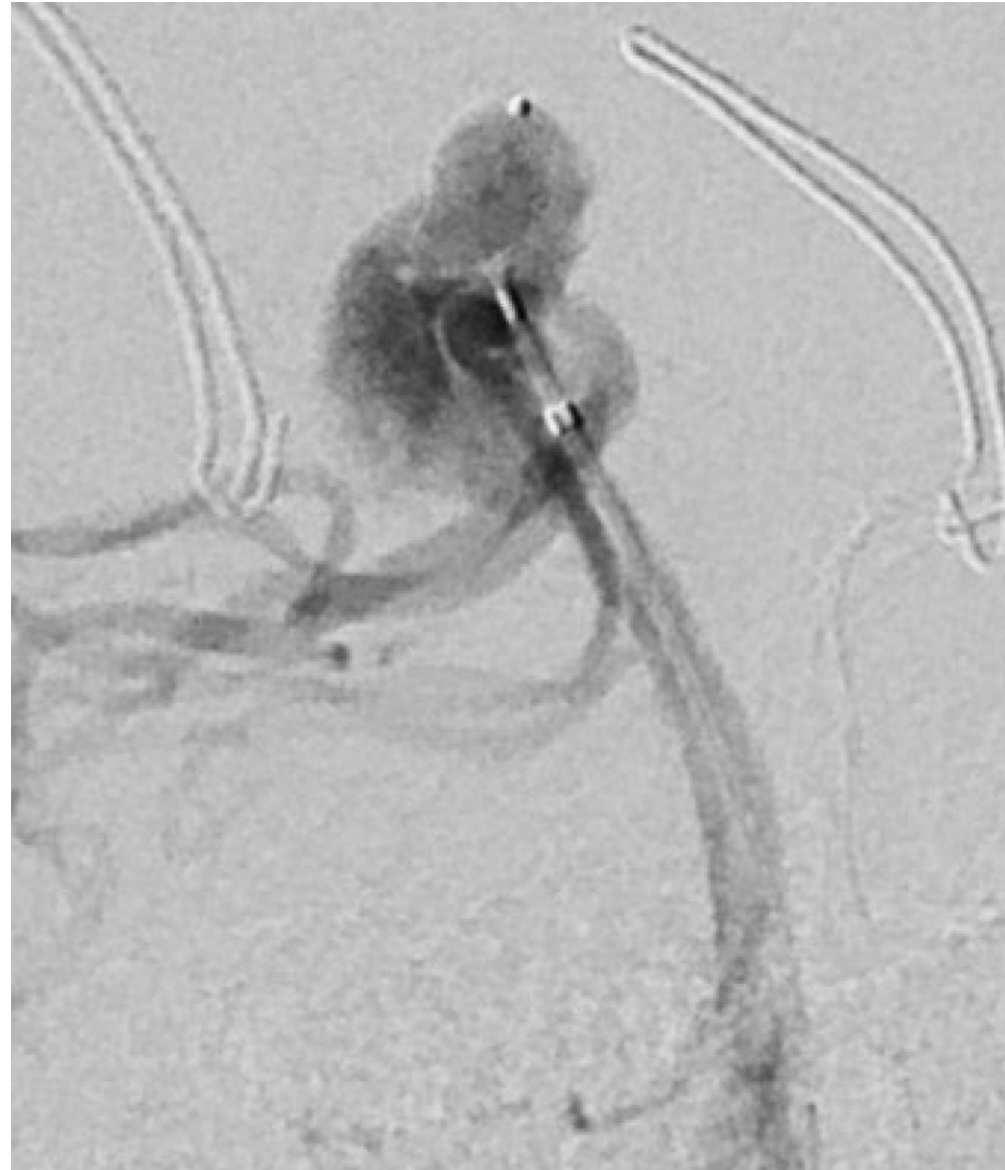


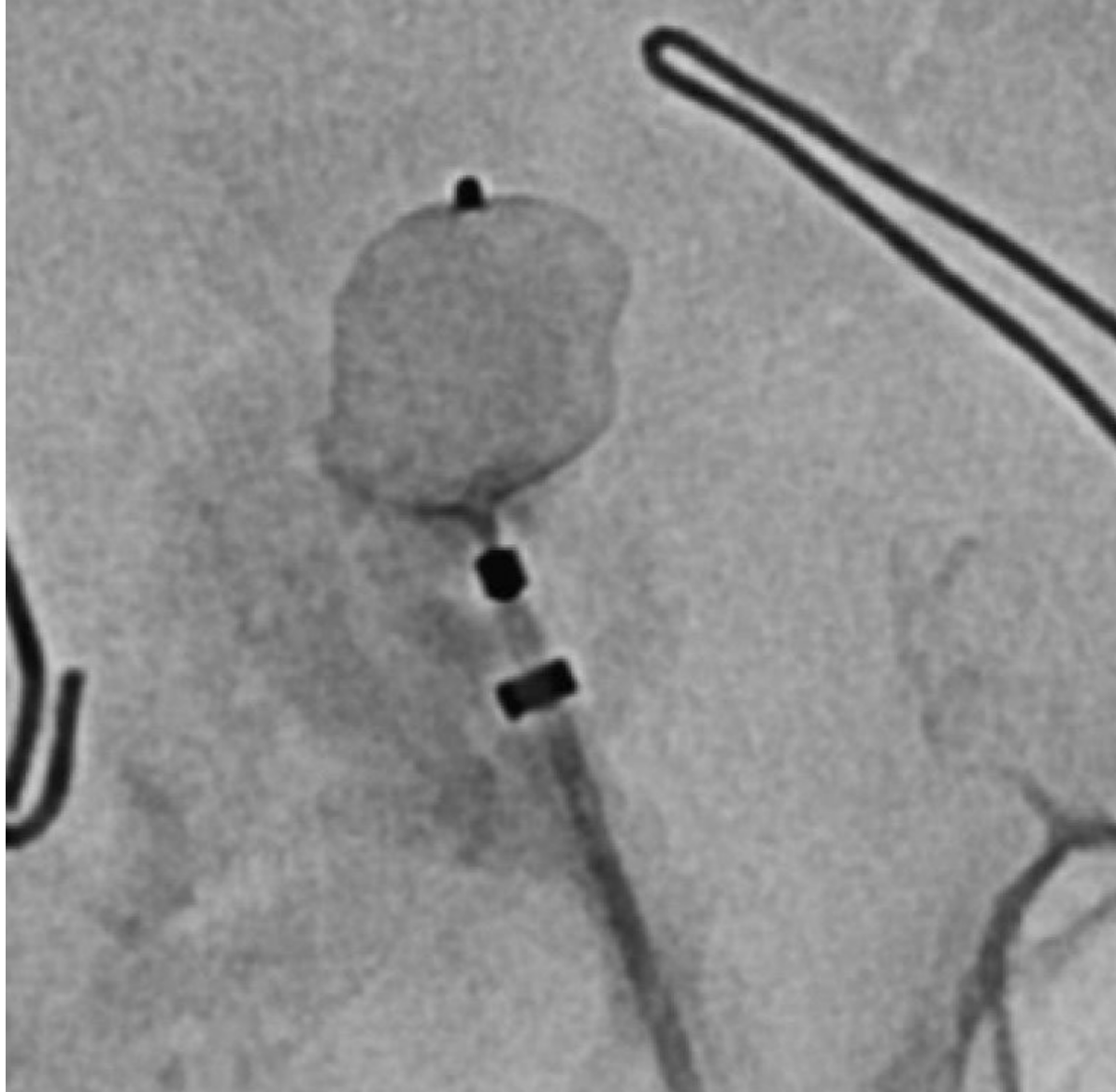










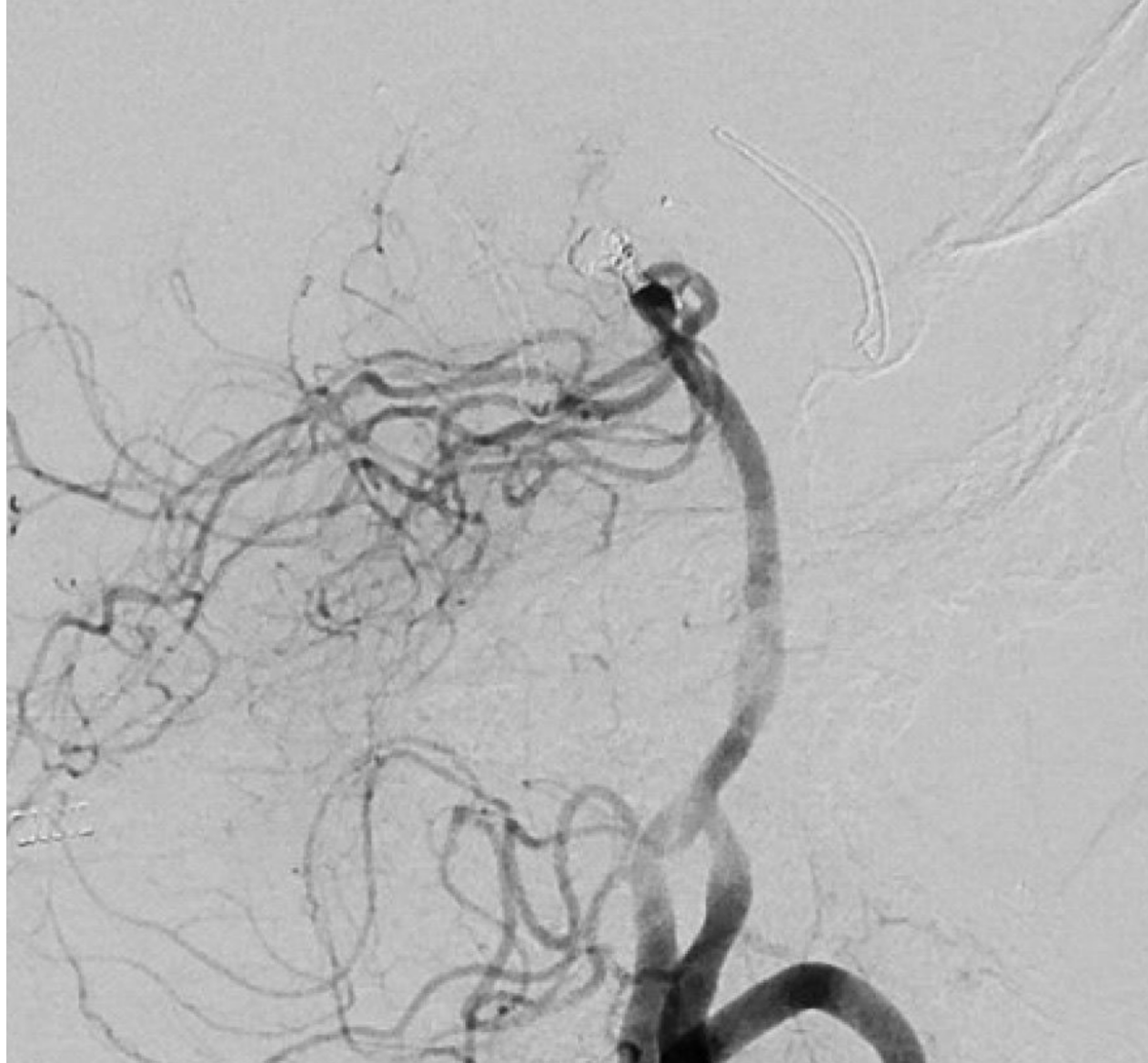






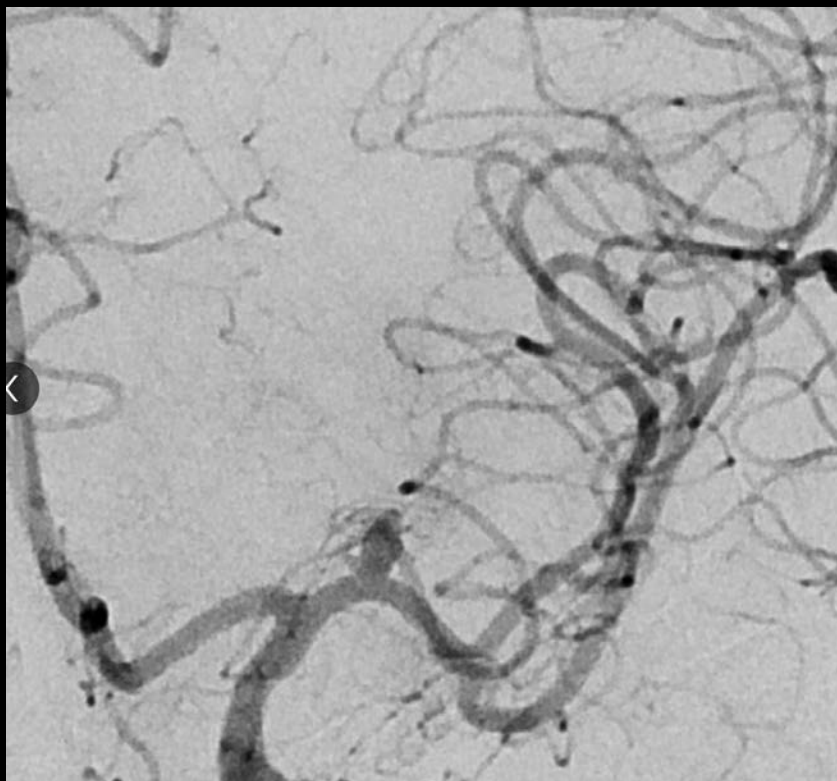


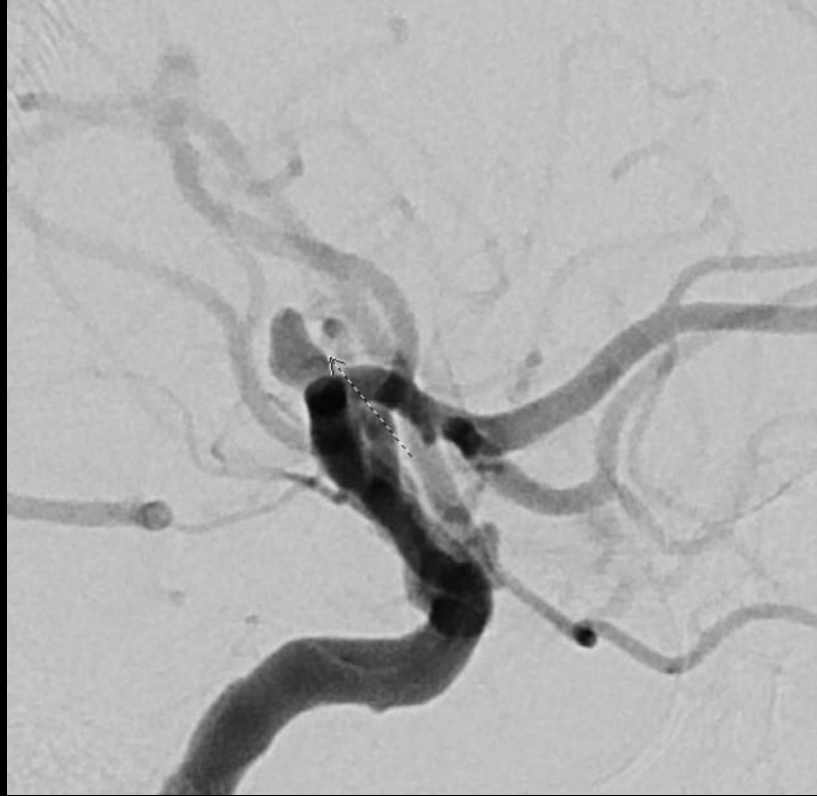


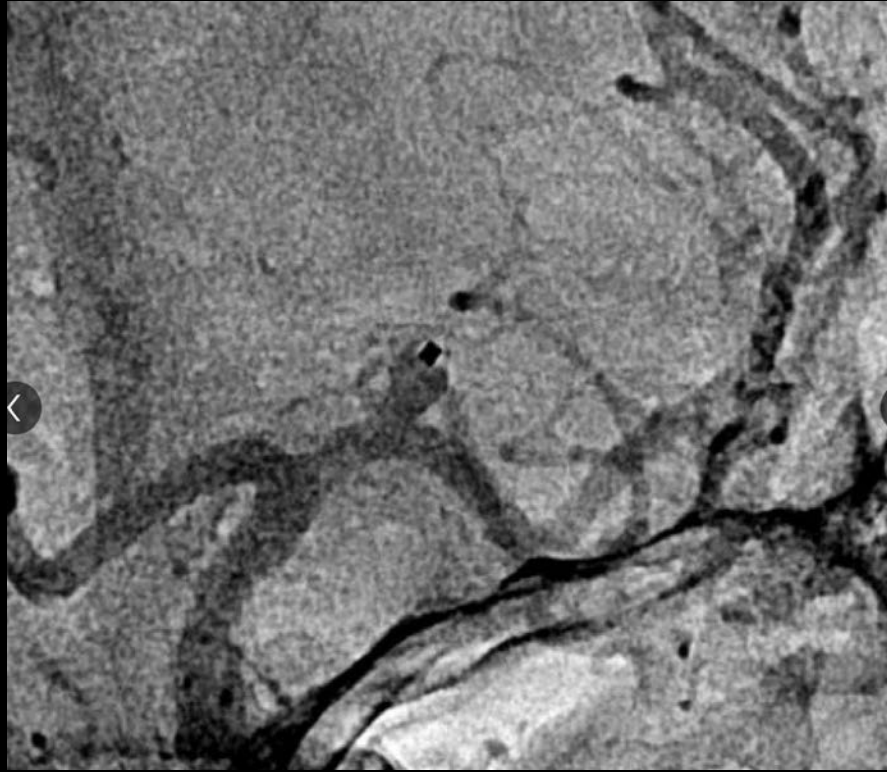


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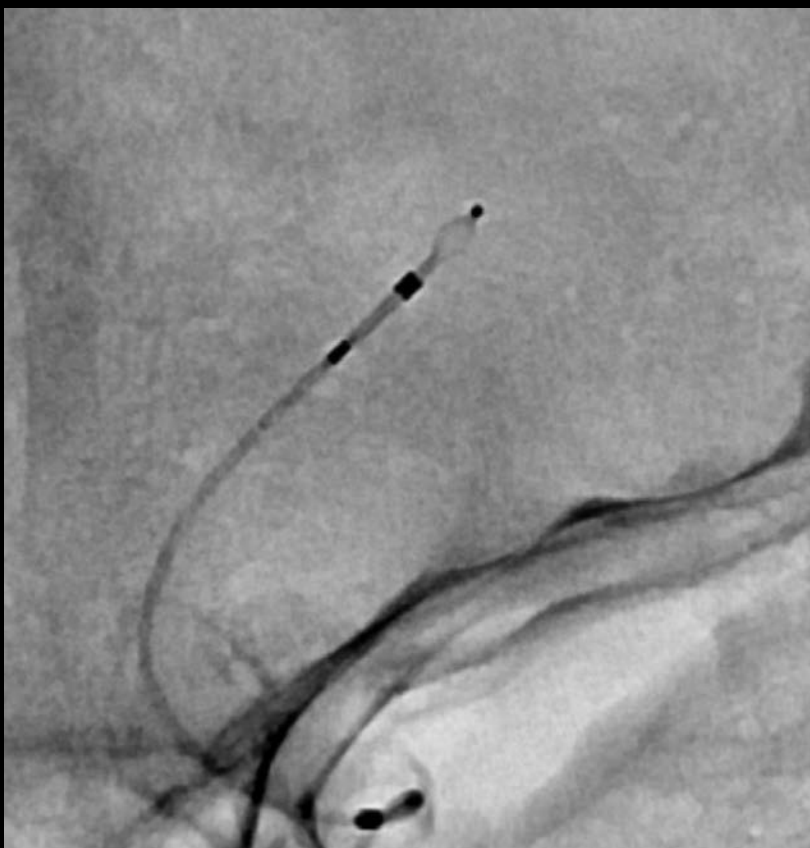




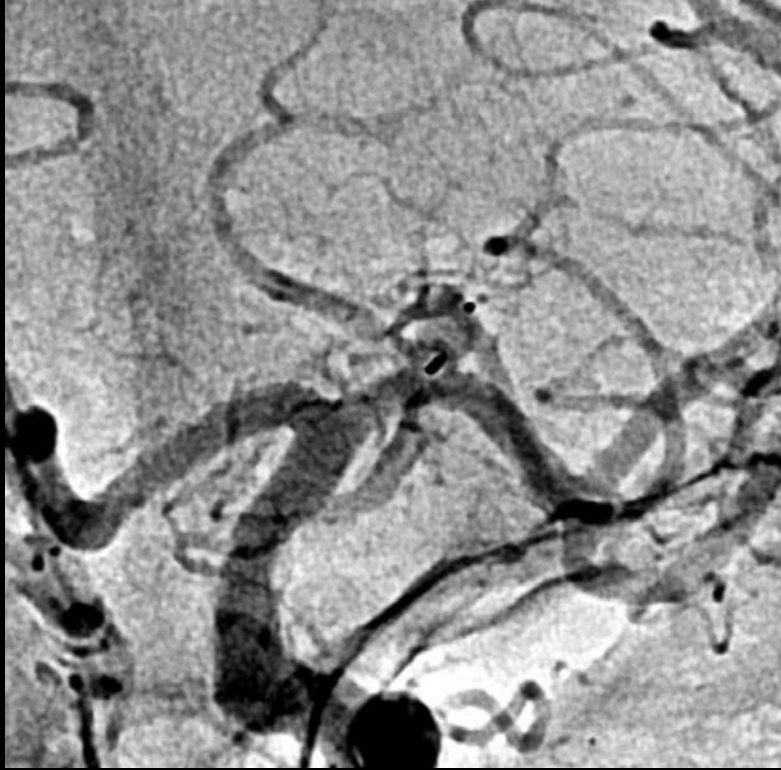


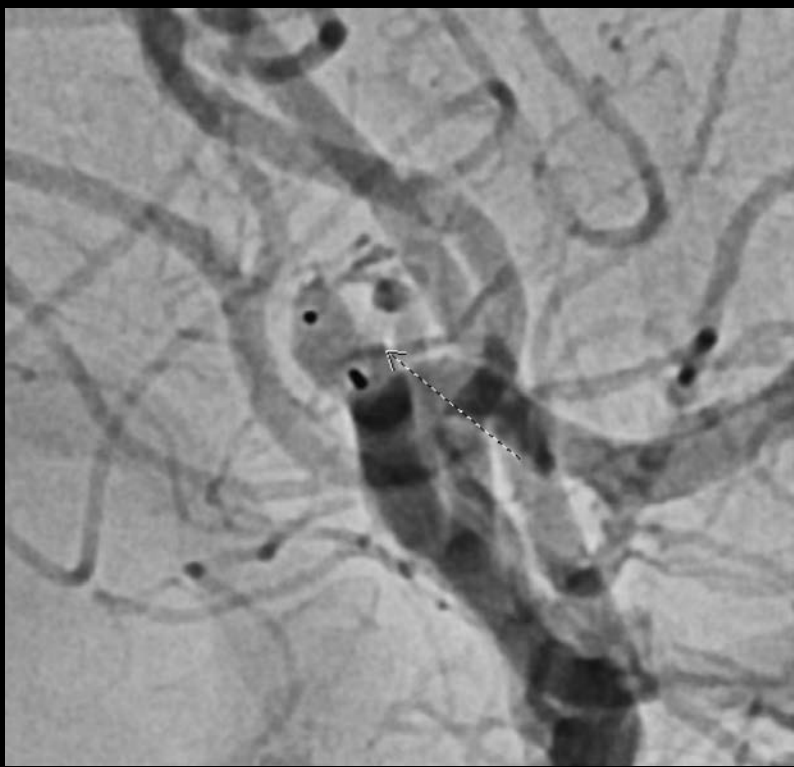


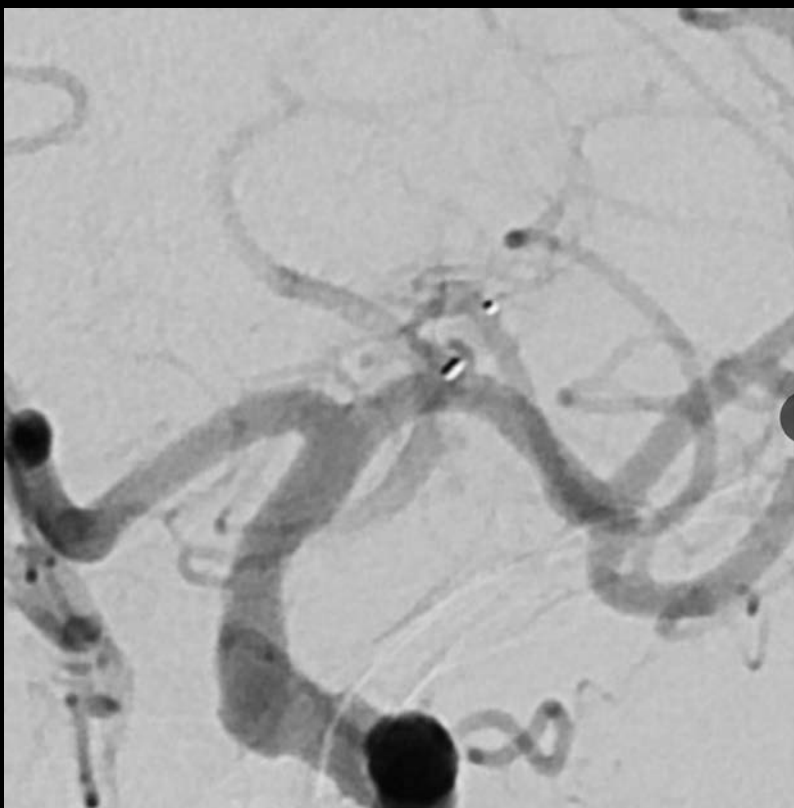


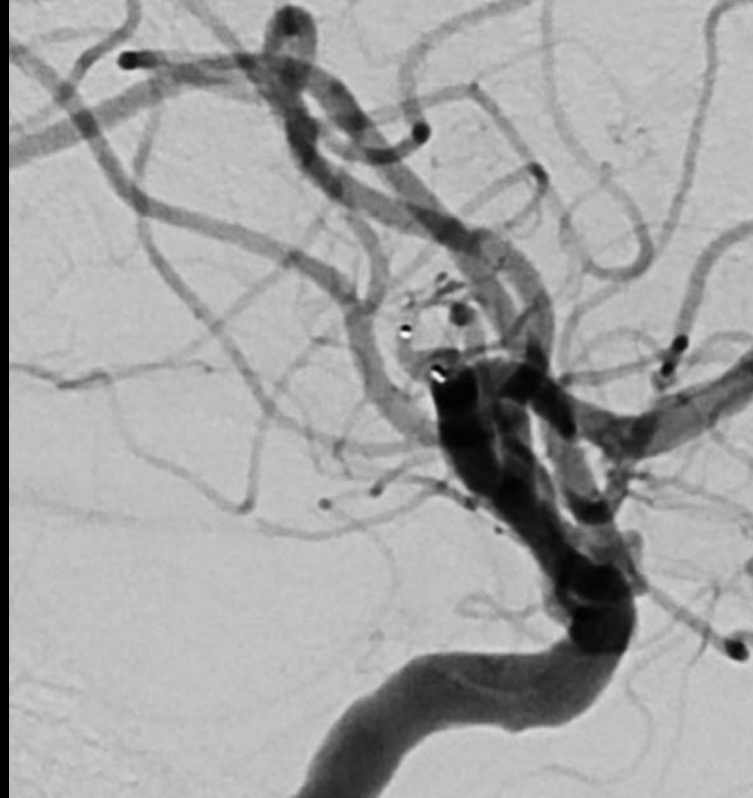








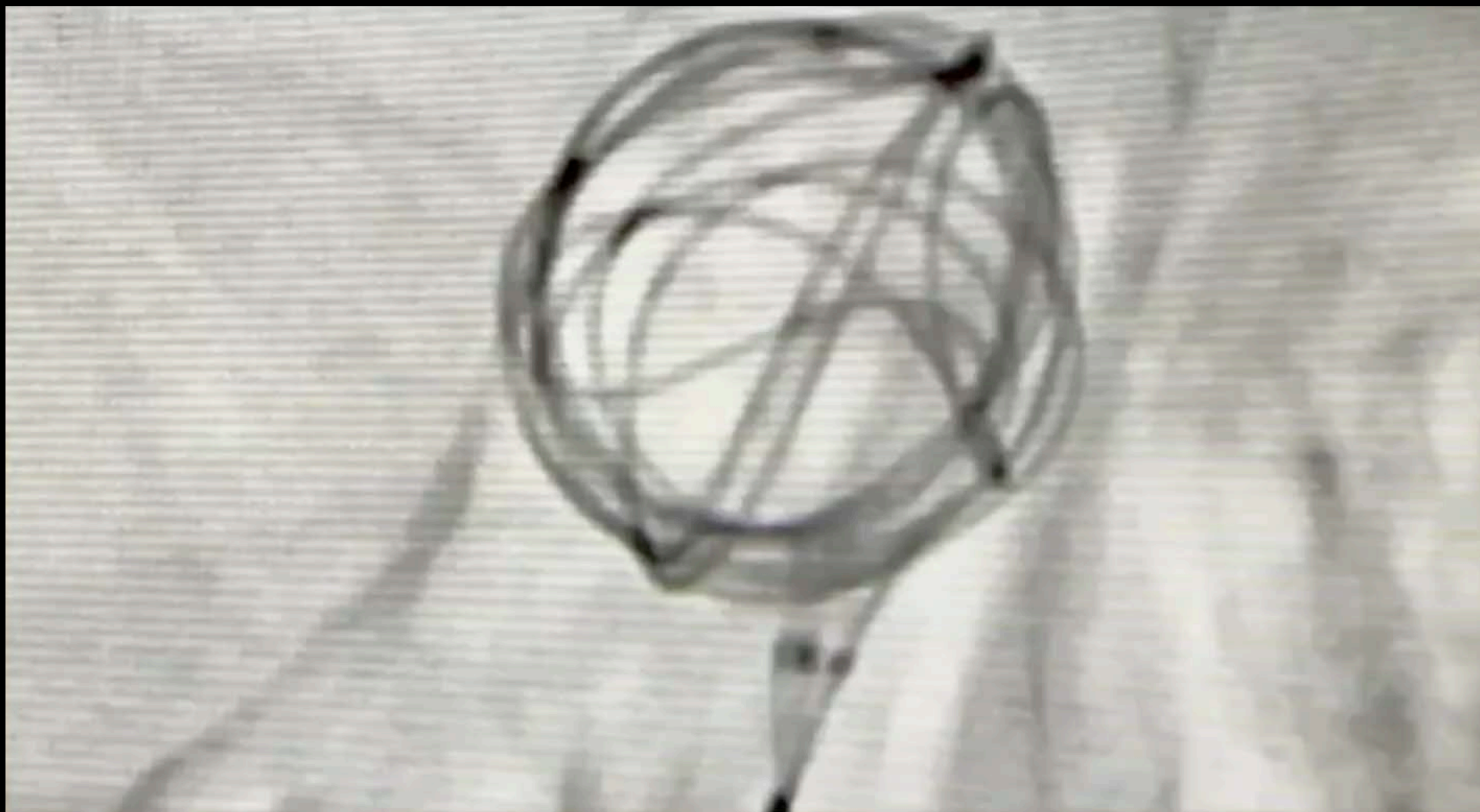








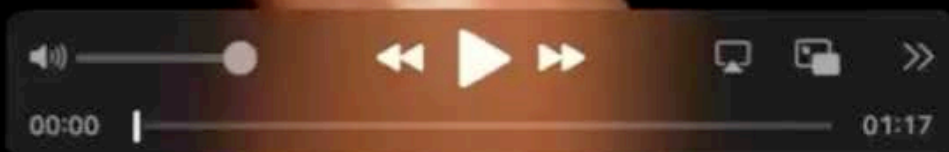








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Thank you