

# Endovascular Stroke Therapy

Update with Emphasis on  
Practical Clinical and Imaging  
Considerations

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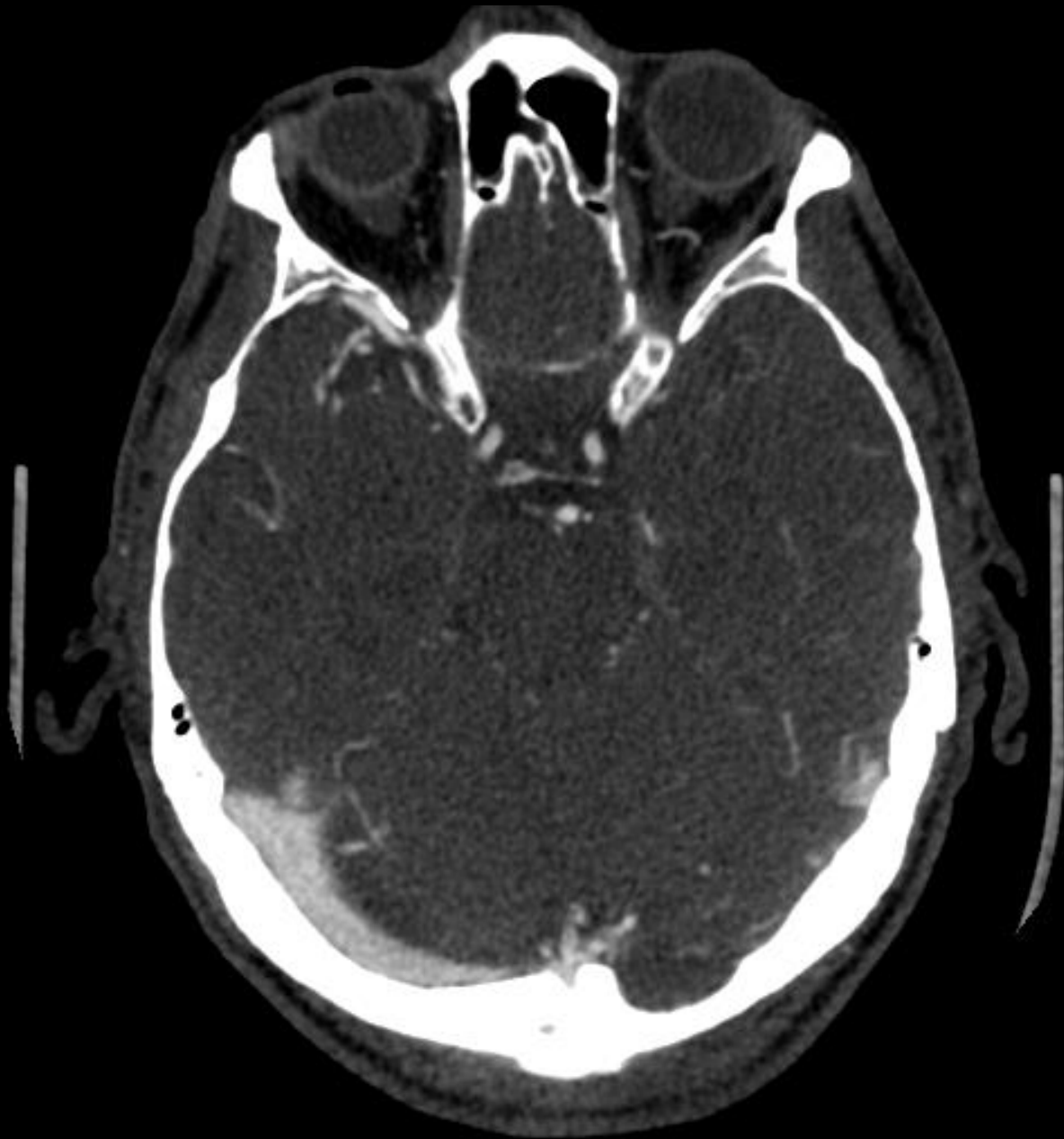
# Disclosures

- I have no relevant financial disclosures or conflict of interest

# Overview

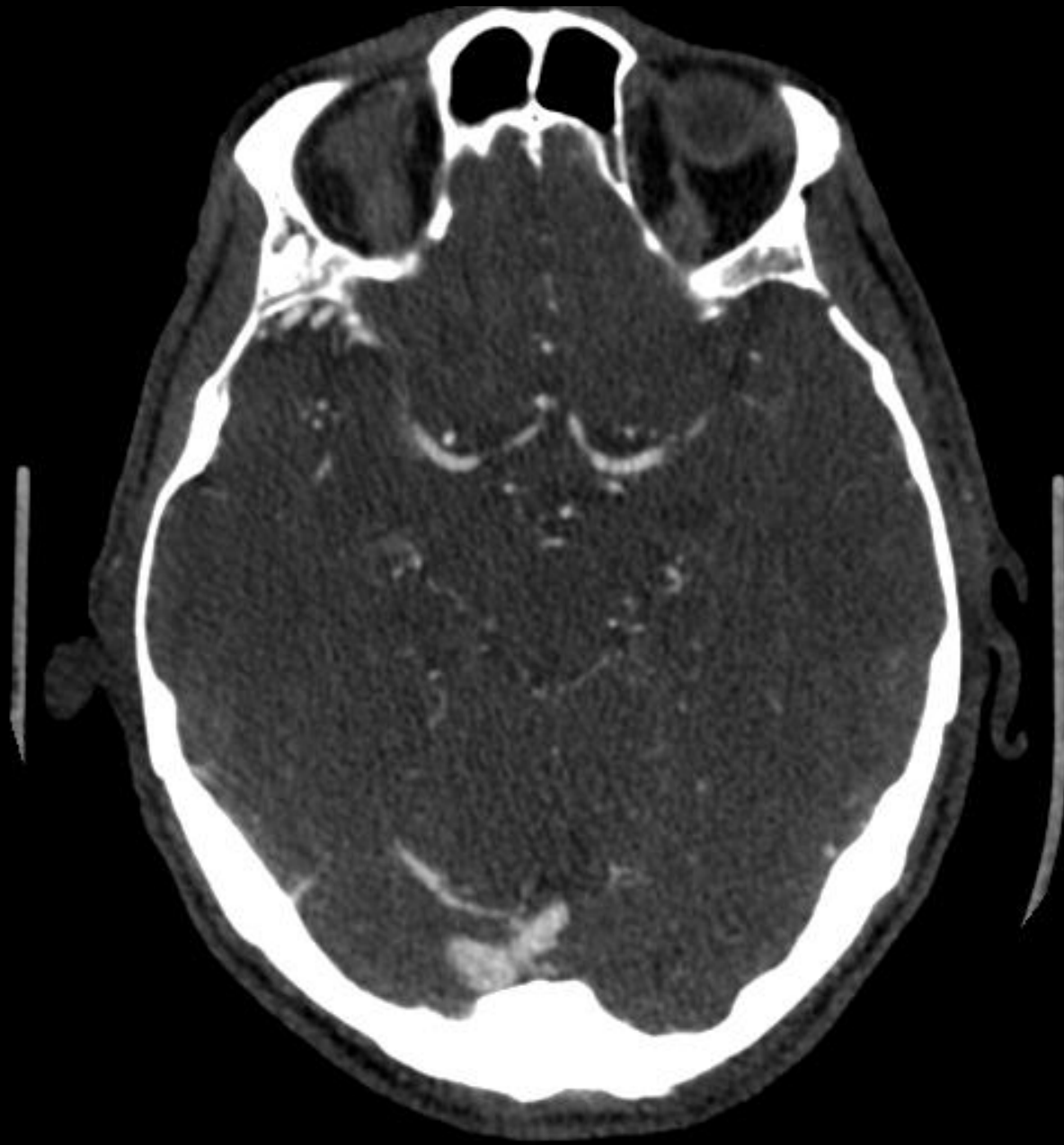
- Review of the recent literature
  - Emphasis on what was studied, reasons for trial failures/successes and implications for imaging.
- Review Canadian practice guidelines
- Use the literature and national guidelines to develop a practical, acute imaging protocol





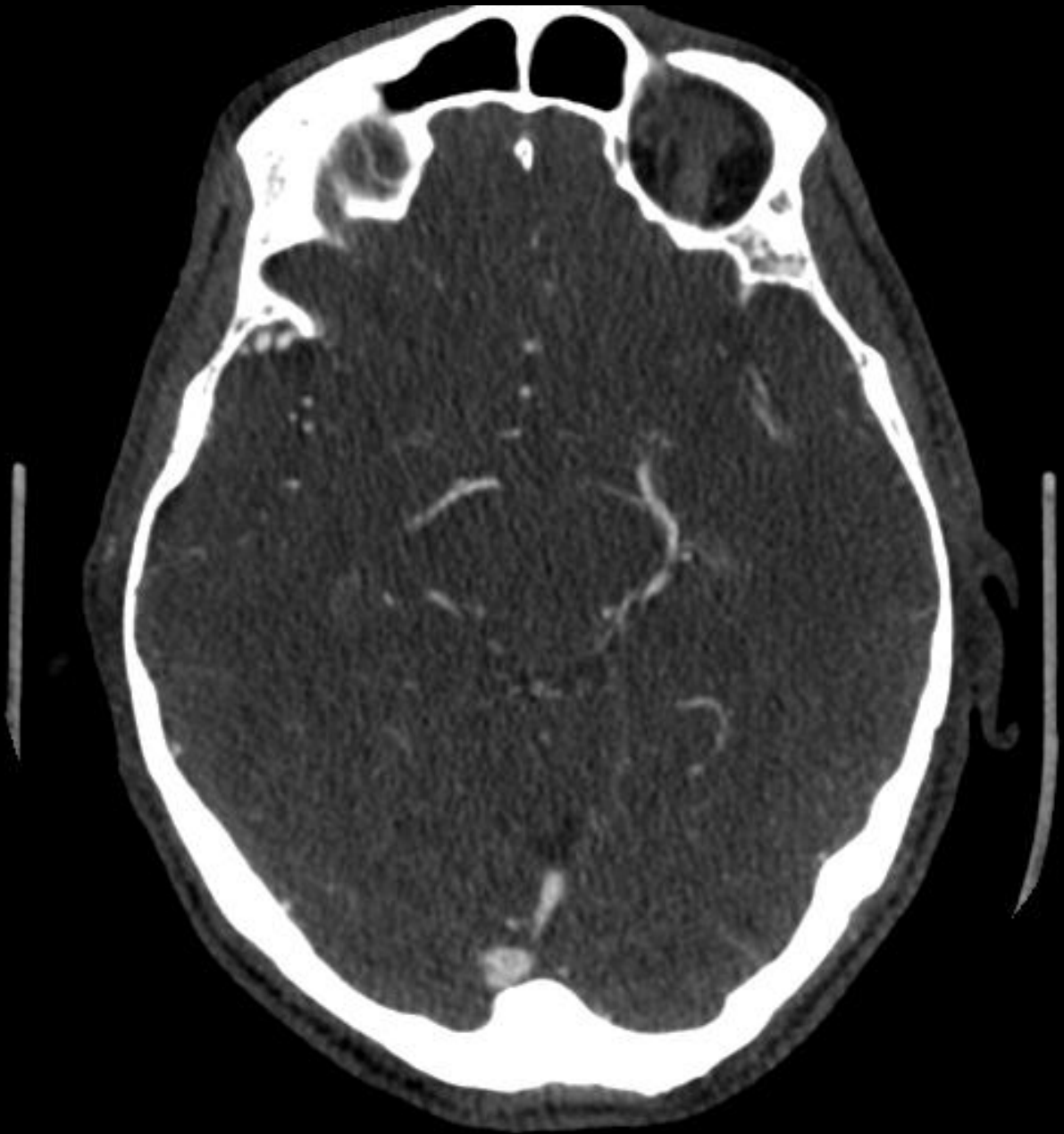


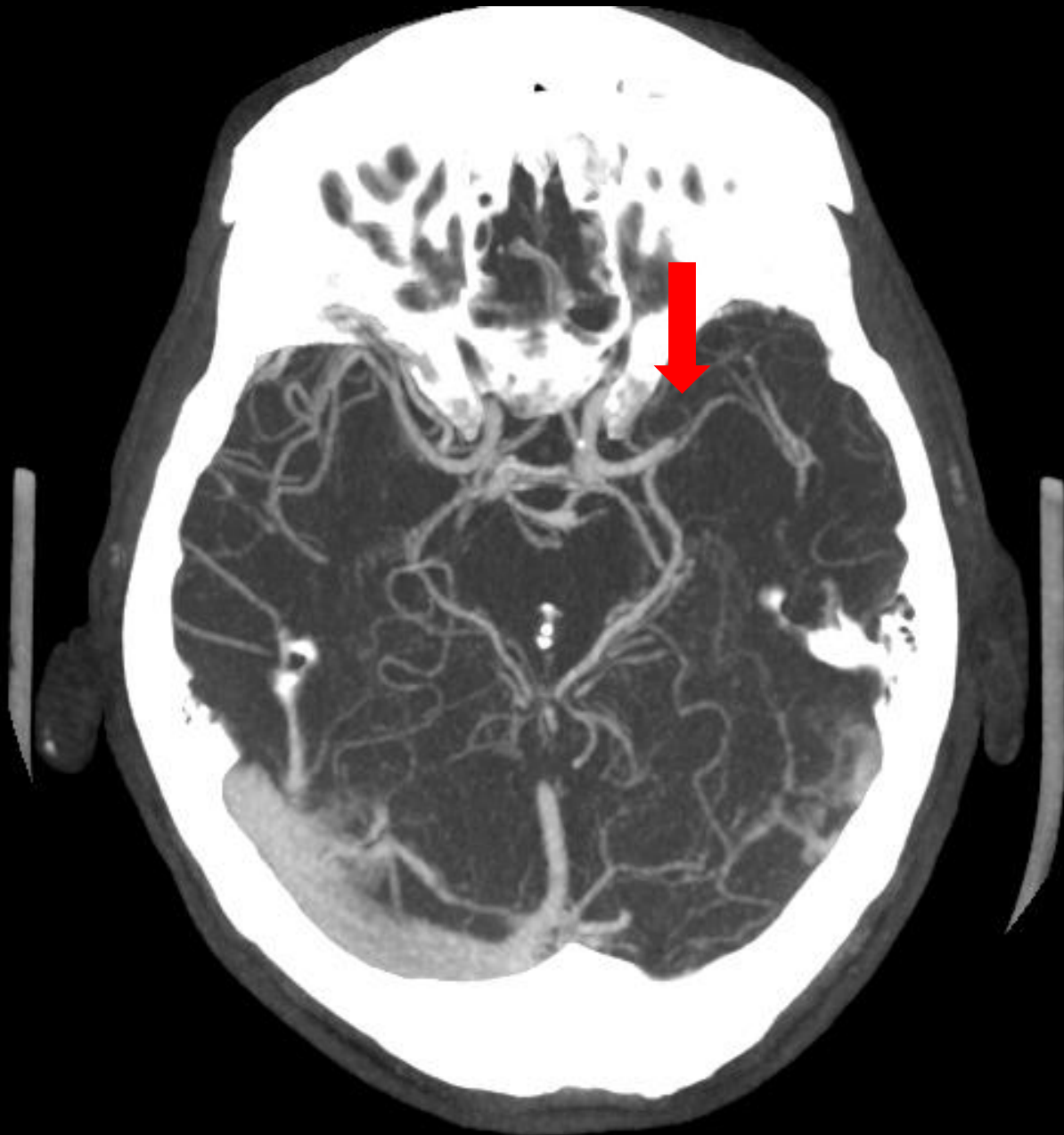






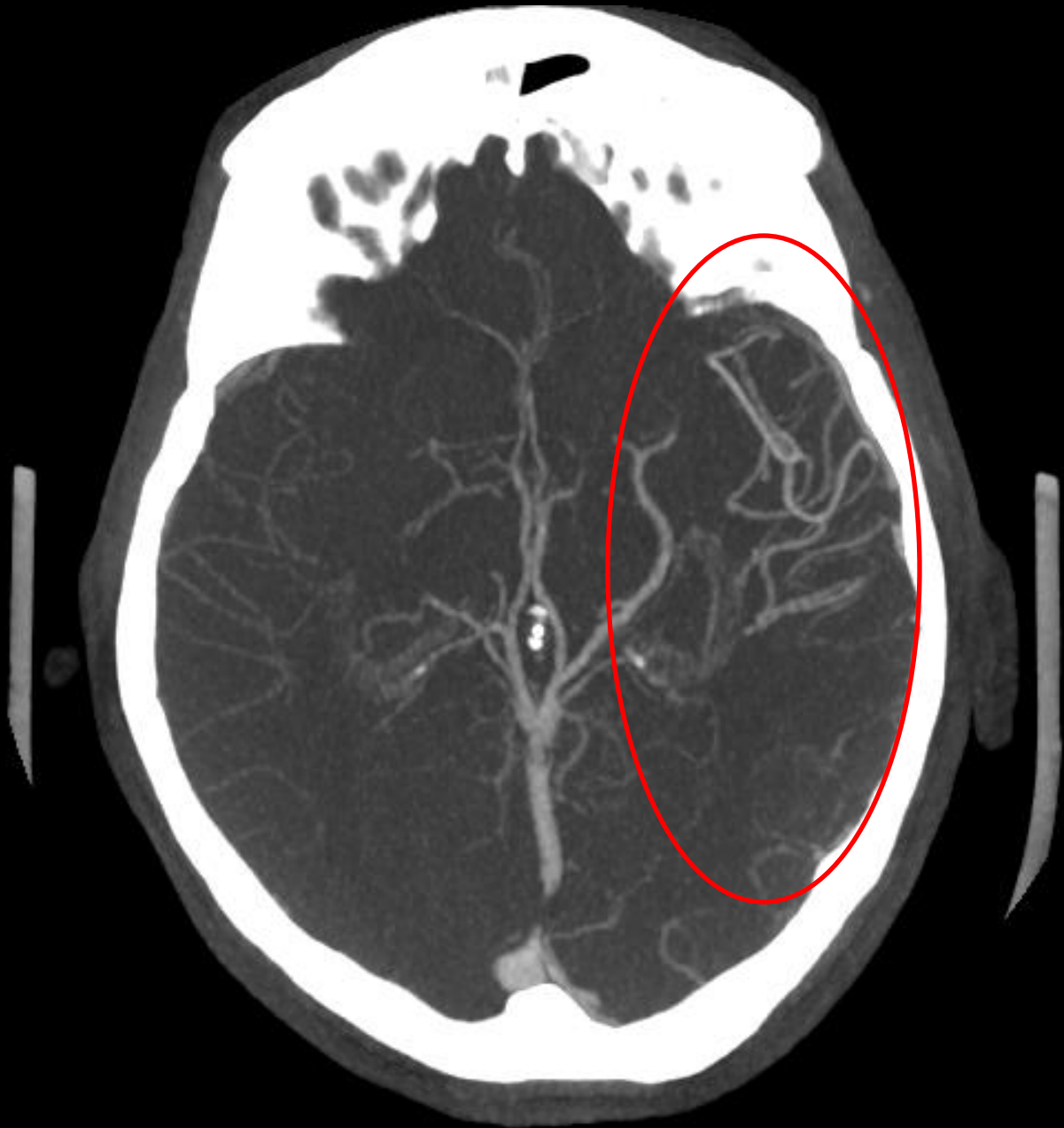




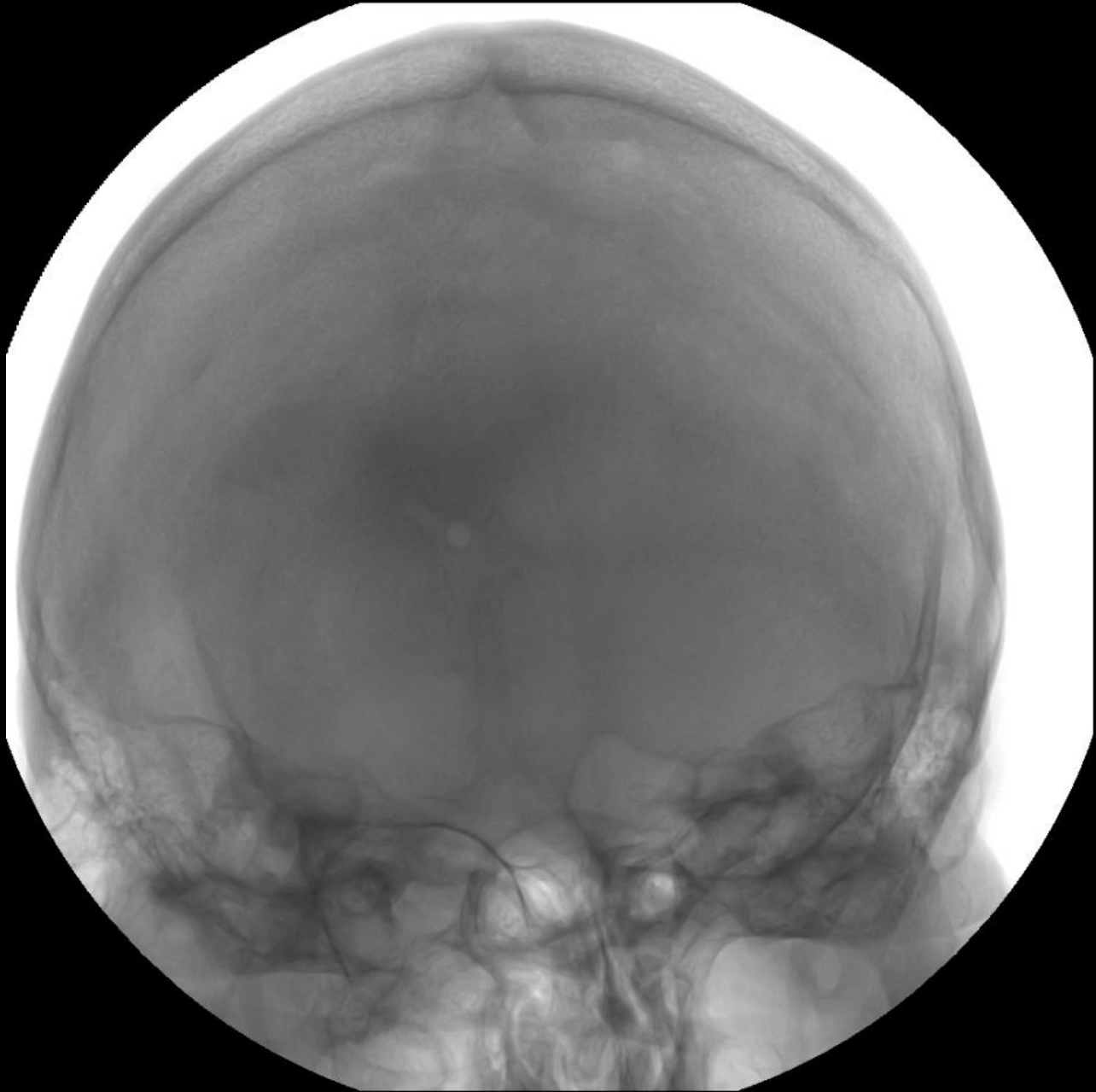




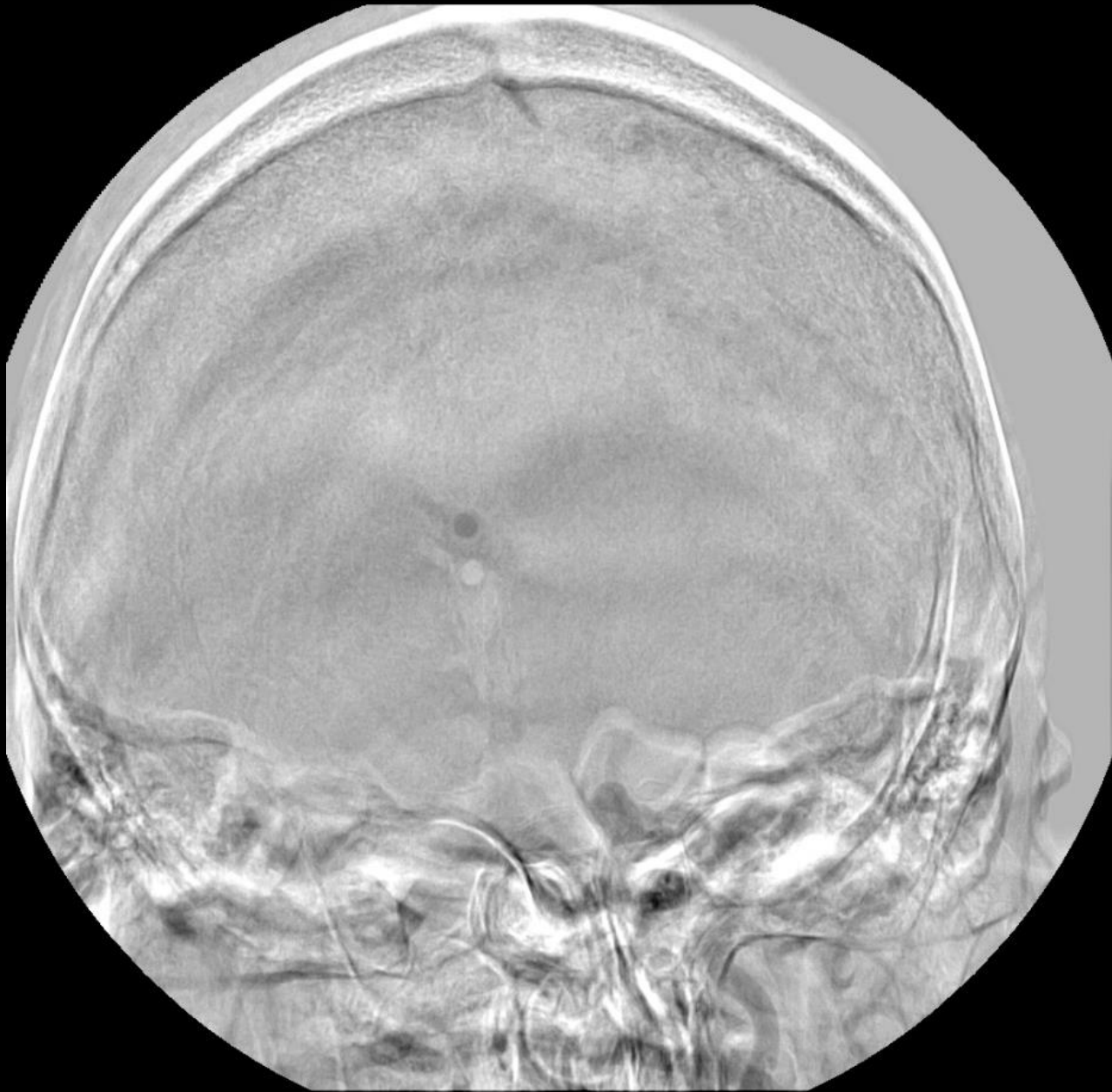


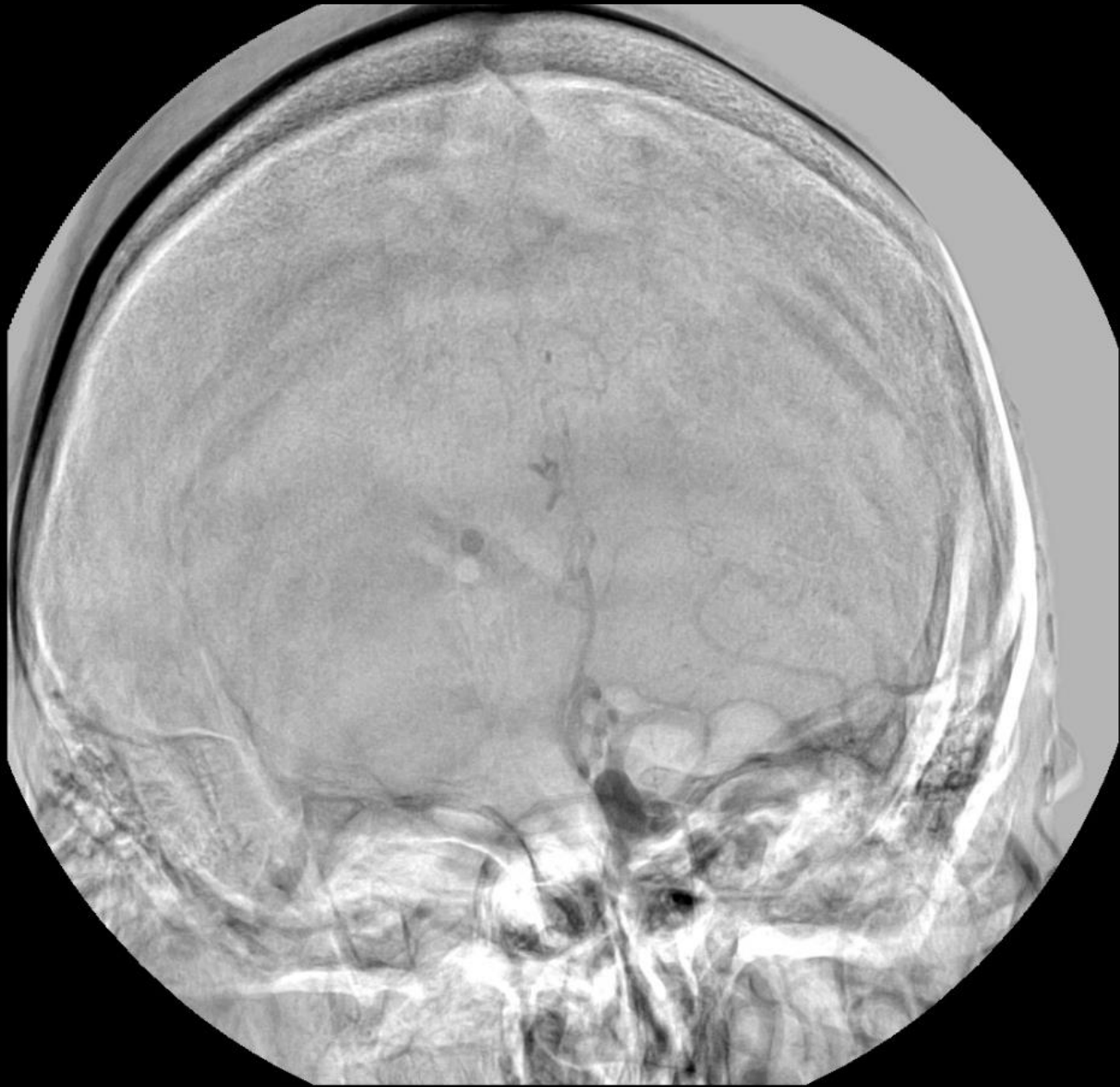


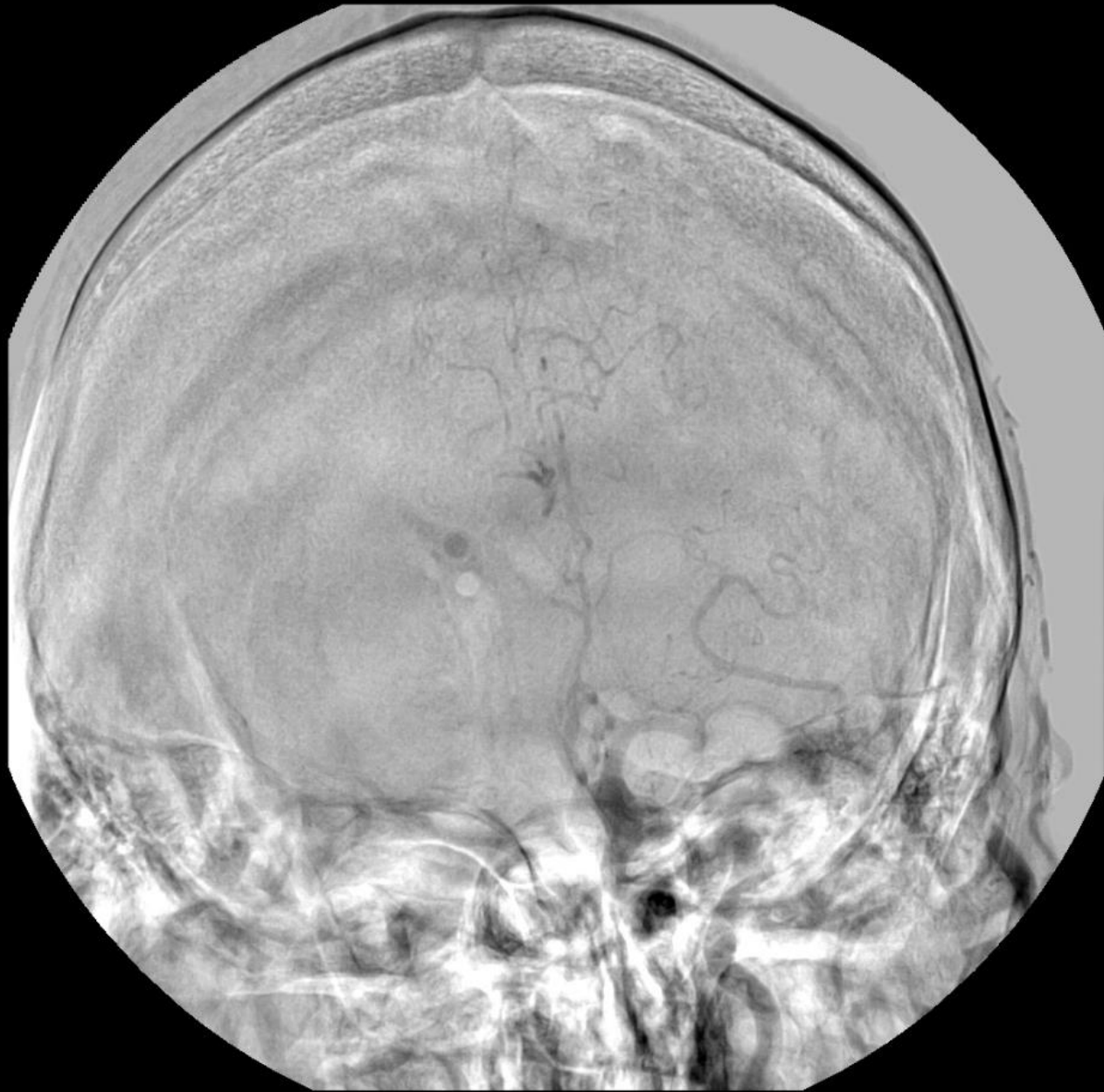




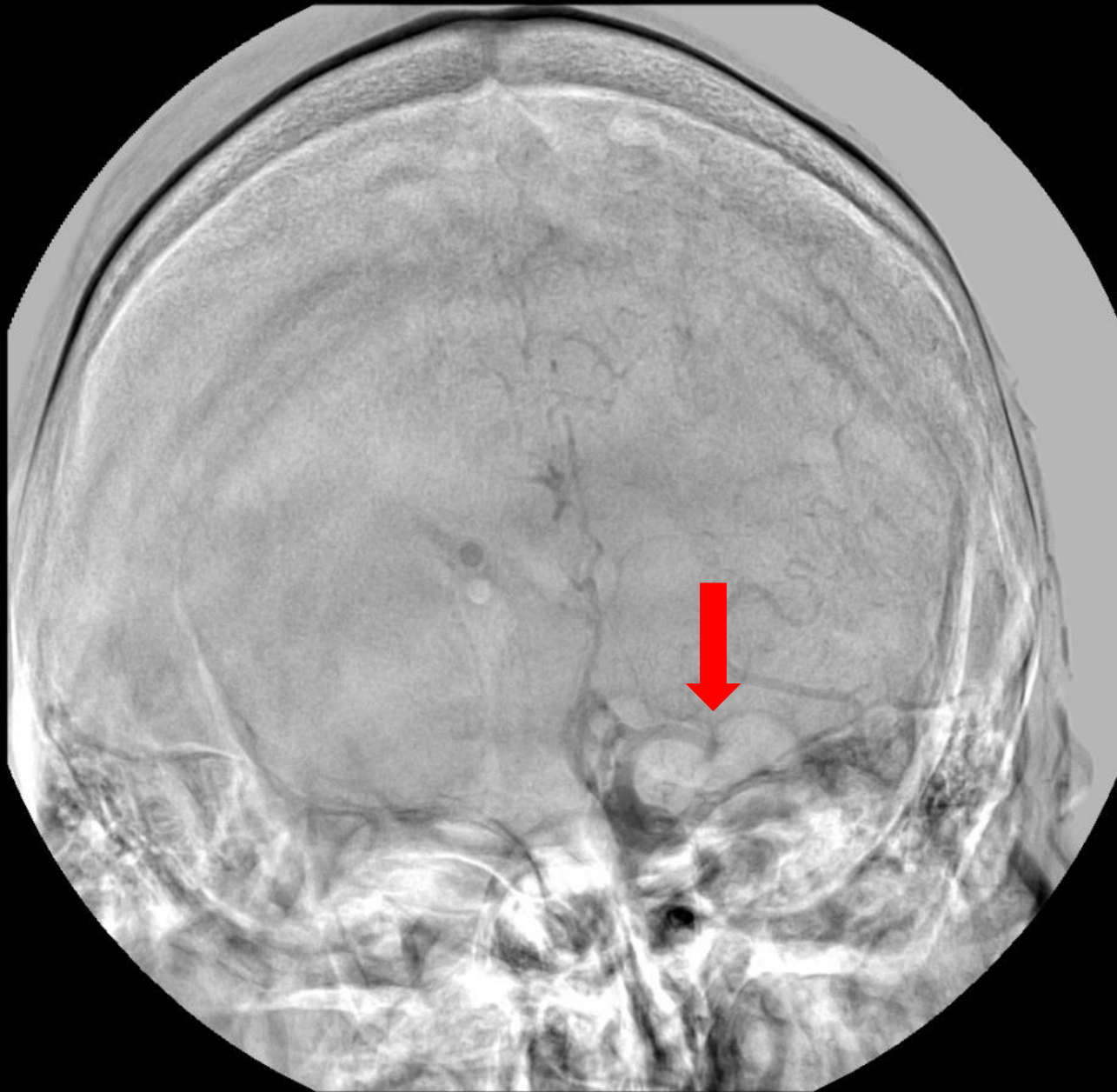




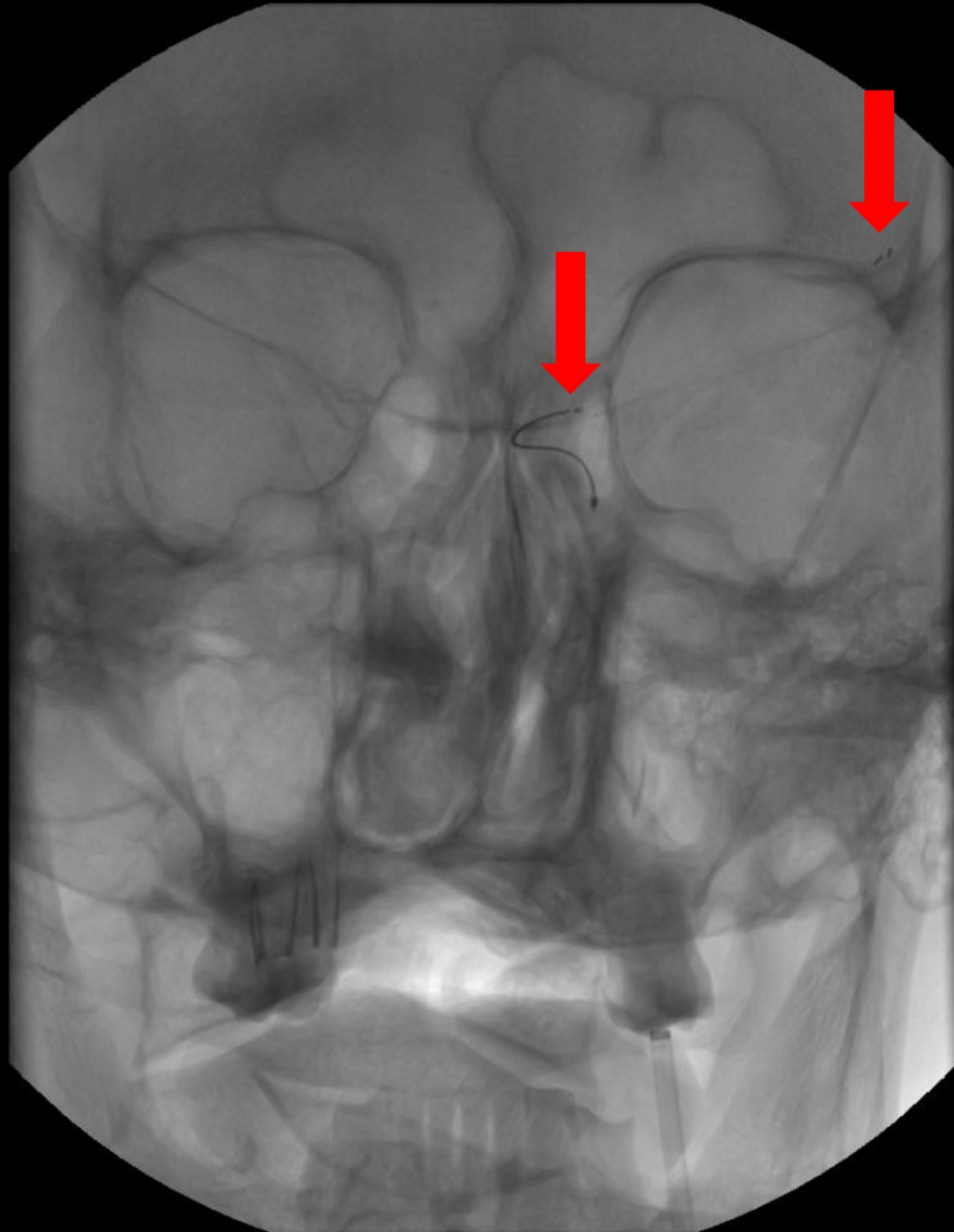


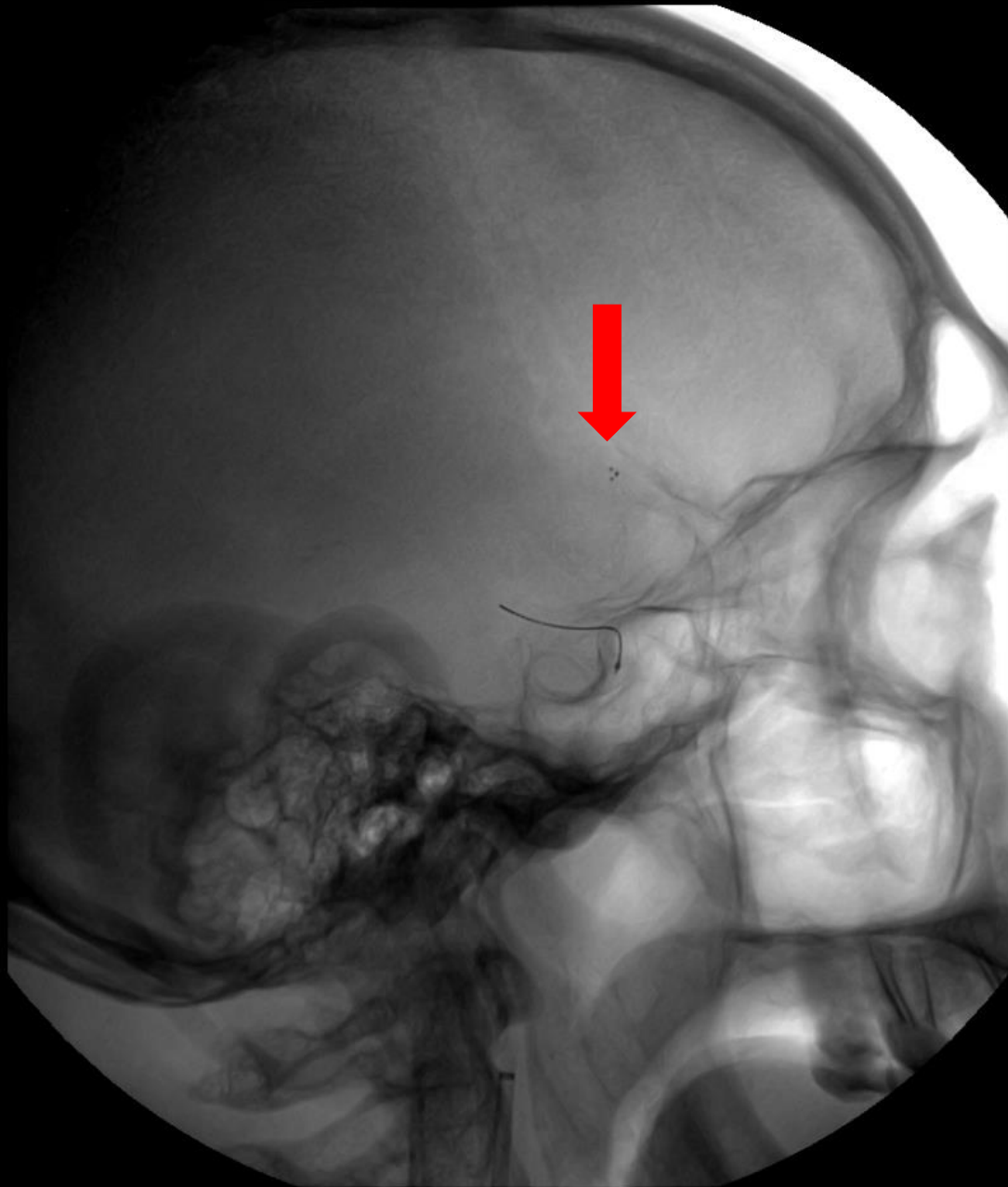












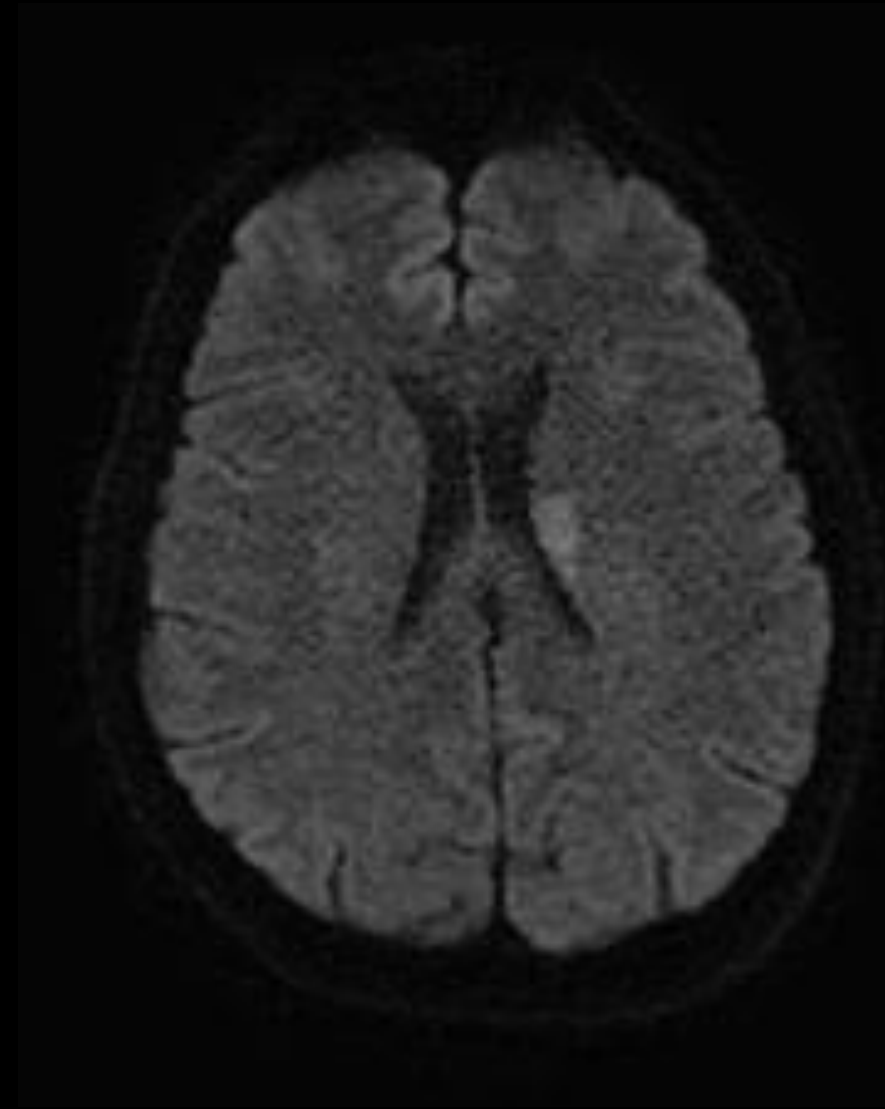
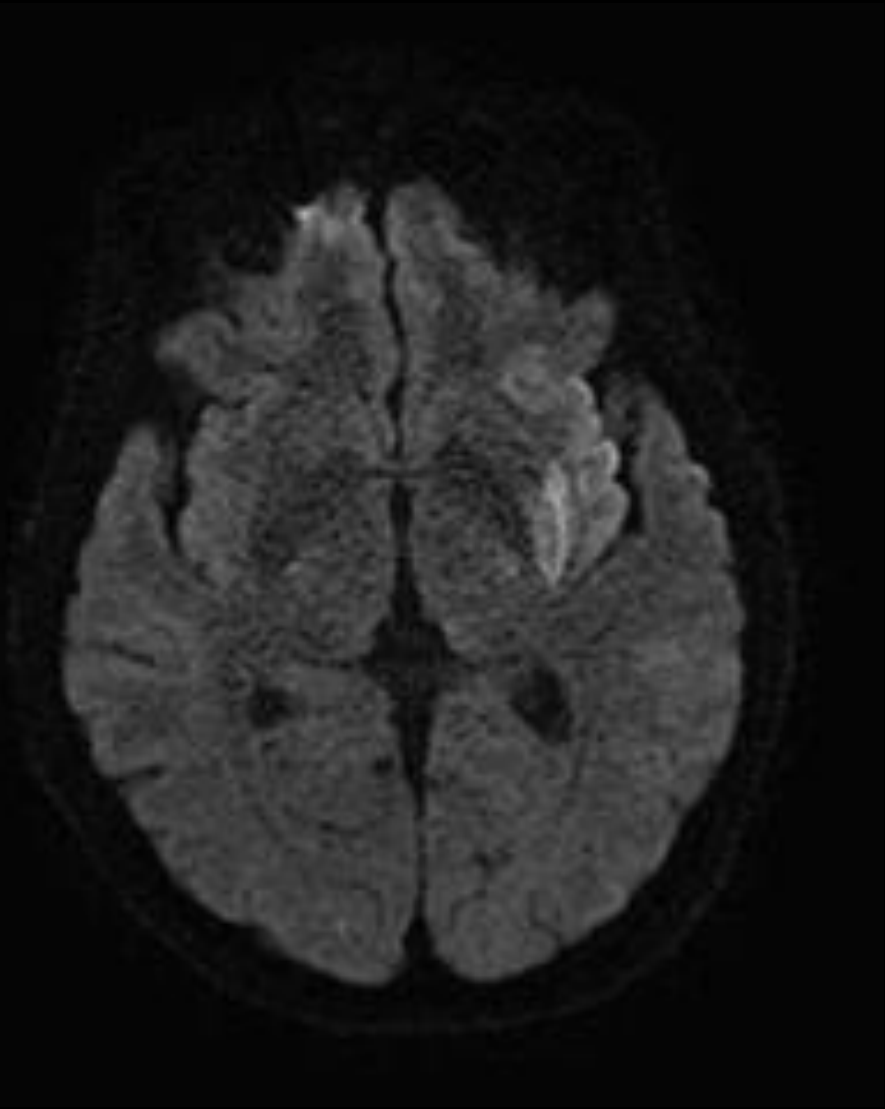












# Recent Stroke Trials

- In addition to ESCAPE, 4 other major trials published in NEJM in 2015
  - MR CLEAN
  - EXTEND-IA
  - REVASCAT
  - SWIFT-PRIME

# MR CLEAN

- Dutch trial published in NEJM December 2014
- 502 patients enrolled from 2010-2014
  - 18yrs old – No upper age limit
  - NIHSS >2
  - CTA confirmed anterior occlusion
- Treatments
  - IV tPa (or not) per standard guidelines
  - Allowed IA tPa and/or suction thrombectomy, stent-retriever, wire disruption

# EXTEND-IA

- Australian trial published in NEJM  
March 2015
- 70 patients
  - CTA confirmed anterior occlusion
  - CTP confirmed ischemic penumbra
- Treatments
  - IV tPa per standard guidelines
  - Intervention - Solitaire stent-retriever only.



# REVASCAT

- Spanish trial published in NEJM April 2015
- 206 patients
  - 18yrs old – 80 (85) yrs old
  - NIHSS >6
  - CTA confirmed anterior occlusion
- Treatments
  - IV tPa (or not) per standard guidelines
  - Intervention – Solitaire stent retriever only

# SWIFT-PRIME

- International trial published in NEJM April 2015
- 196 patients
  - 18yrs old – 85yrs old
  - NIHSS >
  - CTA confirmed anterior occlusion
- Treatments
  - IV tPa (or not) per standard guidelines
  - Intervention – Solitaire stent retriever only

# Trial Take Home Points

- All studies demonstrated statistically significant improvement in 90day mRs
- No study demonstrated statistically significant differences in 90day mortality or rates of symptomatic intracranial hemorrhage

# Trial Take Home Points

- All patients subjected to endovascular treatment should be confirmed to have appropriate targets
- Timing is critical to good outcomes
- The use of modern stent-retriever devices improves our ability to open arteries

# SYMPTOM ONSET TO tPa ADMINISTRATION

Trial	Standard Therapy	Endovascular + Standard Therapy
ESCAPE	125 mins	110 mins
MR CLEAN	85 mins	87 mins
EXTEND-IA	145 mins	127 mins
REVASCAT	105 mins	117 mins
SWIFT-PRIME	117 mins	111 mins

# SYMPTOM ONSET TO GROIN PUNCTURE

Trial	Endovascular + Standard Therapy
ESCAPE	185 mins
MR CLEAN	260 mins ←
EXTEND-IA	210 mins
REVASCAT	269 mins ←
SWIFT-PRIME	224 mins

# TICI 2B/3 Rates

Trial	Endovascular + Standard Therapy
ESCAPE	72.4 %
MR CLEAN	59 %
EXTEND-IA	86 %
REVASCAT	65.7 %
SWIFT-PRIME	88 %

# For 1 Additional Patient with Independent Outcome

- ESCAPE - NNT 4
- EXTEND-IA - NNT 3.2
- REVASCAT - NNT 6.5
- SWIFT-PRIME - NNT 4
- MR CLEAN – NNT 7
  
- HERMES – NNT 2.6



# Time is Brain

- SWIFT-PRIME
  - IA arm pts reperfused within 2.5hrs of symptom onset → 91% estimated probability of functional independence
  - By 3.5hrs → 80%
  - By 4.5hrs → 60%
  - By 5.5hrs → 40%

# Time is Brain

- ESCAPE
  - For every 30 minute increase in CT-to-reperfusion time:
    - Probability of reaching a functionally independent outcome falls by 8.3%

# So What Does This Mean For the Imaging?

- Our imaging must be:
  - FAST – To acquire and to interpret
- Our imaging must answer the following questions:
  - Should the patient be screened out of consideration?
  - Does the patient have the disease?
  - Should the patient be treated?

# Canadian Best Practice Recommendations - Patient Timelines

- All pts with disabling acute ischemic stroke must be screened without delay to determine eligibility for IV tPA (within 4.5hrs) and/or IA therapy (within 6hrs)

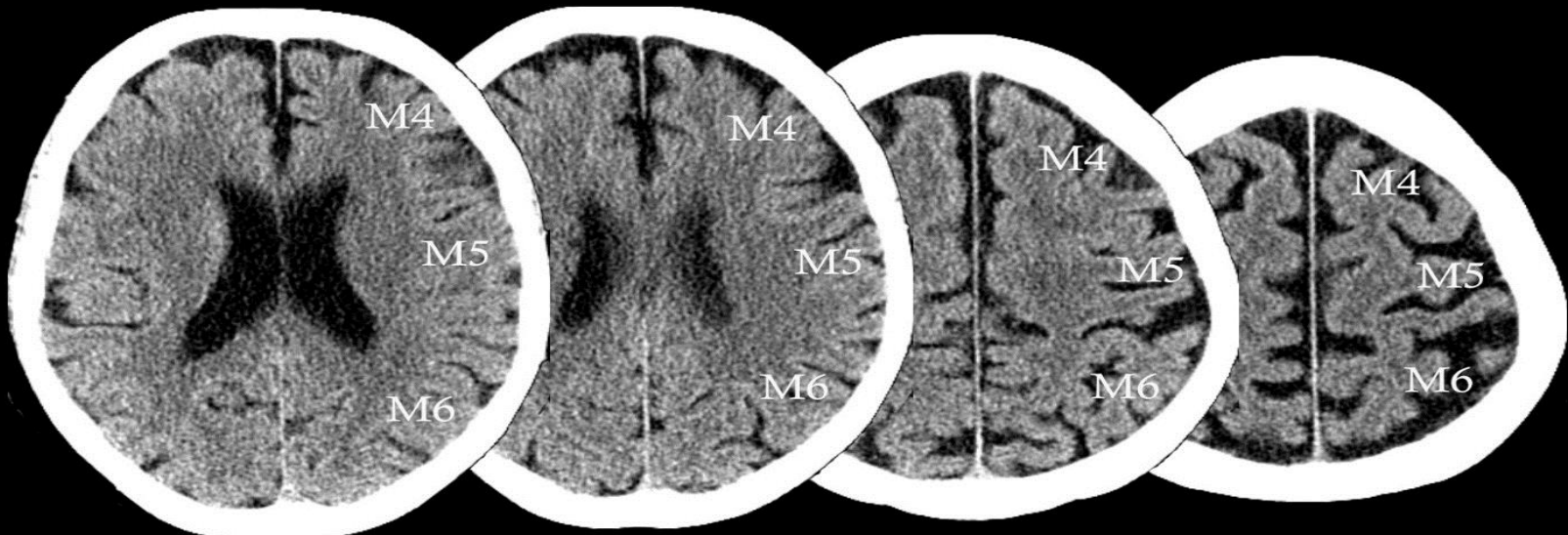
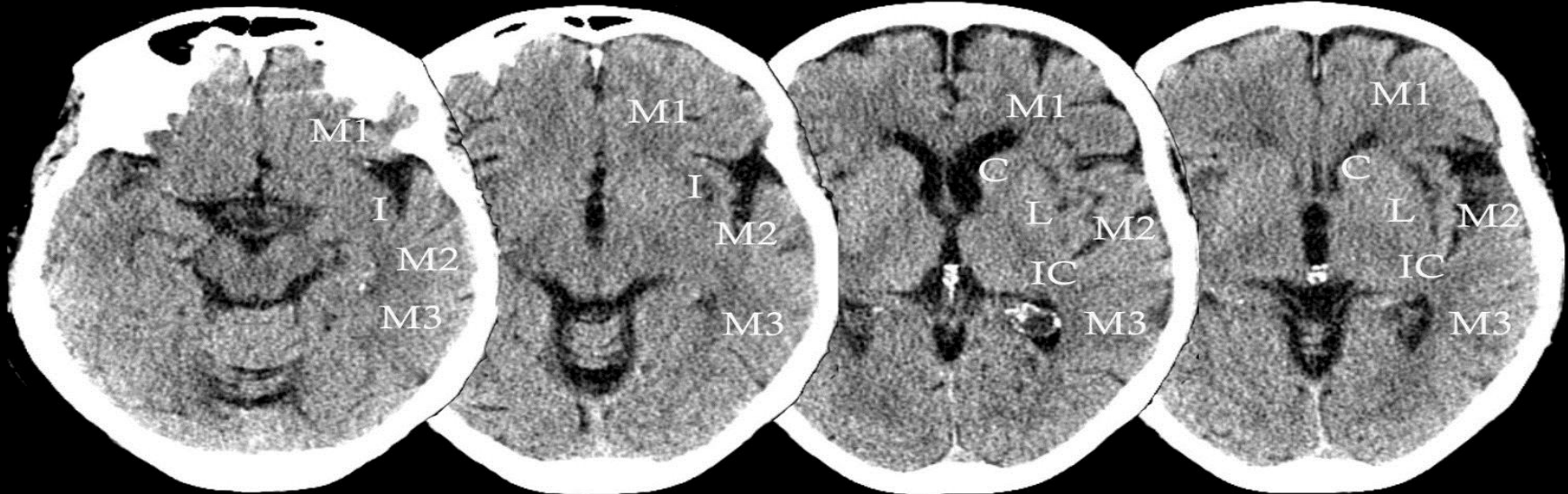
# Canadian Best Practice Recommendations - Imaging

- Non-contrast CT – Identify small-to-moderate ischemic ‘core’ (ASPECTS 6 or higher)
- Endovascular candidates – CTA must demonstrate proximal anterior circulation occlusion
  - ‘Strongly recommended’ that pts have evidence of moderate-to-good collaterals on CTA or CT perfusion ‘mismatch’

# Hyperacute Stroke Imaging – Practical Approach

- Non-contrast CT
  - Is there acute hemorrhage?
  - Is there a large, established stroke (ie. poor ASPECTS)?

# Ganglionic Level



# Supraganglionic Level

# Hyperacute Stroke Imaging – Practical Approach

- CT Angiogram – Head and Neck
  - Is there a proximal large vessel occlusion?
  - Are there any additional proximal occlusions (ie. cervical carotid) or anatomic variants?



# Hyperacute Stroke Imaging – Practical Approach

- ‘Multi-phase’ CT angiogram
  - Normal CT angiogram followed by 2 additional scans from the skull base to vertex only
  - No additional contrast needed
  - Additional radiation dose of  $\sim 1\text{mSv}$
  - Basic Question – Are there moderate-to-good collaterals?

# Radiation Dose Context

- Annual background – 1.8mSv/yr
- Chest CT – 7mSv
- “Kitchen-sink” stroke CT – 12mSv
- Annual dose limit for nuclear workers – 50mSv
- Avg annual exposure to astronaut – 150mSv
- Radiation sickness symptoms – 1000mSv

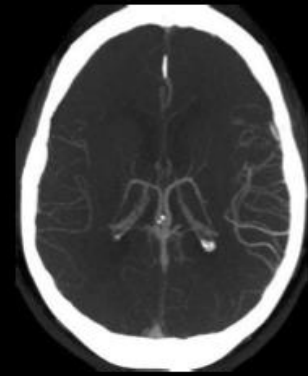
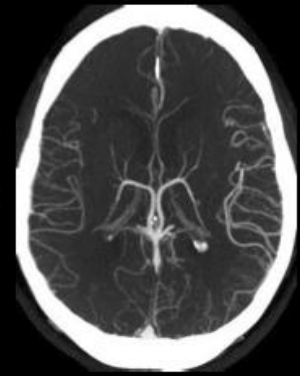
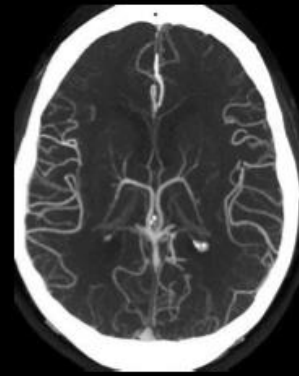
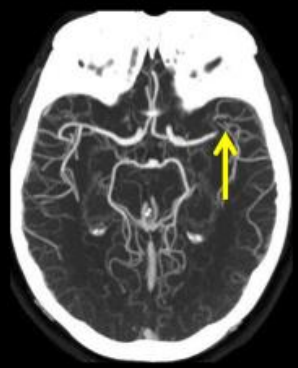
Site of Occlusion

Phase 1

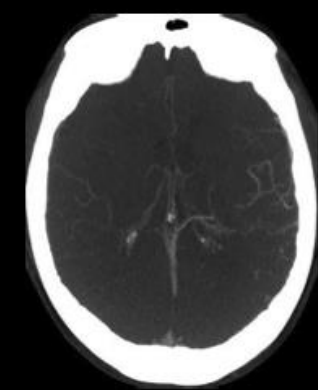
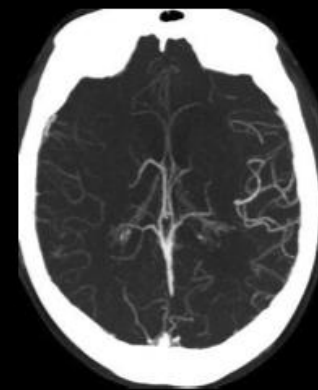
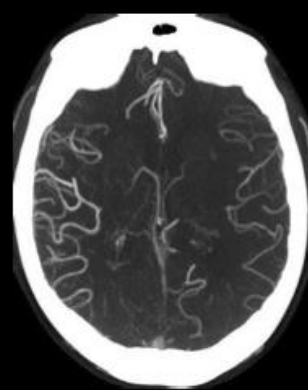
Phase 2

Phase 3

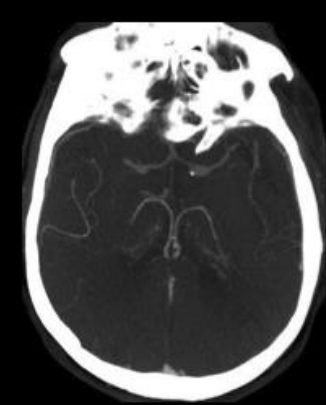
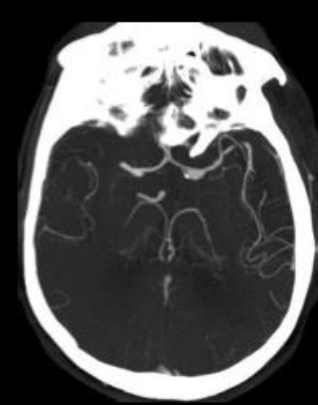
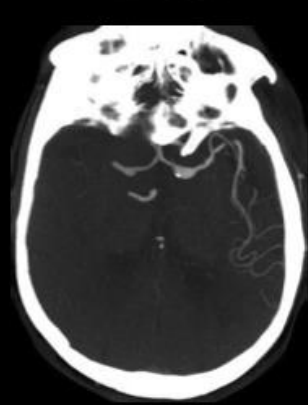
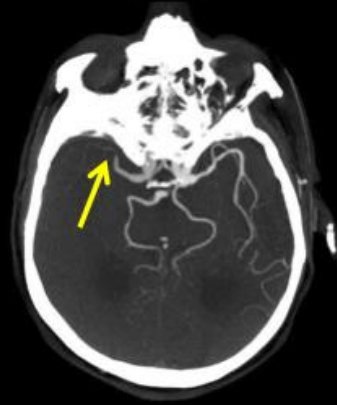
Good  
collaterals



Intermediate  
collaterals



Poor  
collaterals



# Hyperacute Stroke Imaging – Practical Summary

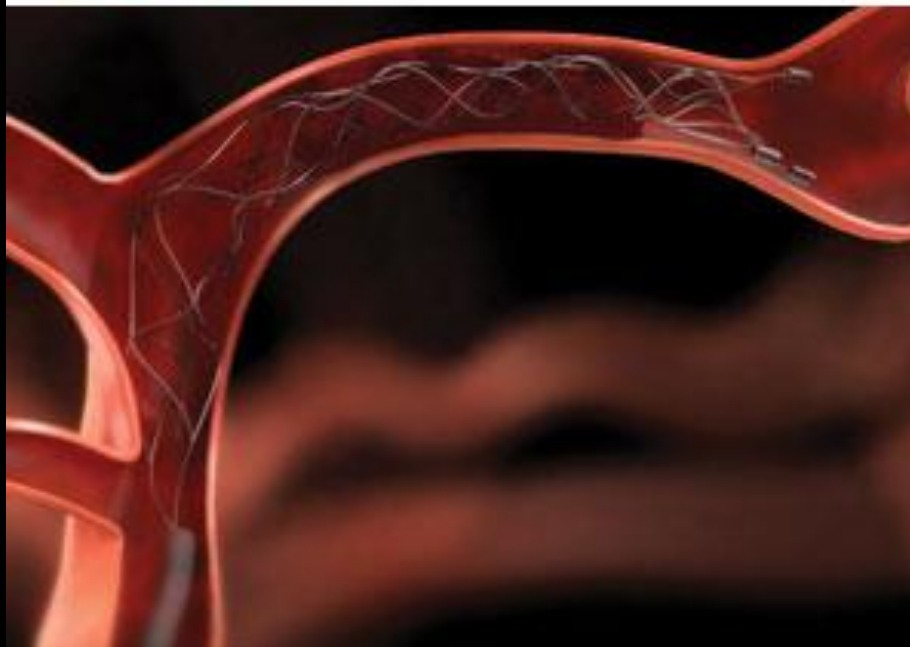
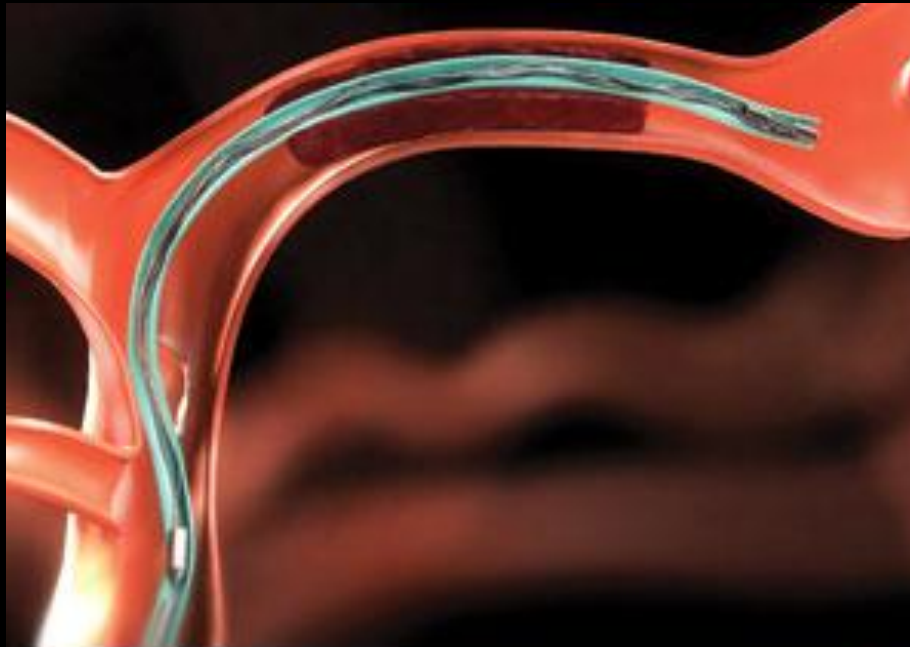
- Screening
  - NC Head – Hemorrhage? ASPECTS?
  - CTA Head/Neck – Proximal large vessel occlusion?
- Decision to Treat
  - Multiphase CTA – Good collaterals?

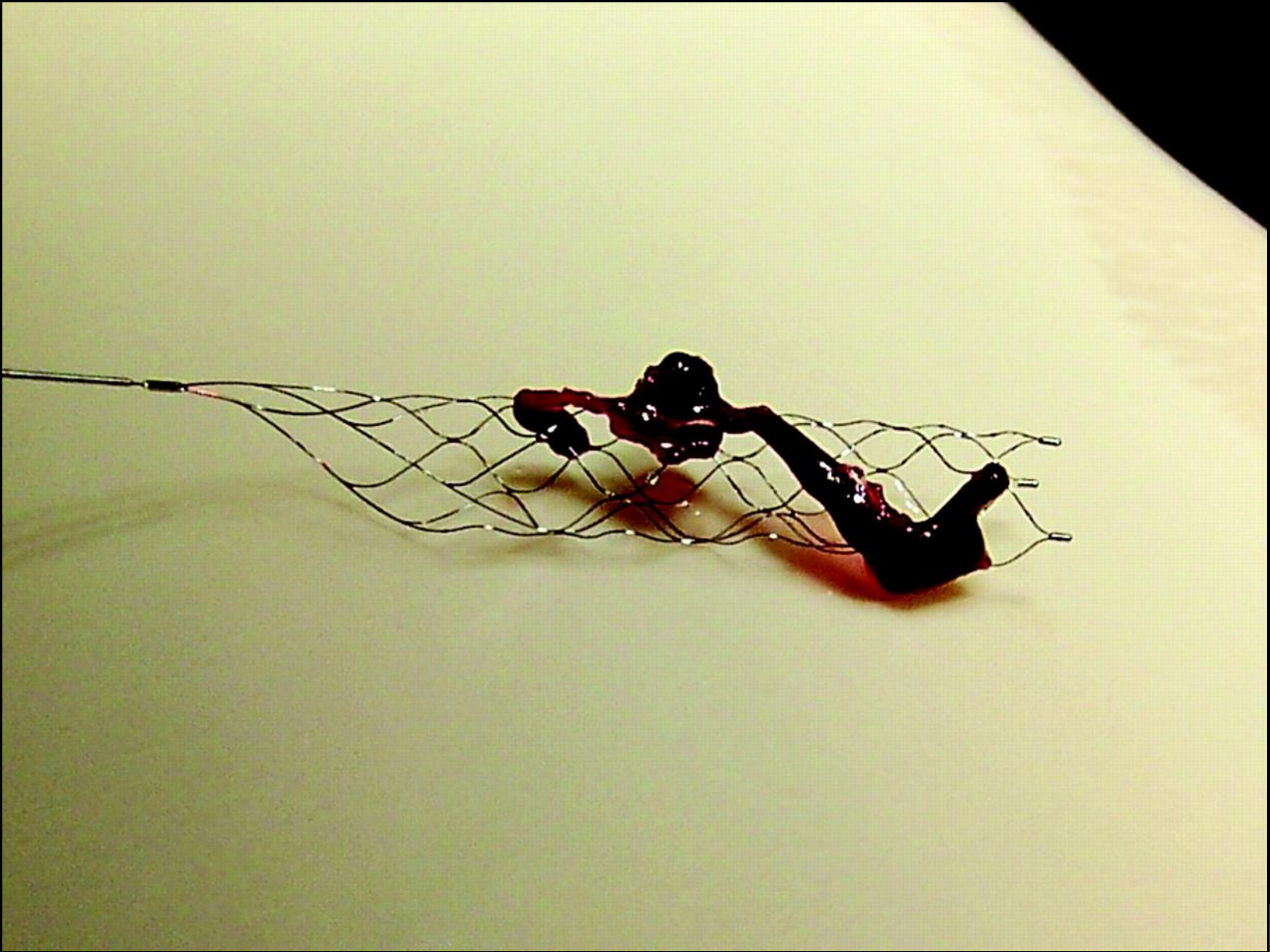
# Canadian Best Practice Recommendations – Clinical Timelines

- Time from Door to t-PA of 30 minutes (median) with 90<sup>th</sup> percentile of 60 minutes
- Time from CT to Groin Puncture of 60 minutes

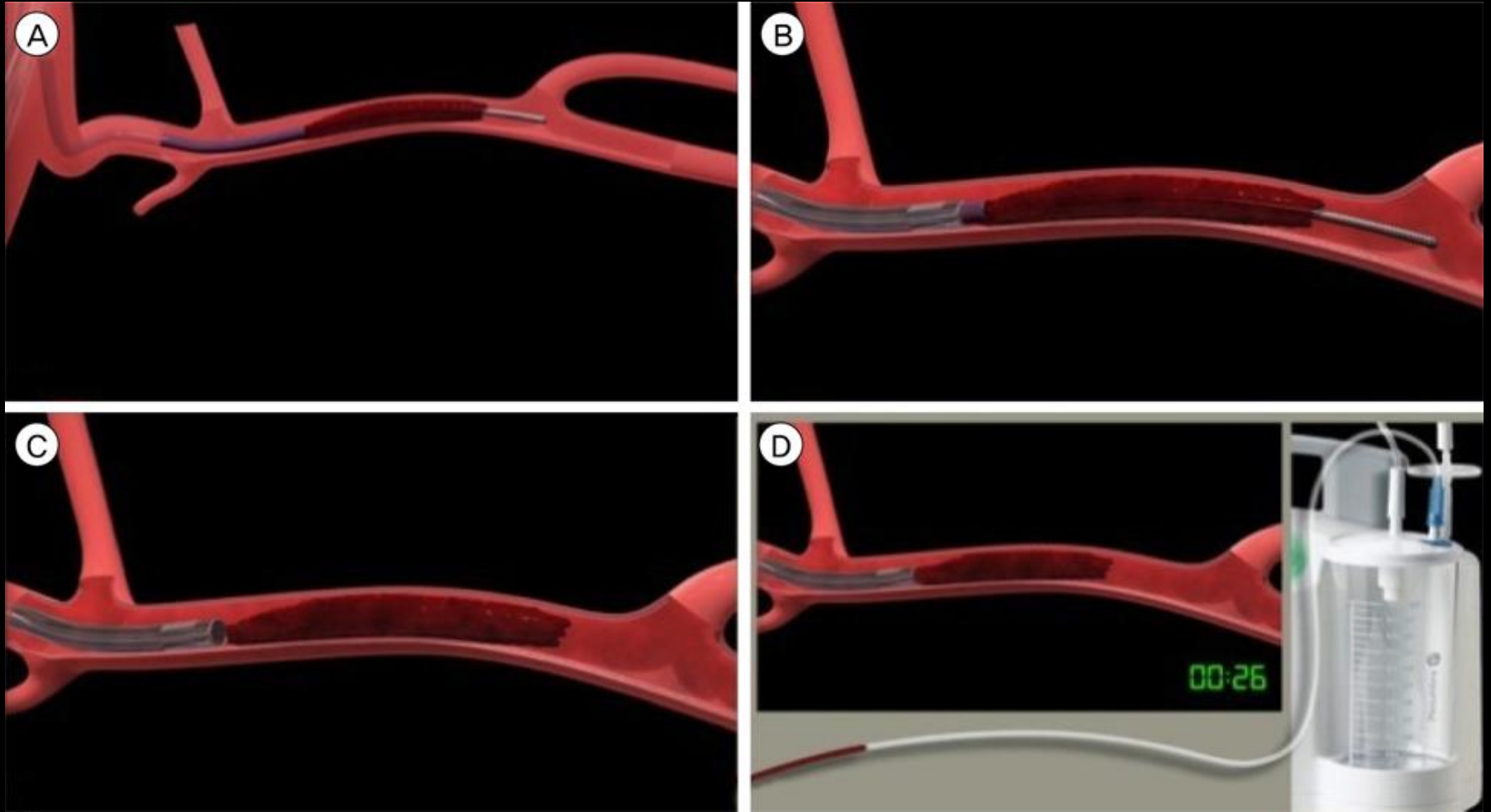
# Mechanical Thrombectomy - Devices

- Retrievable stents
  - Solitaire (Medtronic)
  - Trevo (Stryker)
- Aspiration catheters
  - Penumbra
- Both





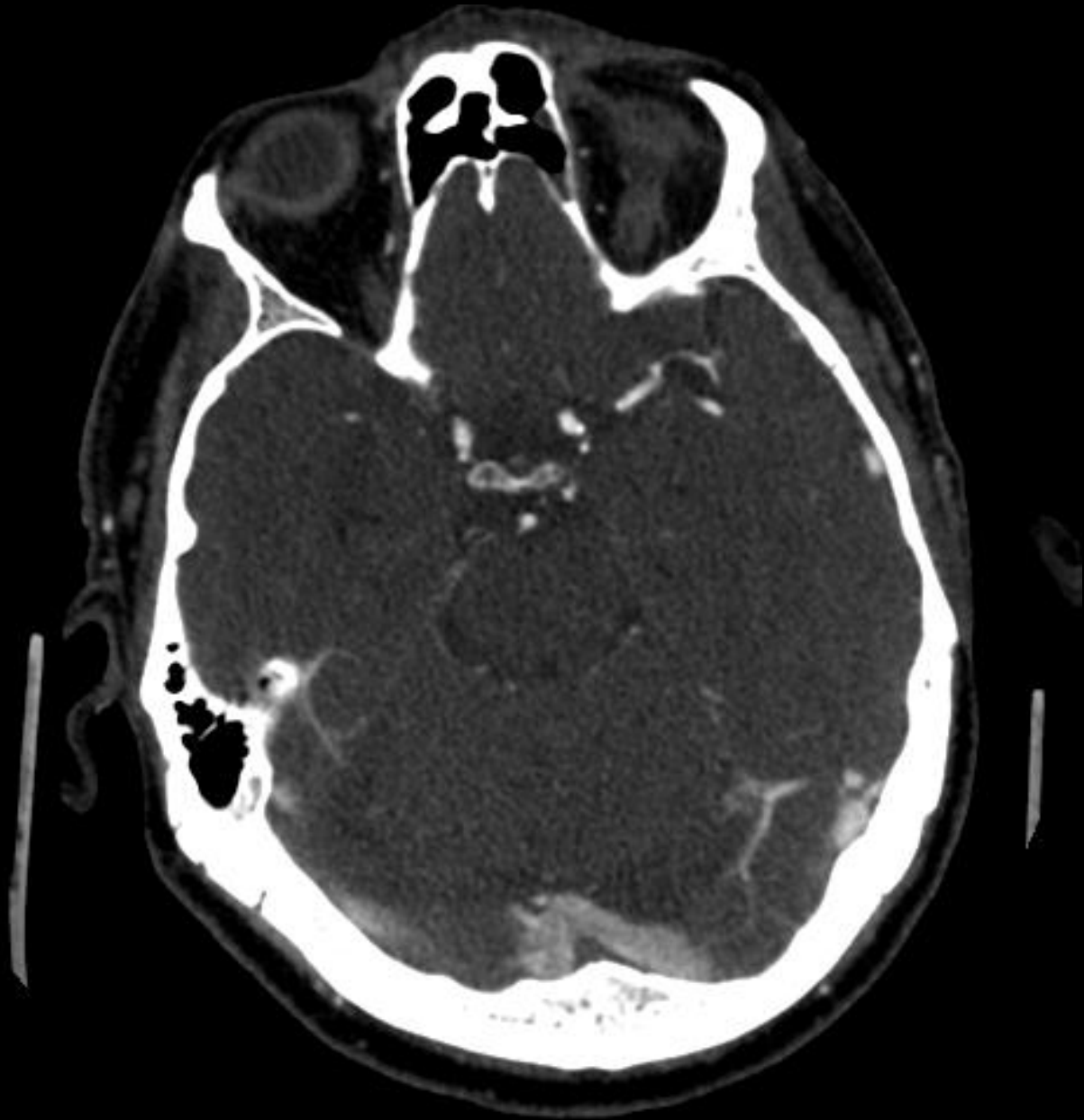




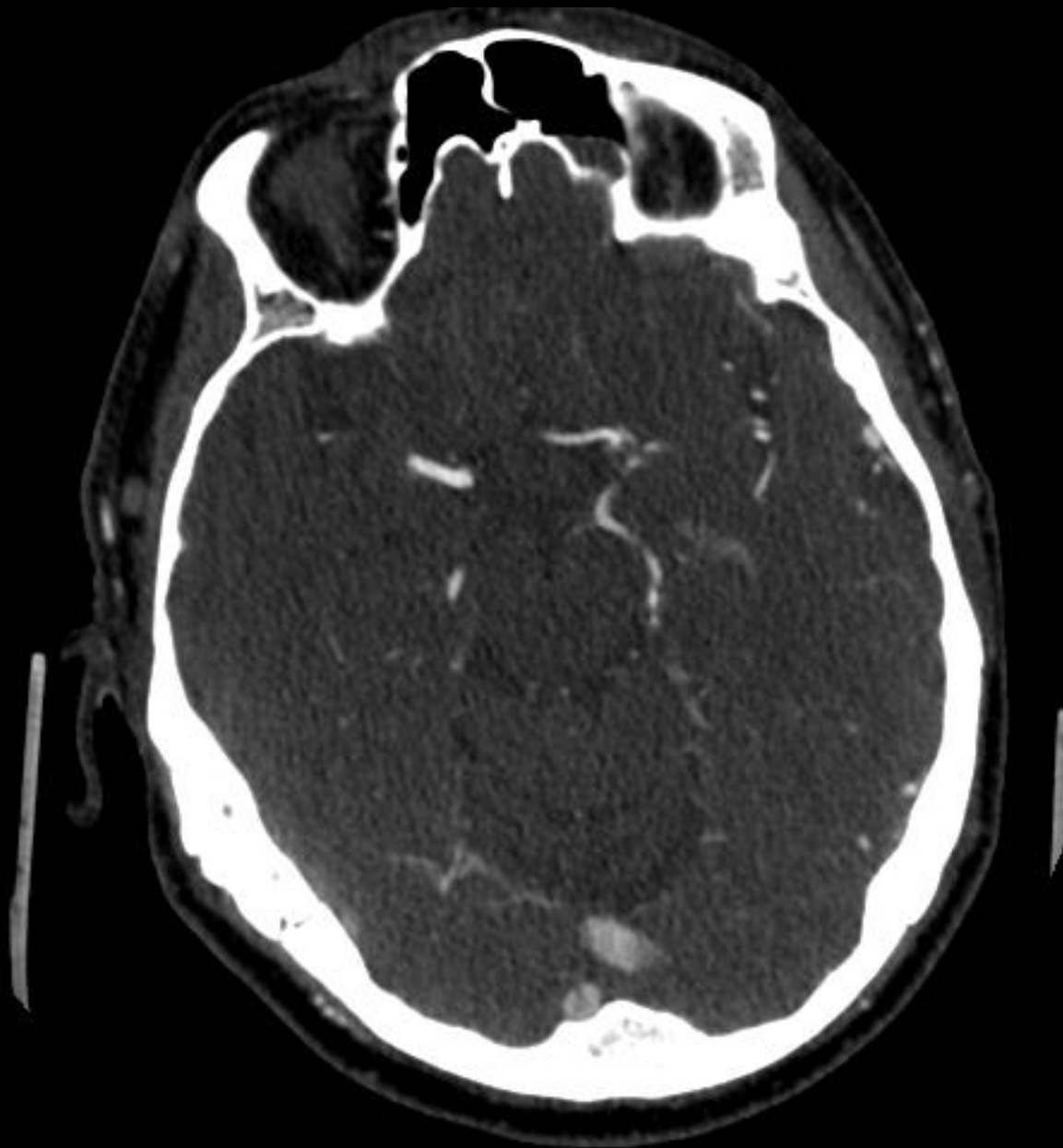






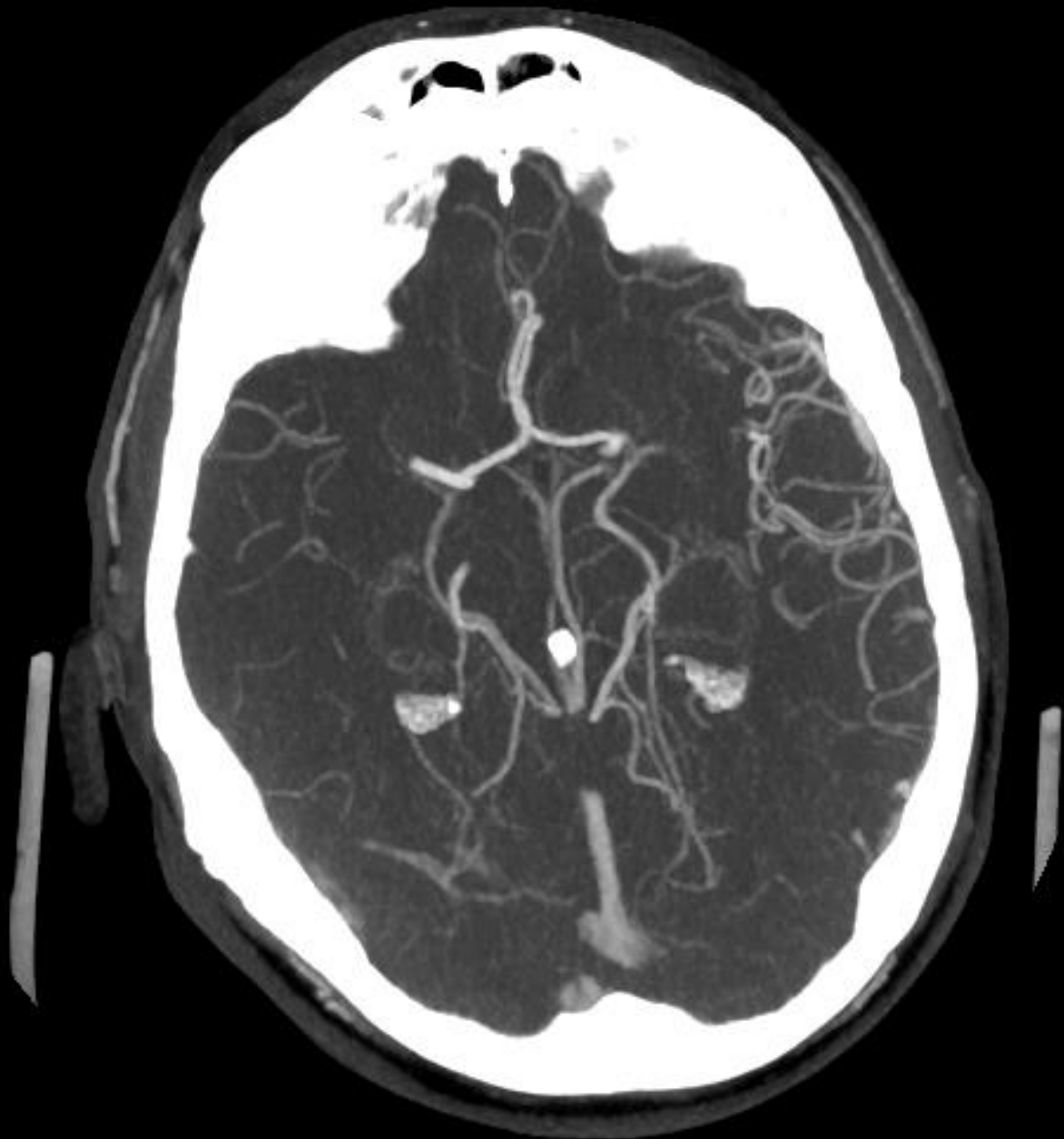


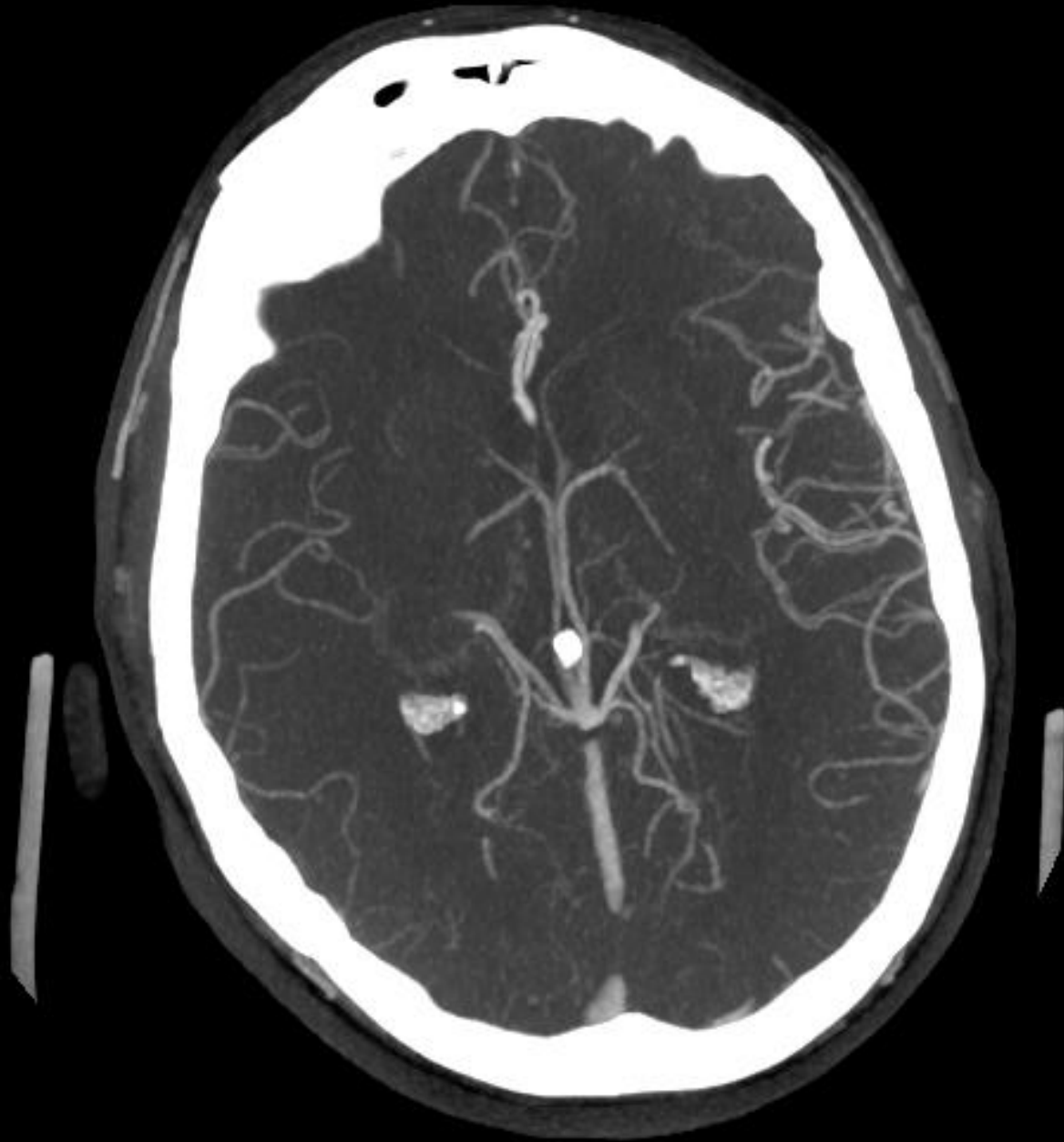


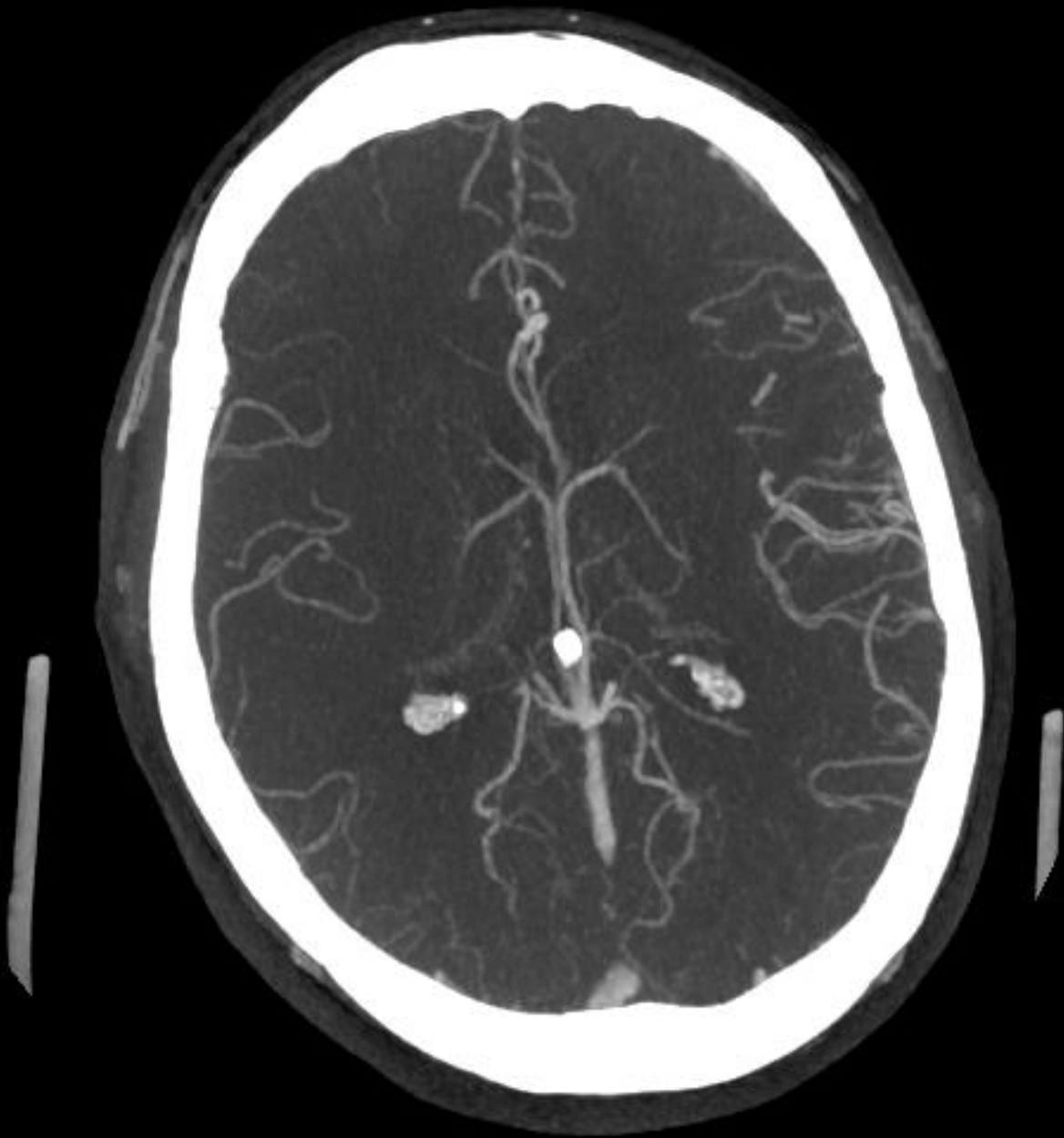


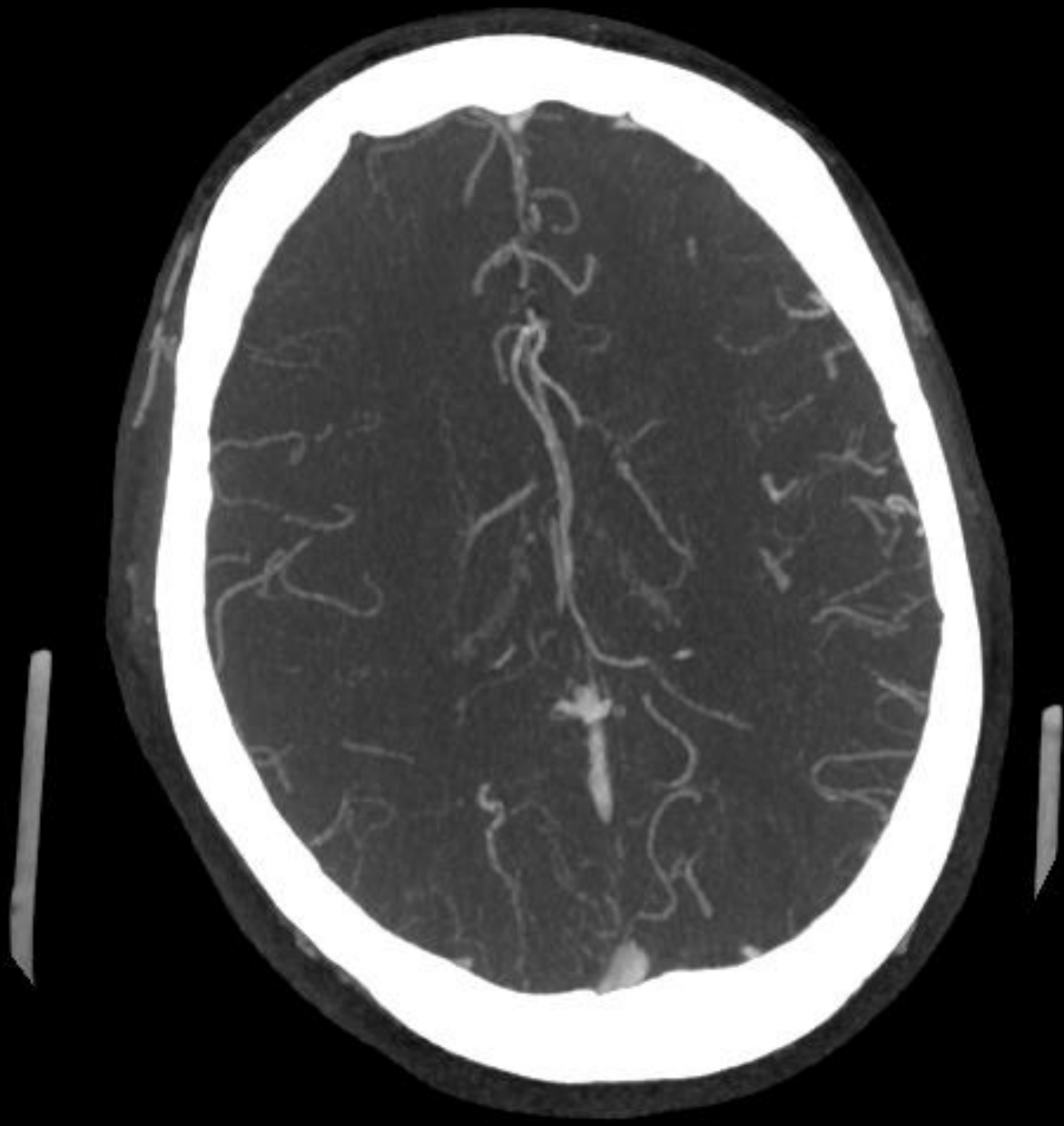


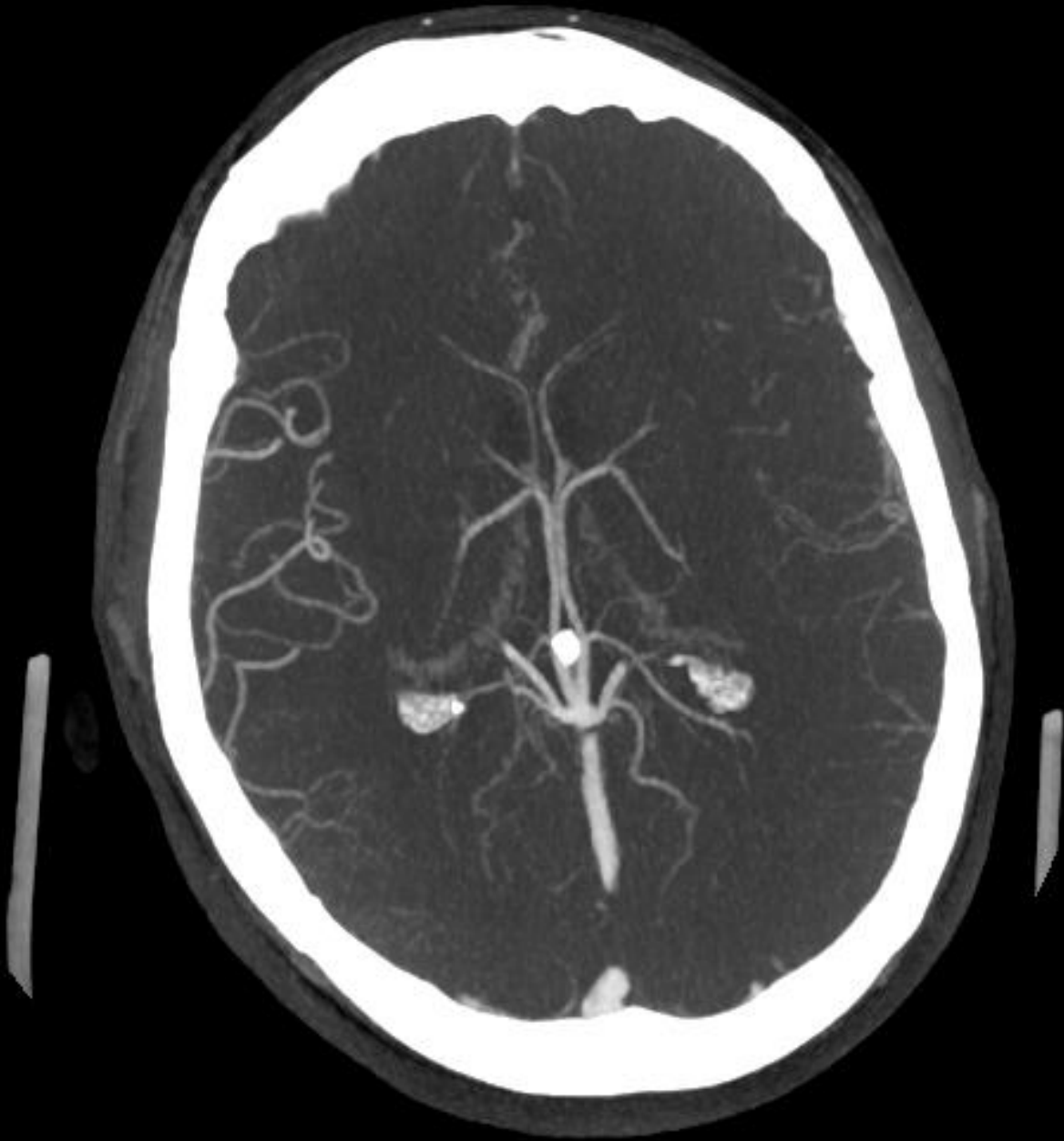






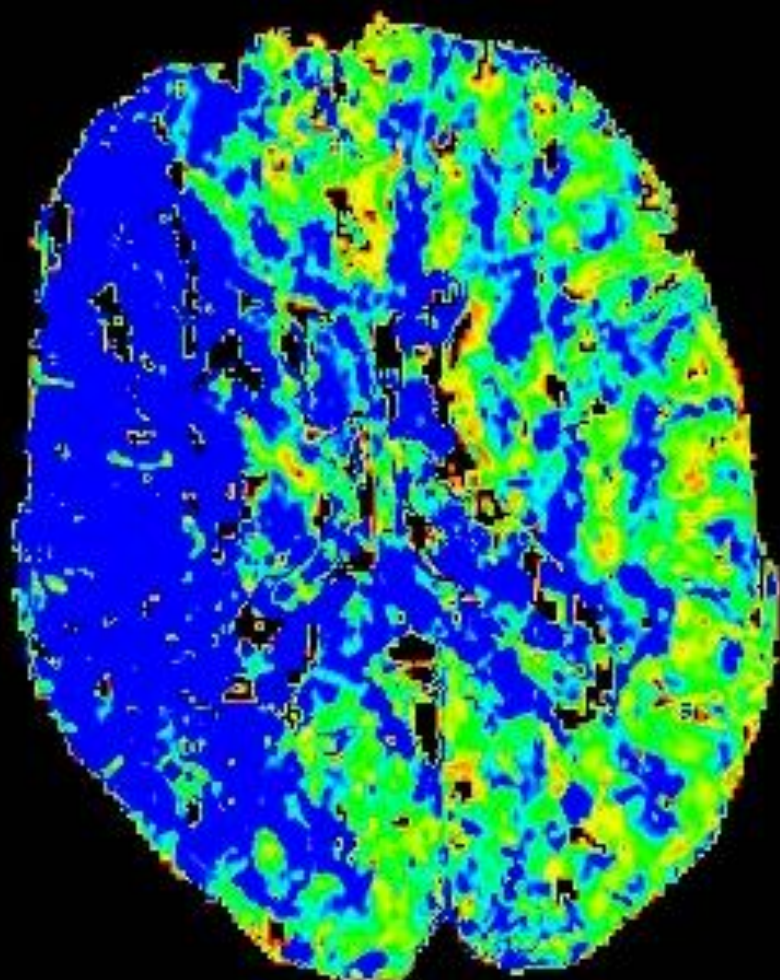






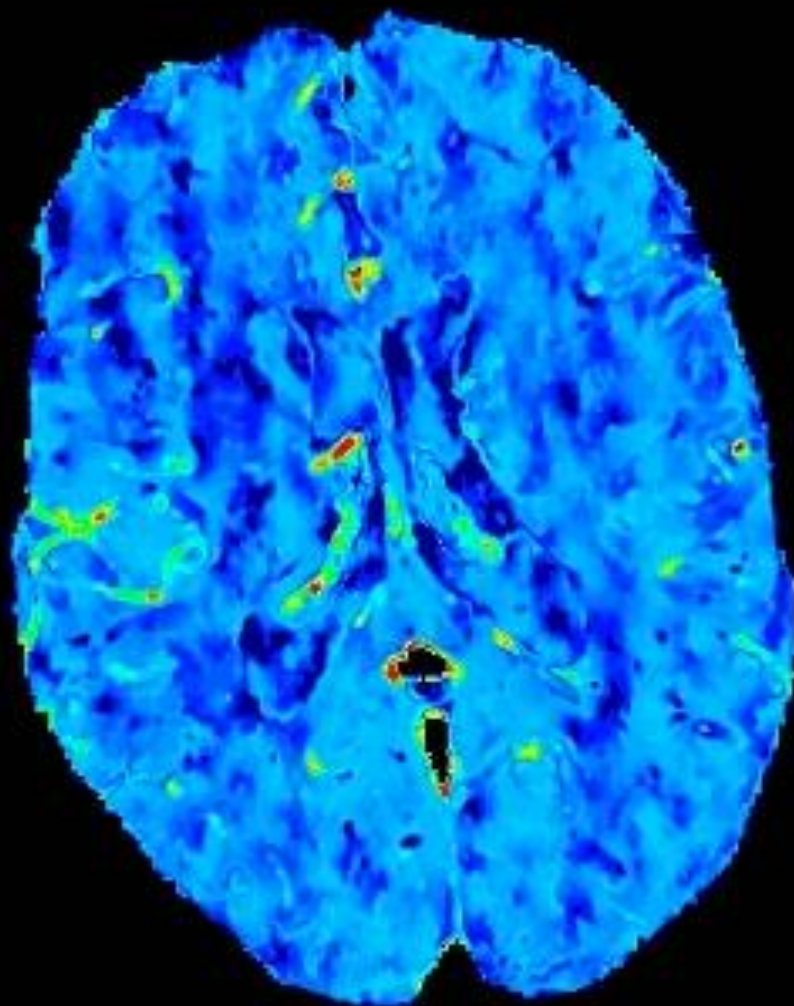


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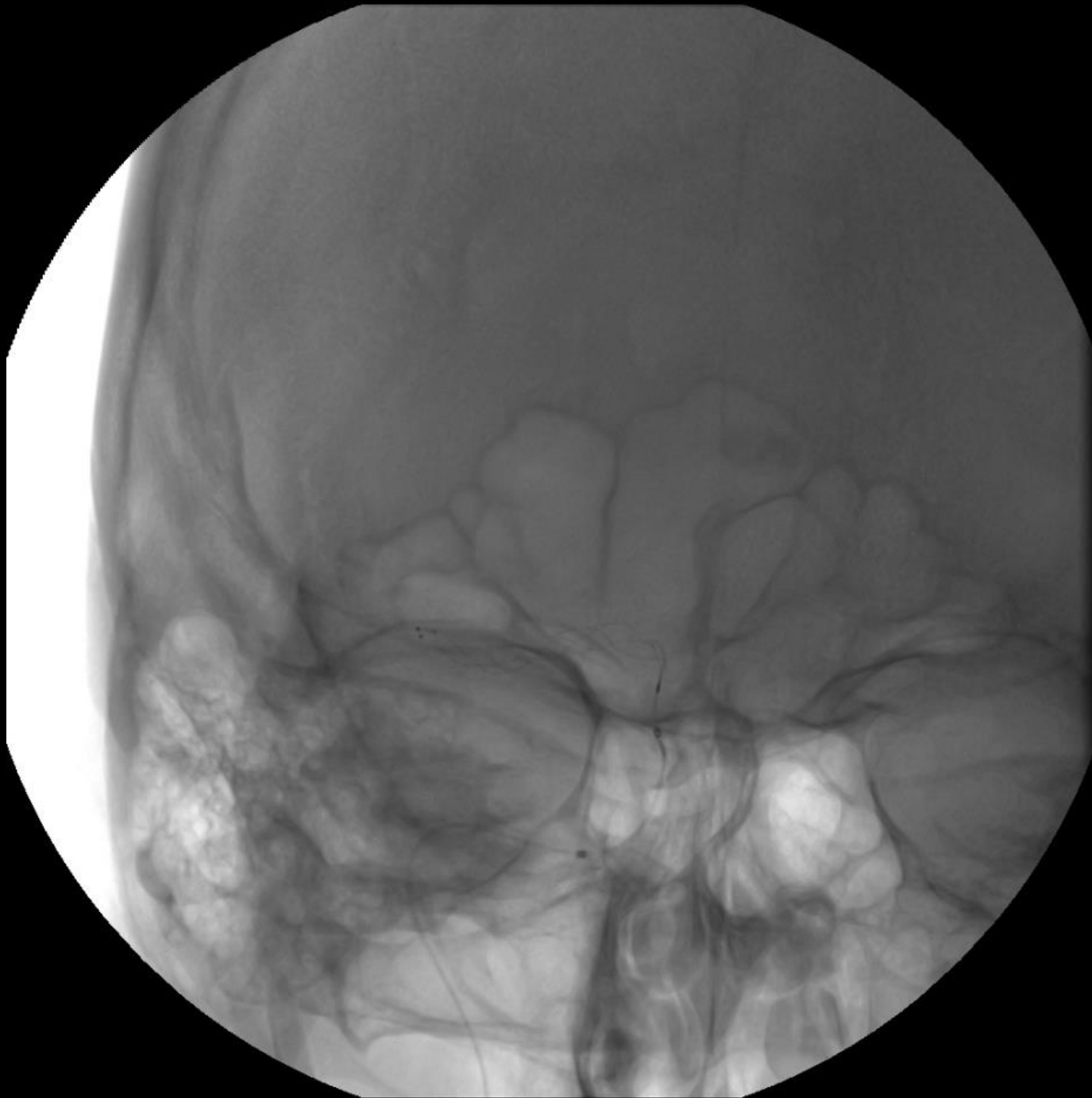


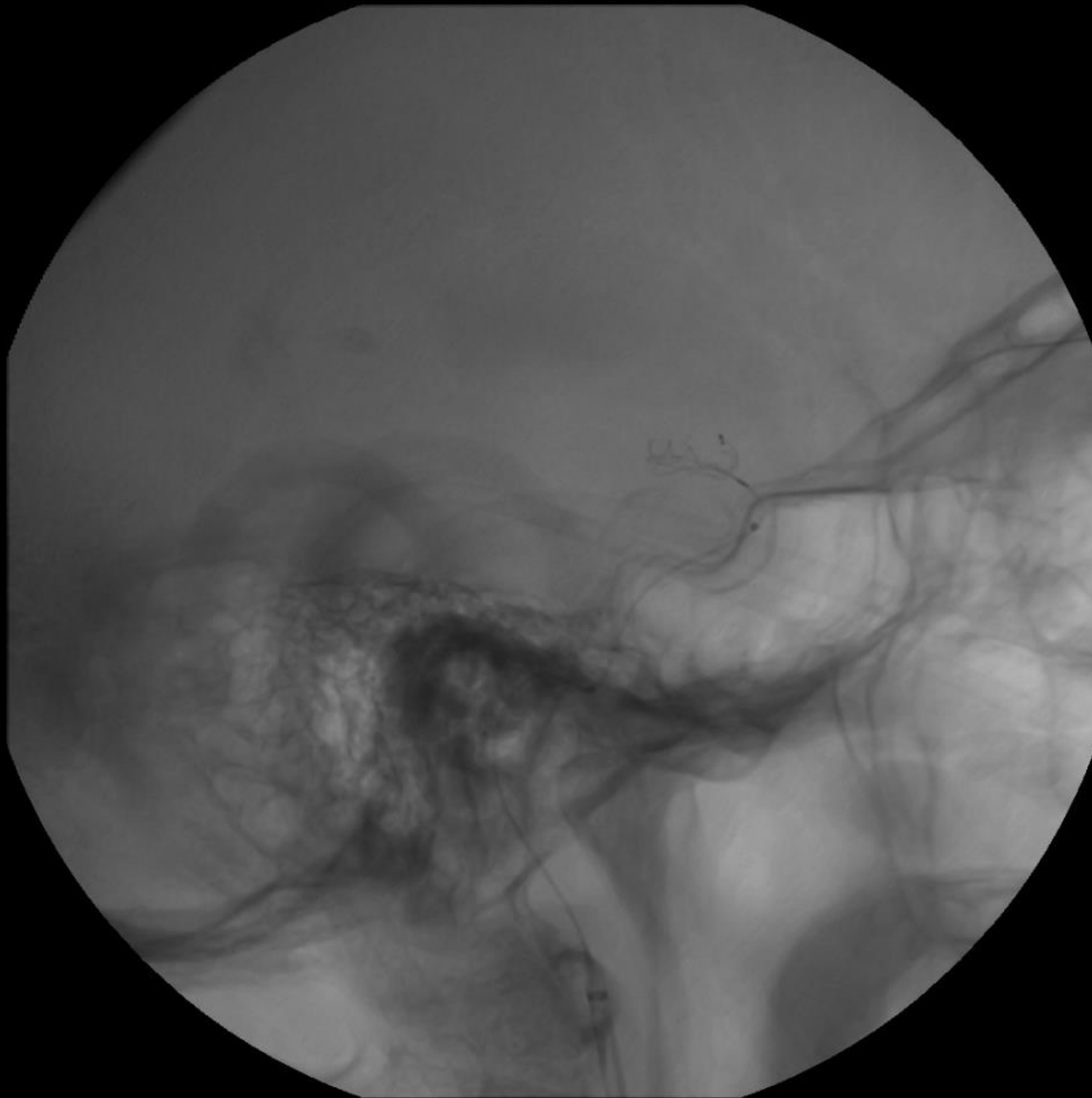
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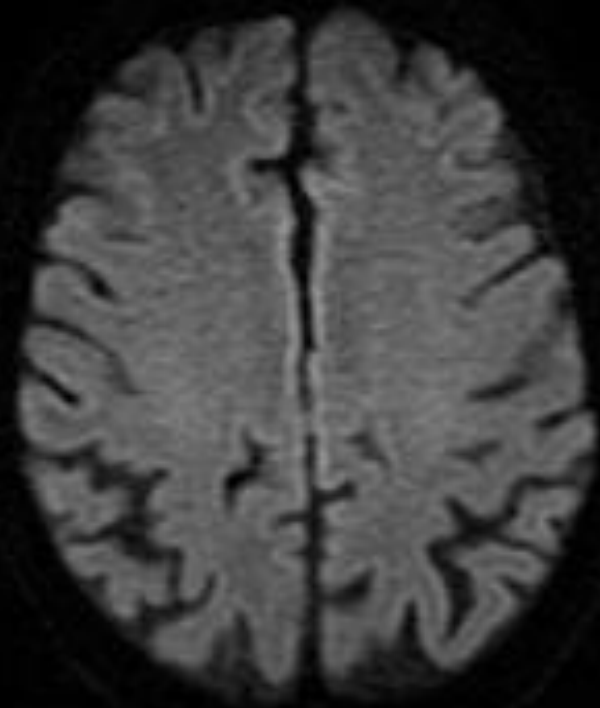
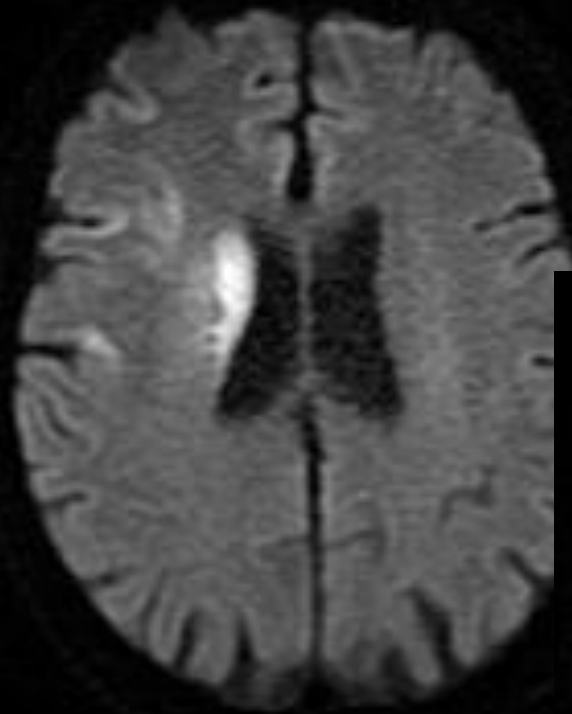
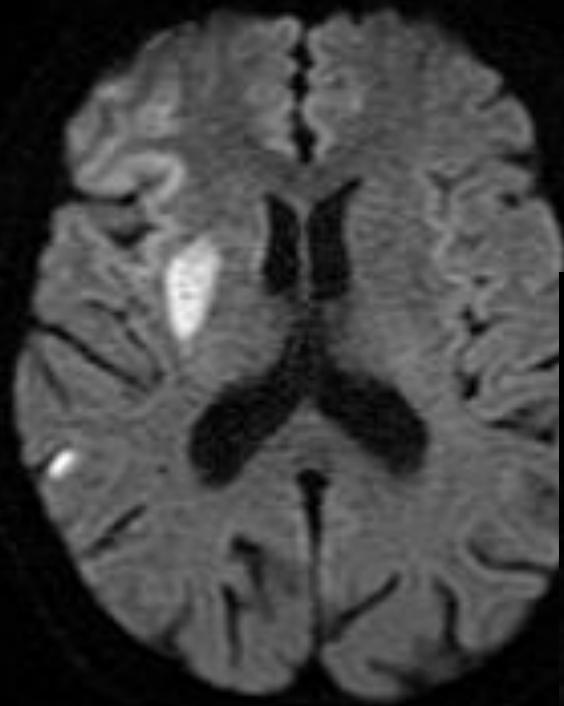






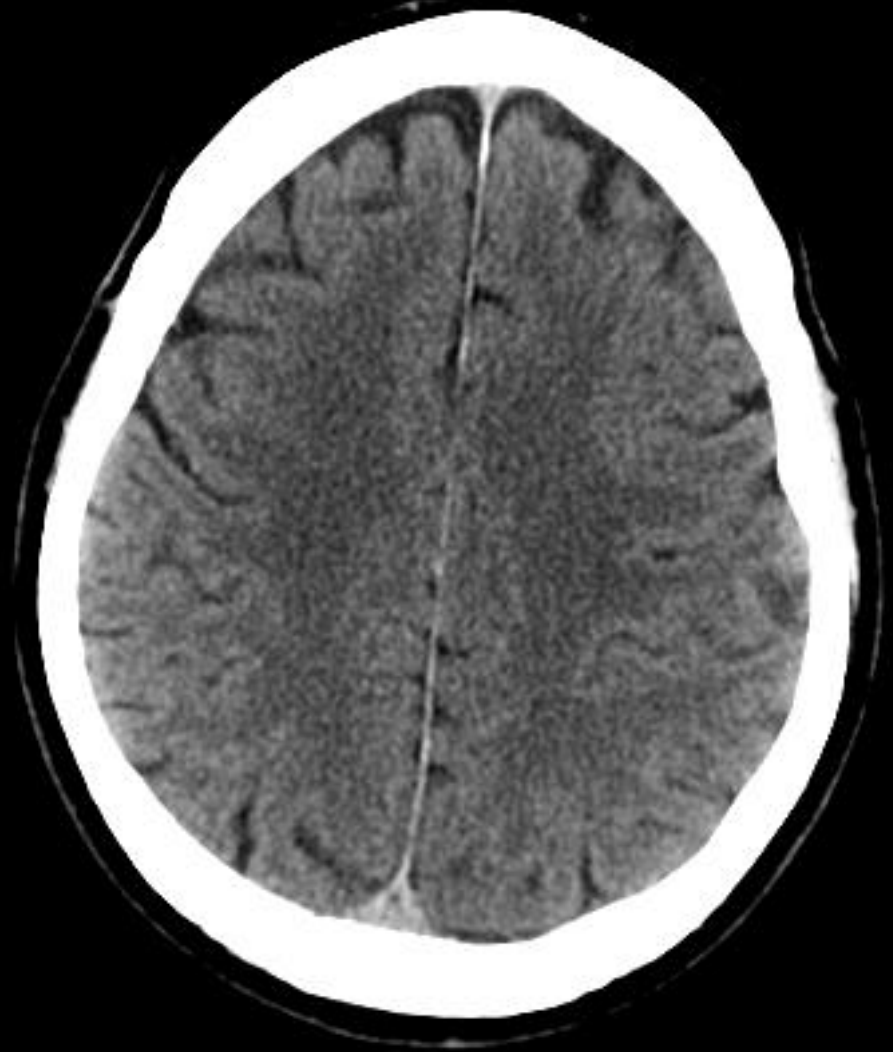
















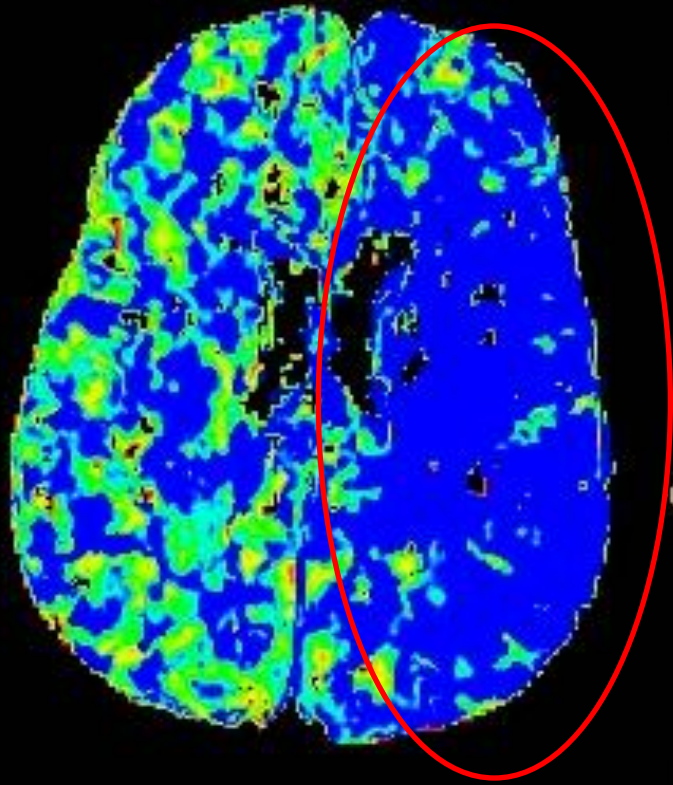


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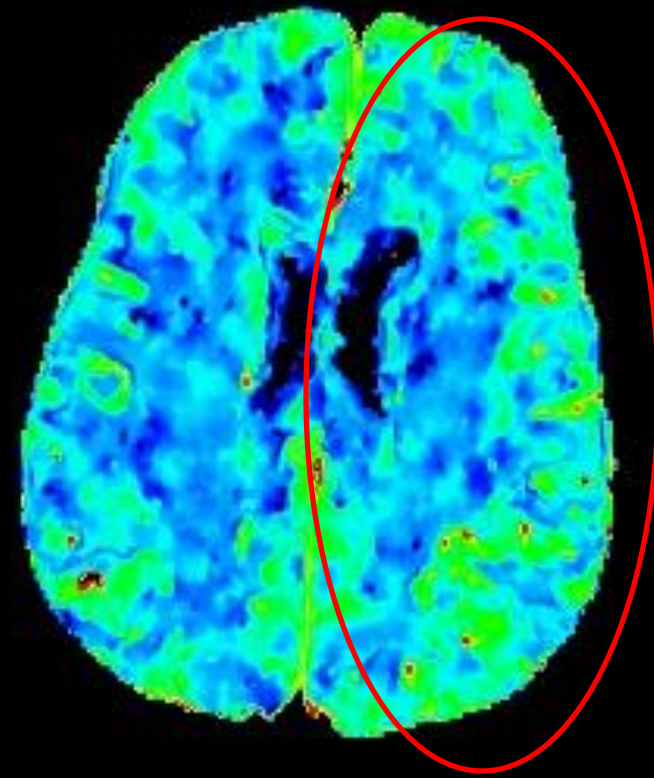
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Image Filter



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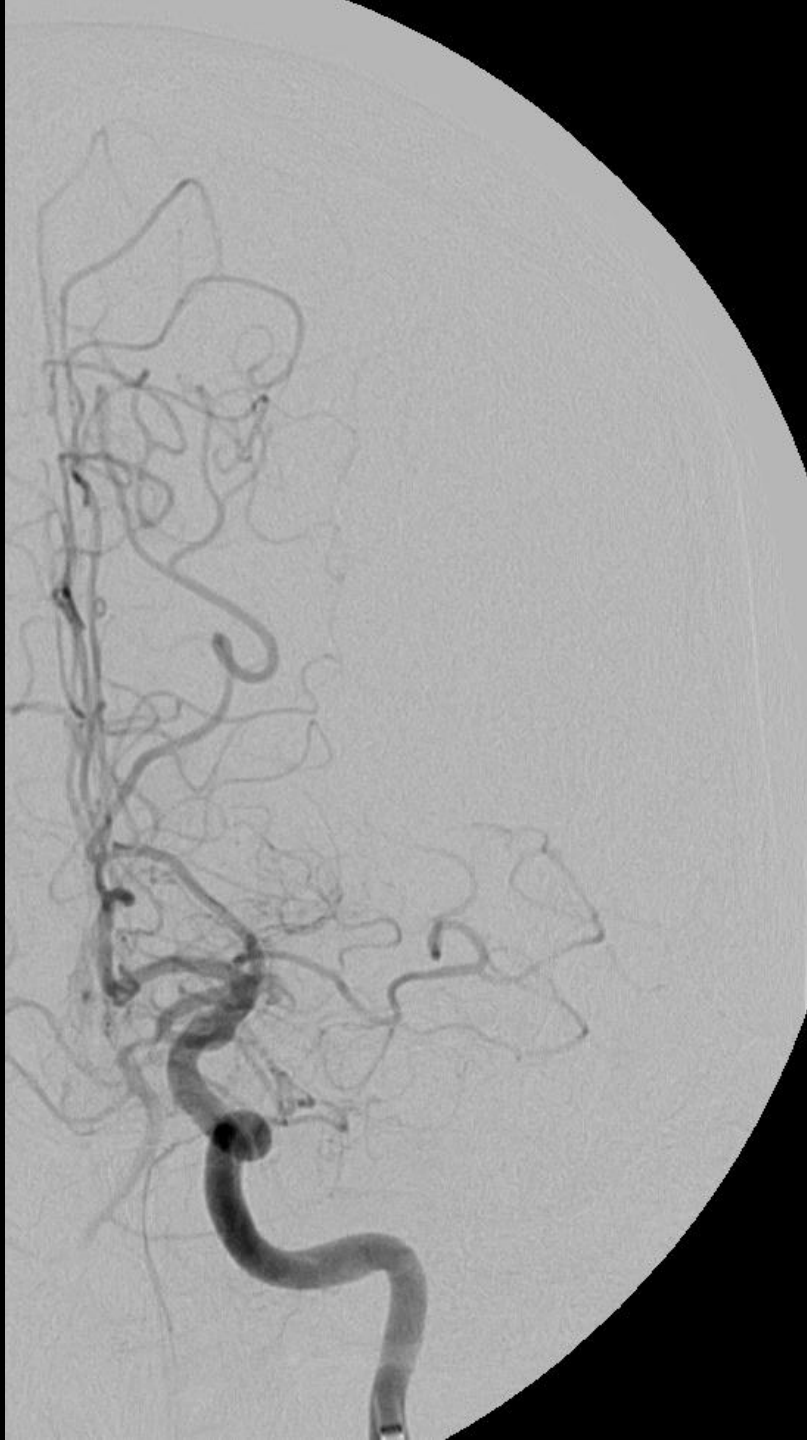


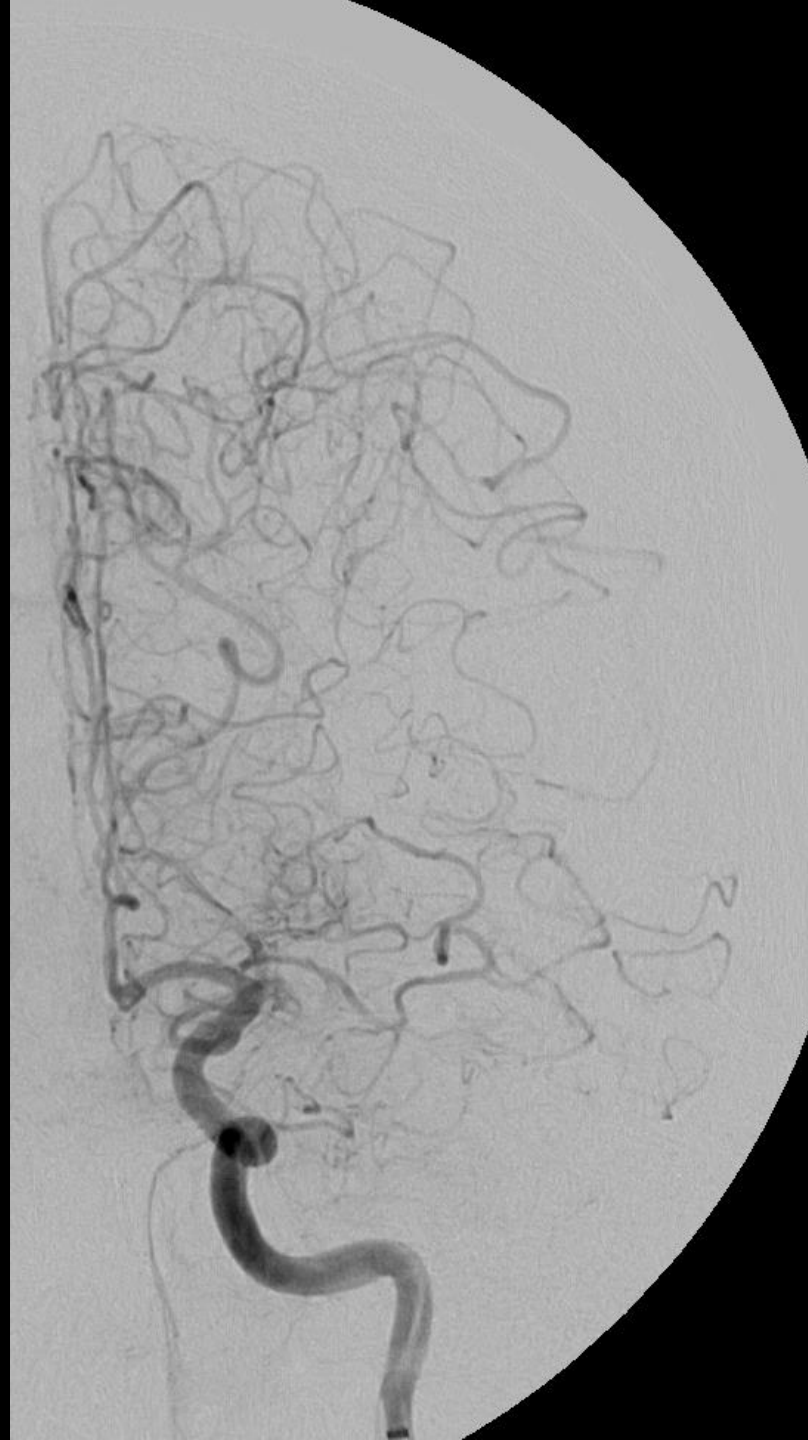
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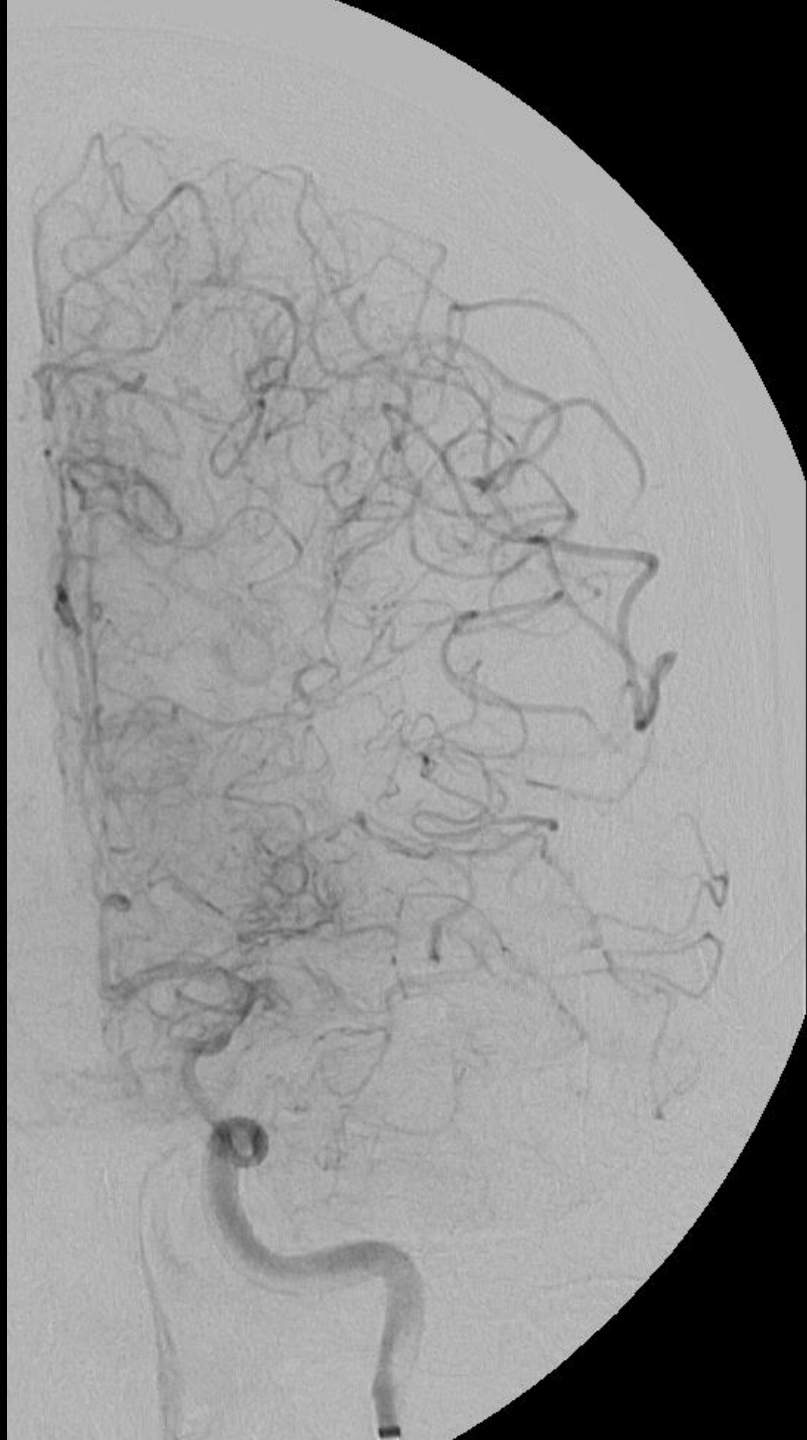


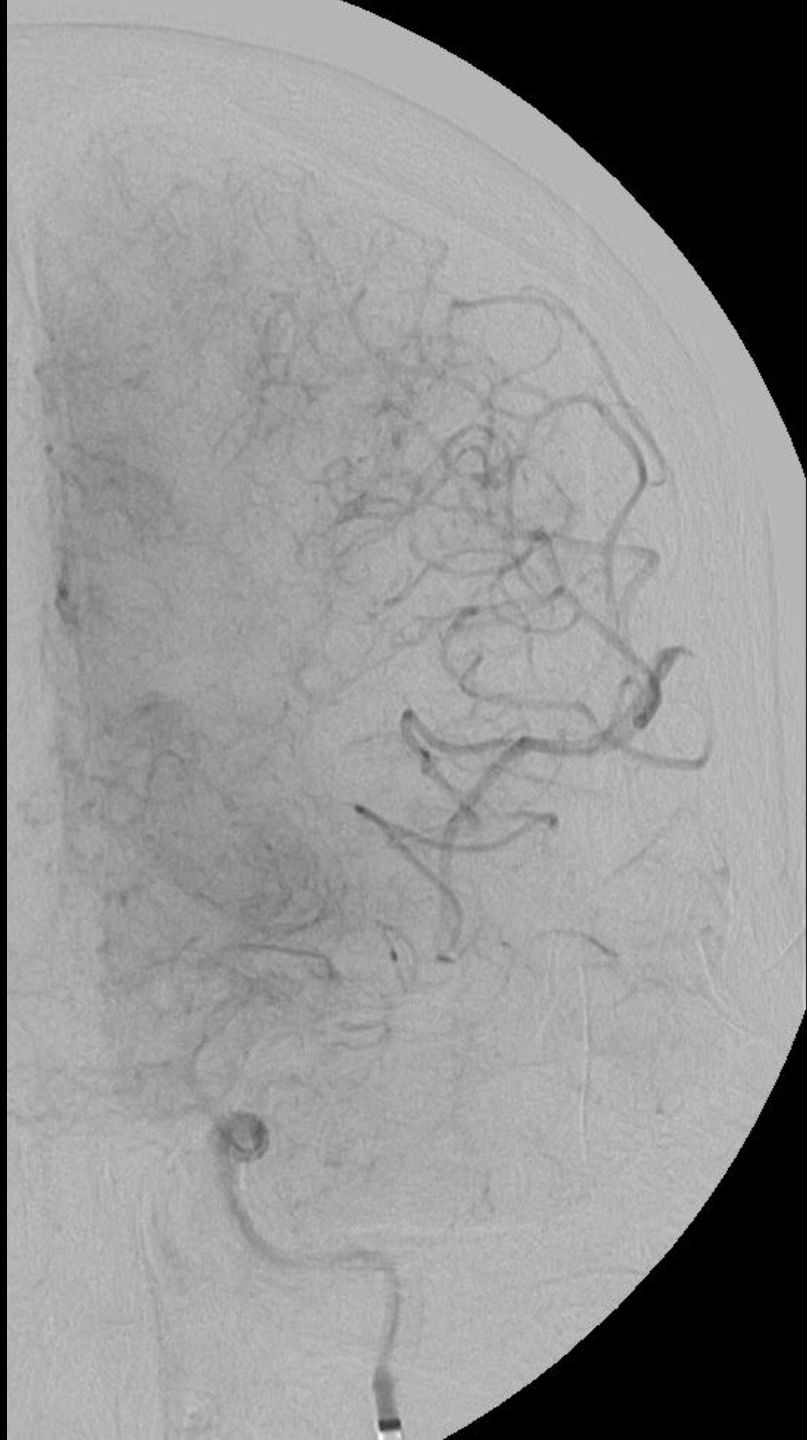
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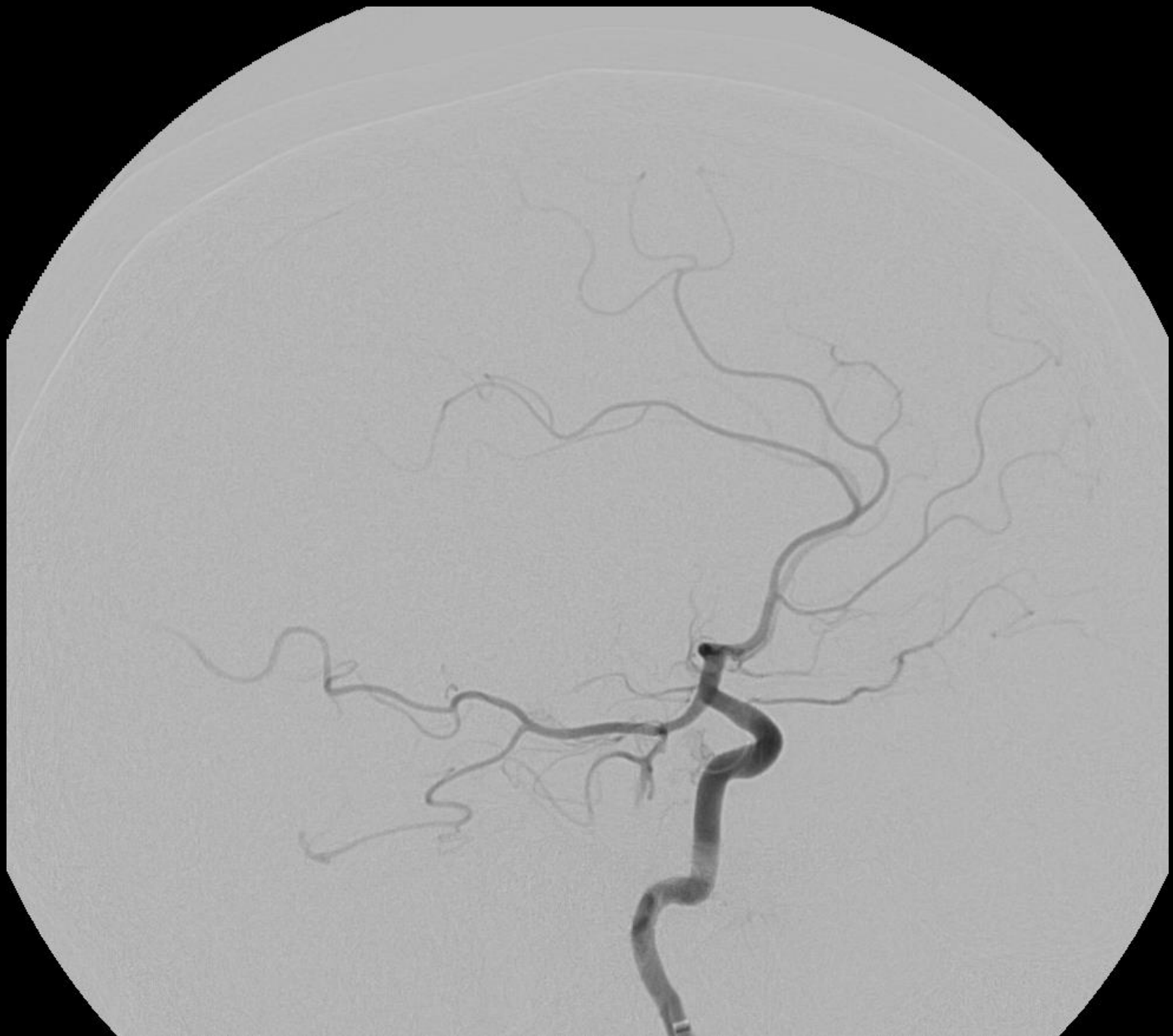


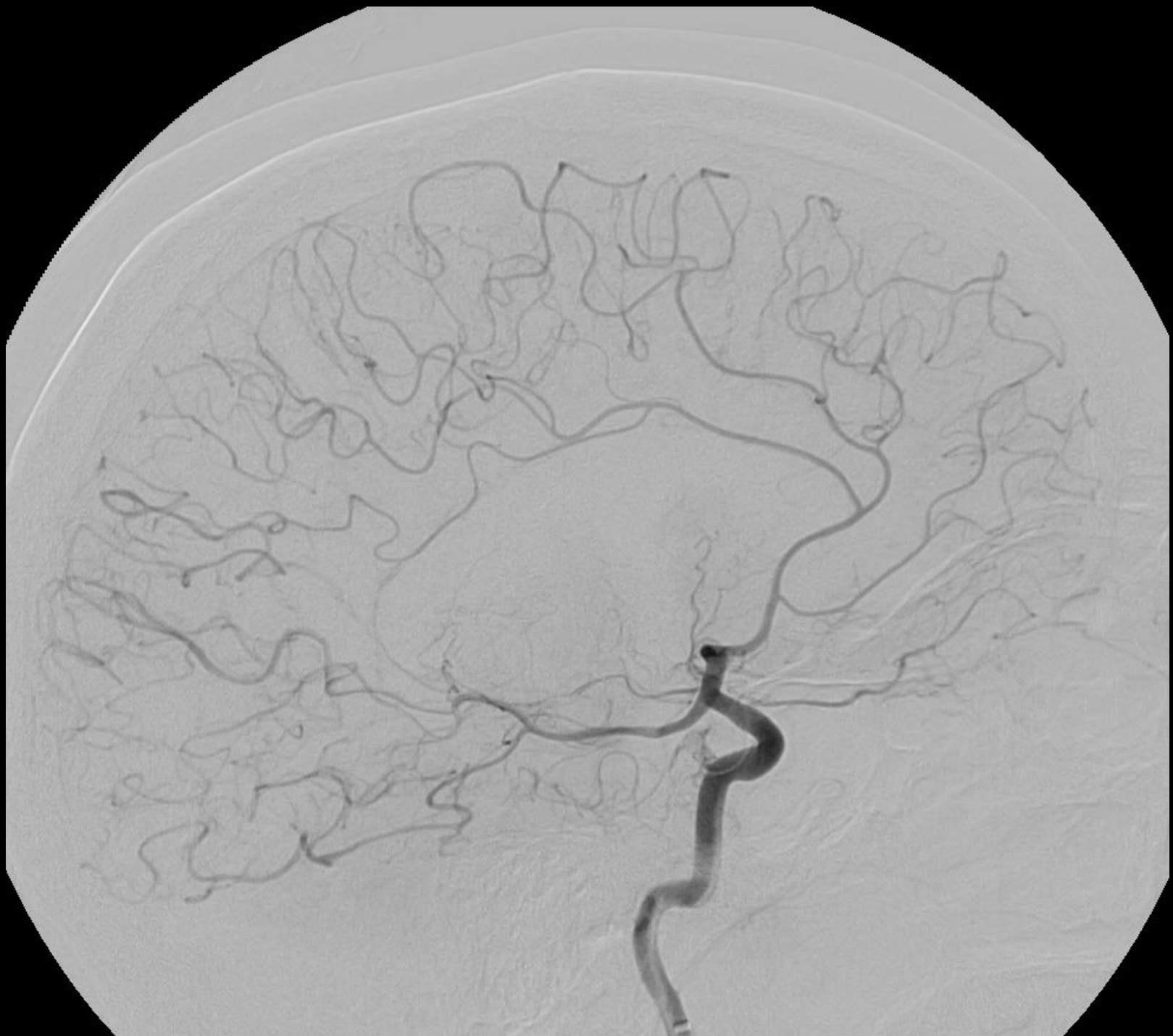


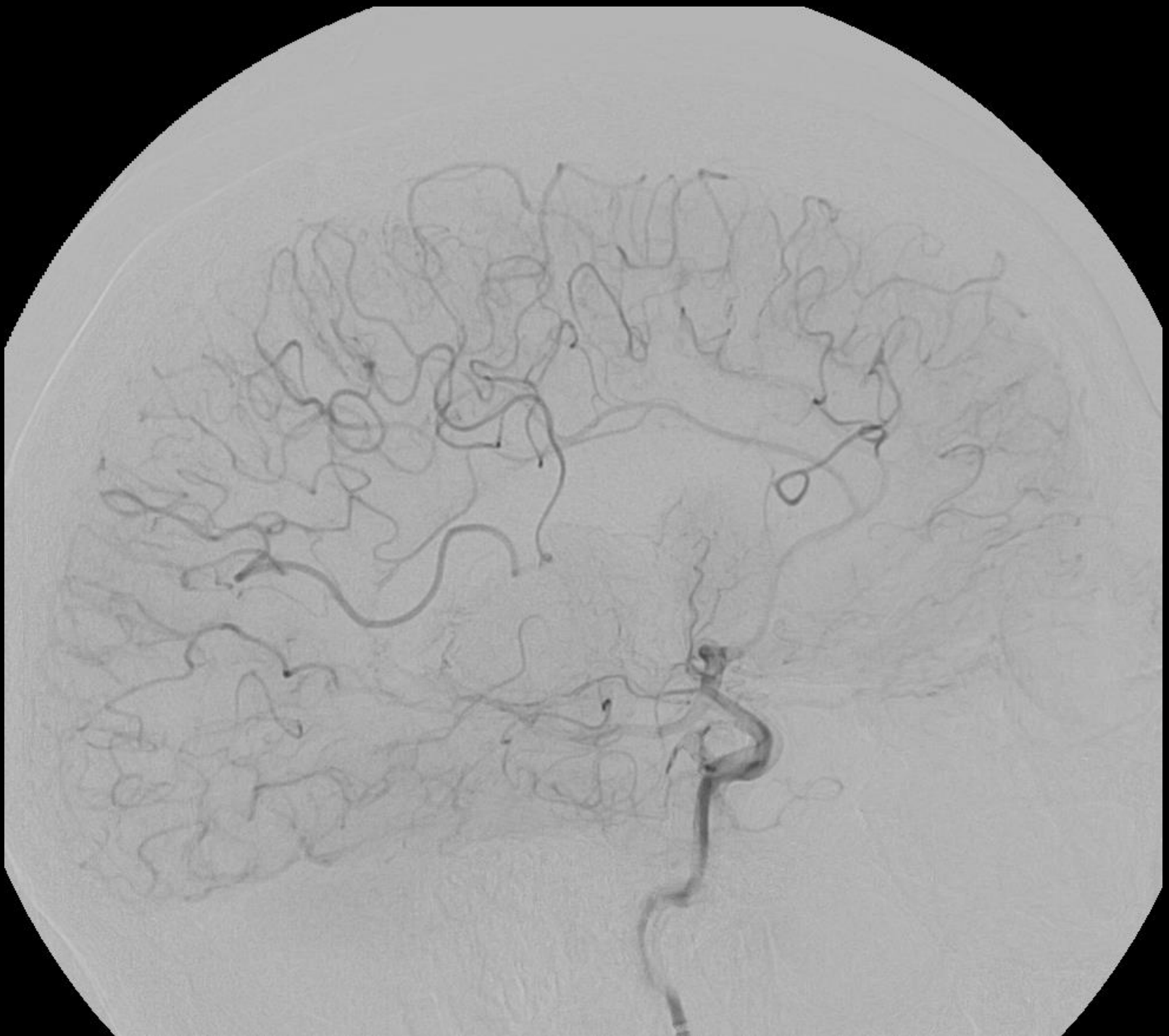


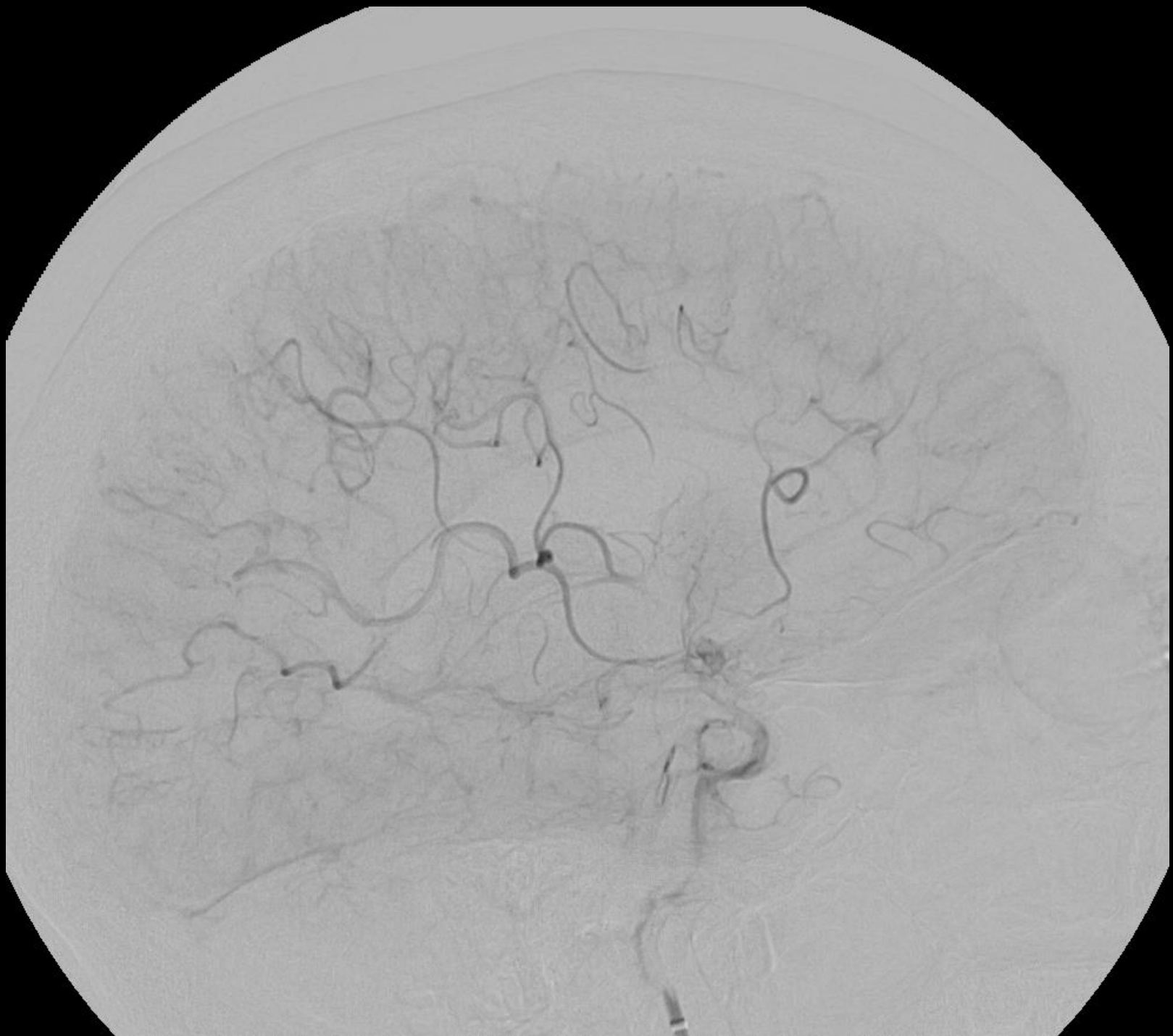


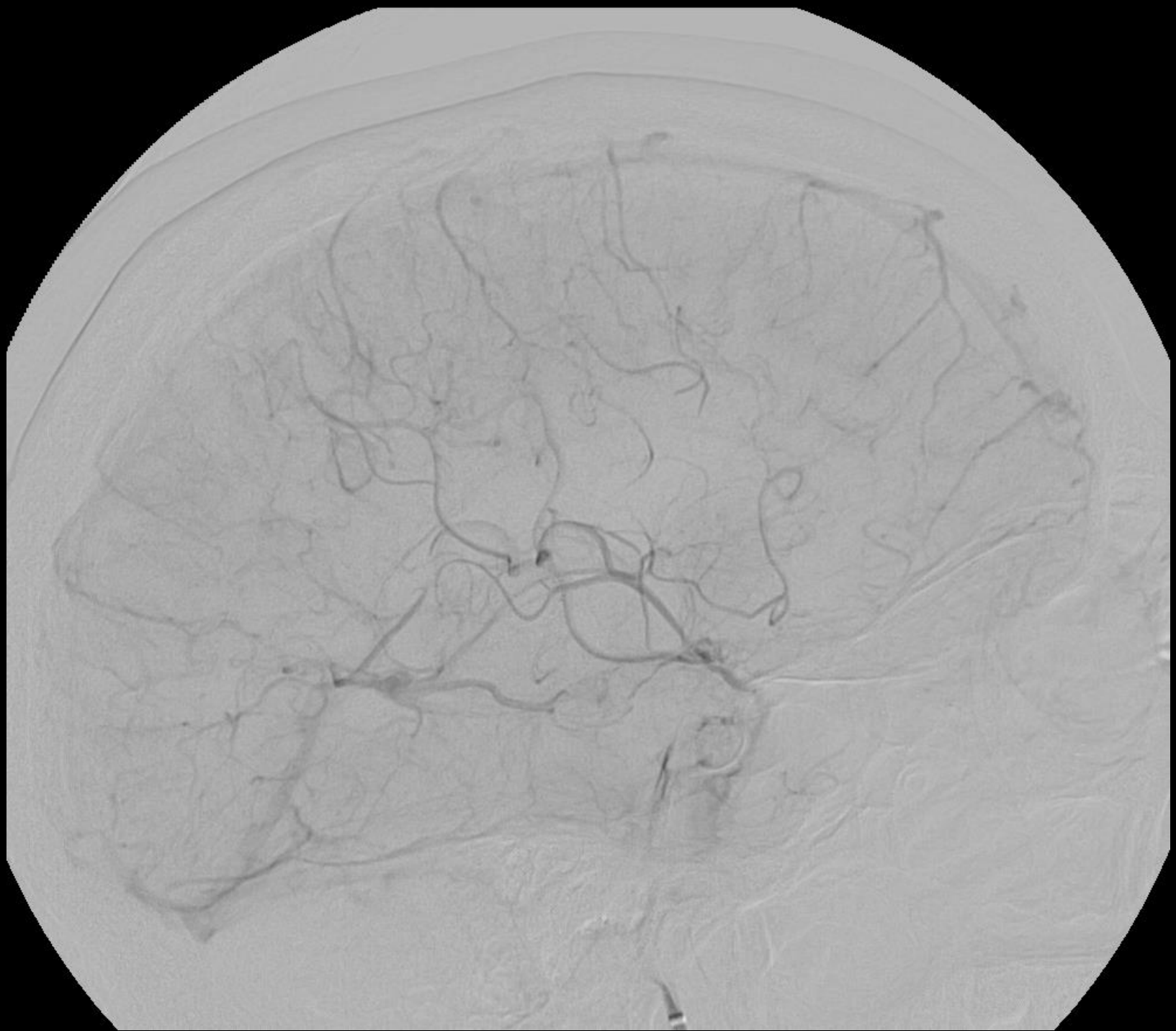


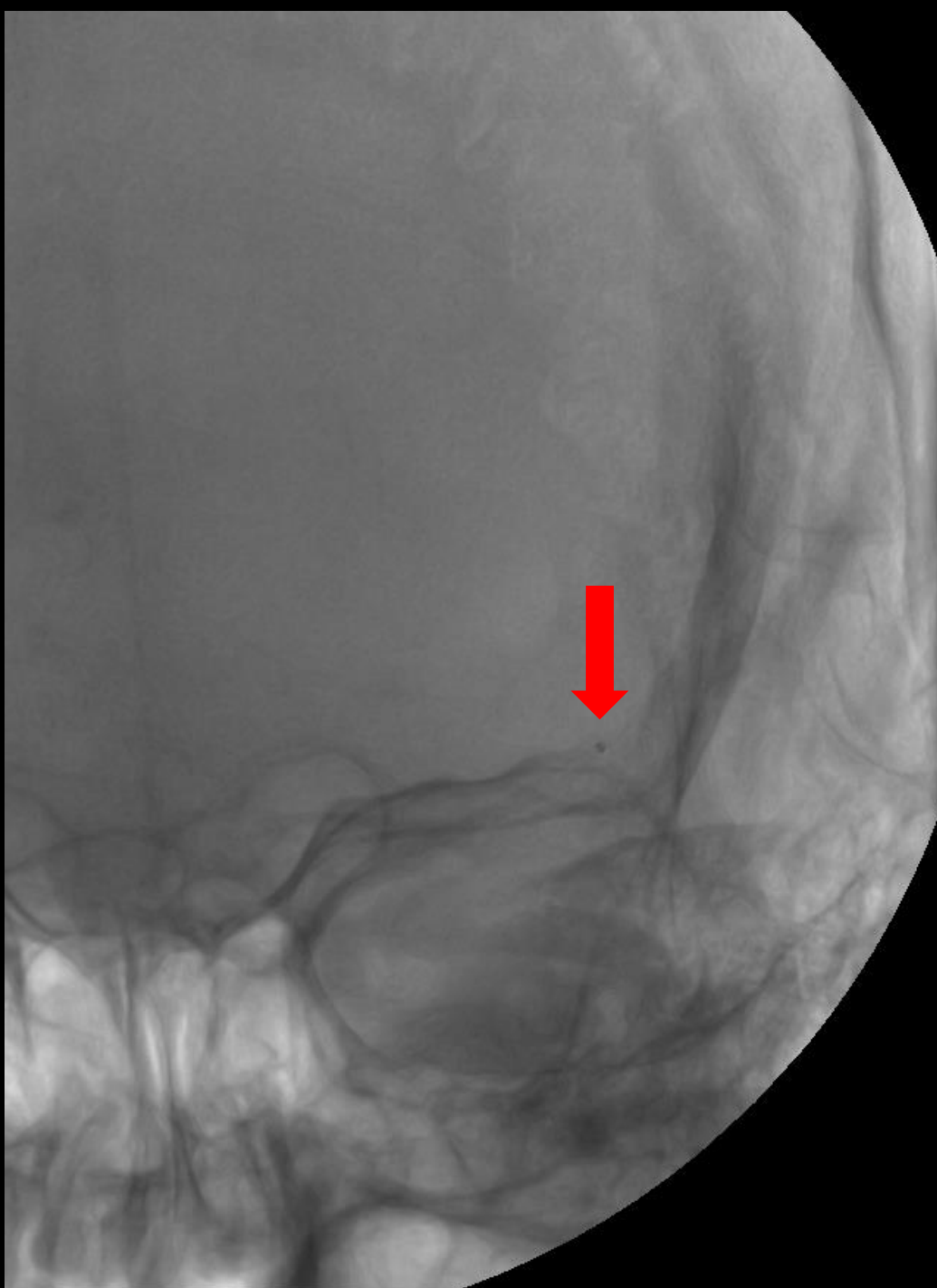




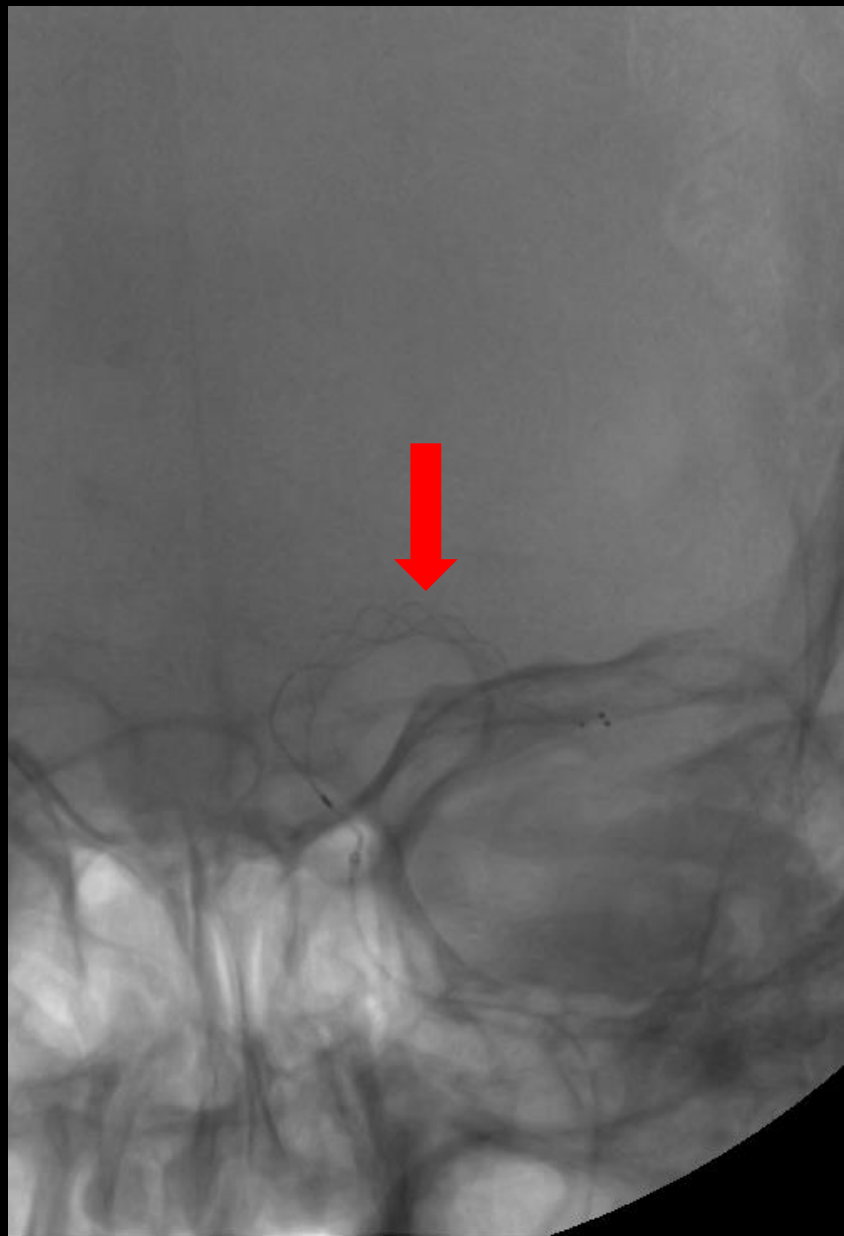
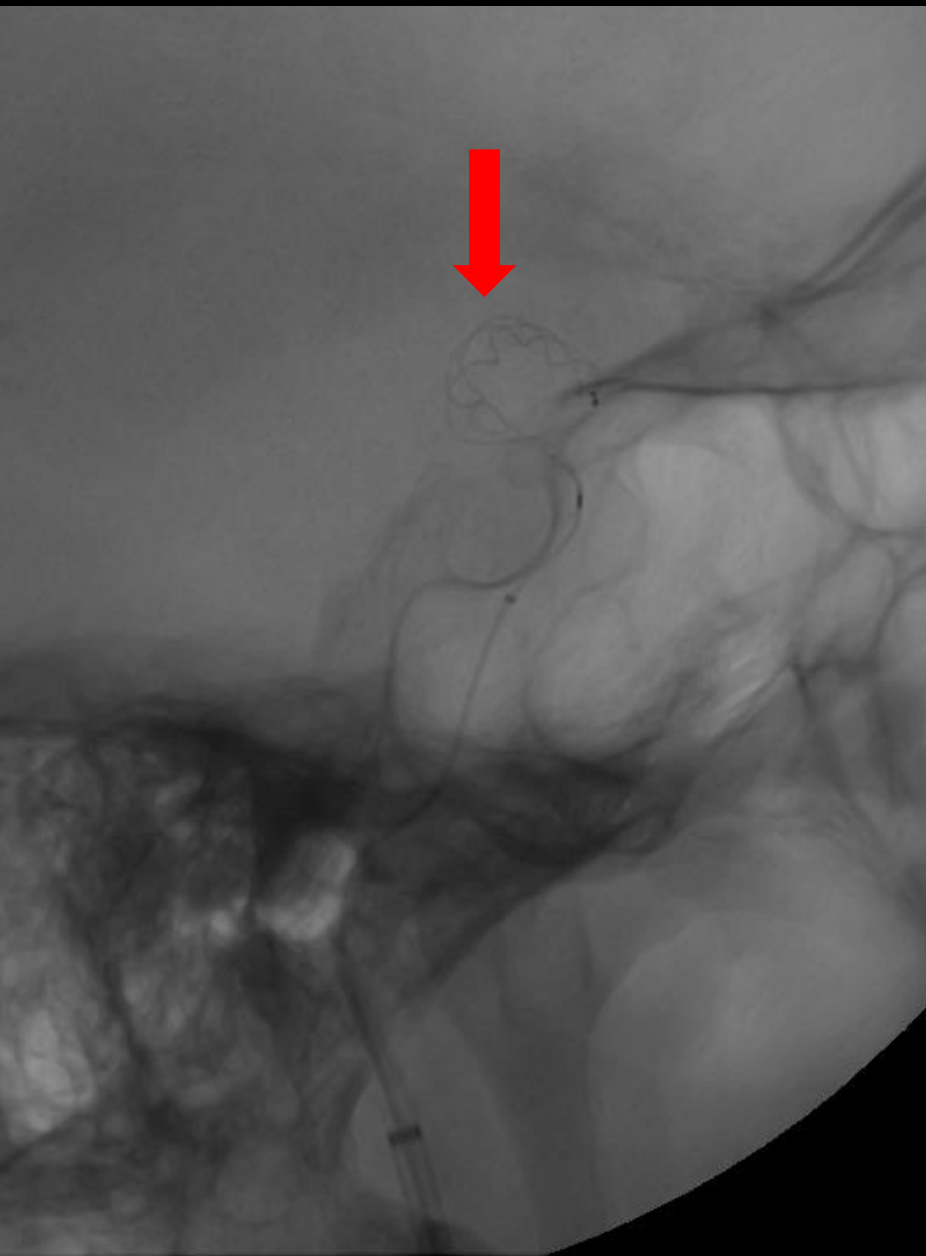




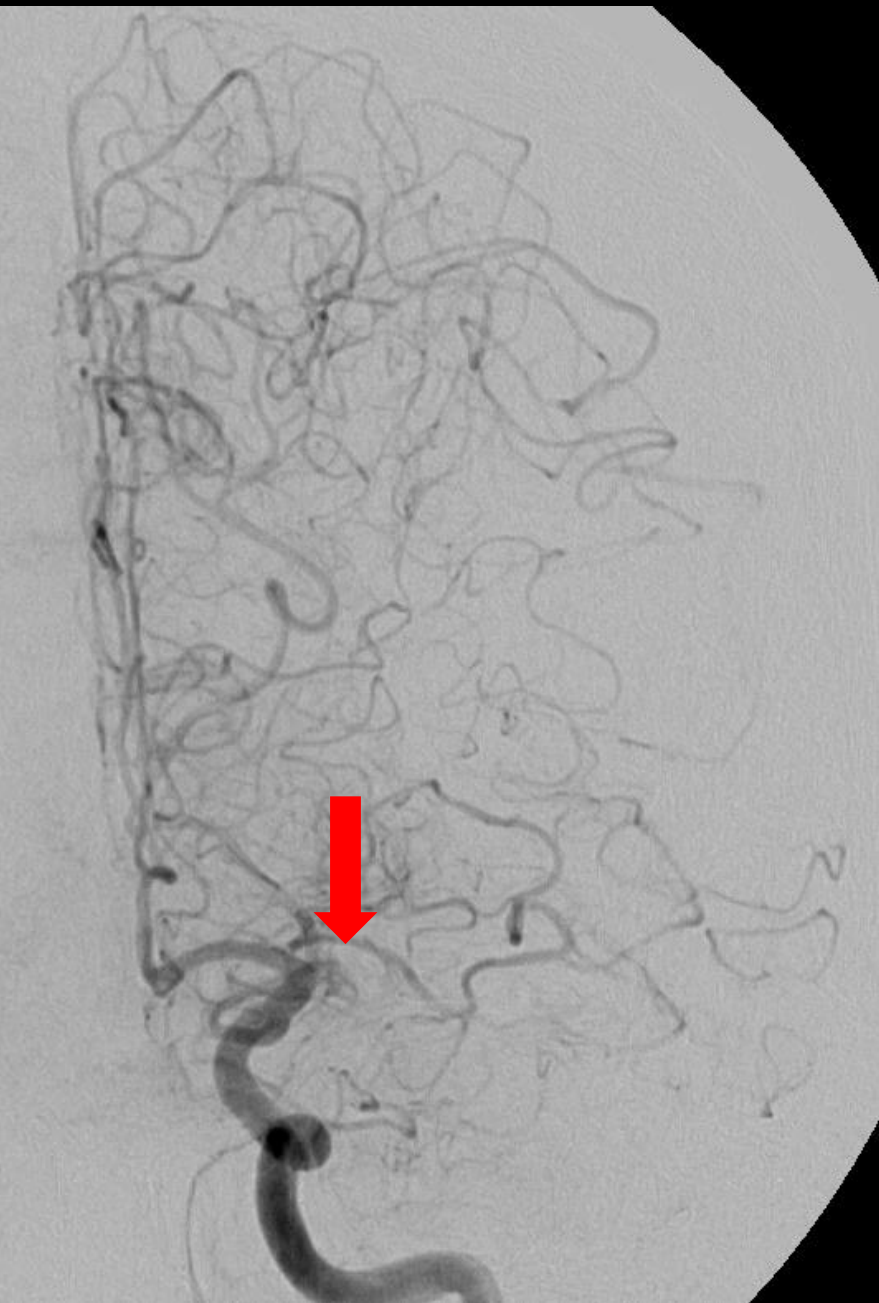


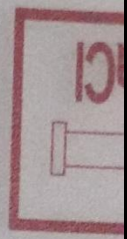
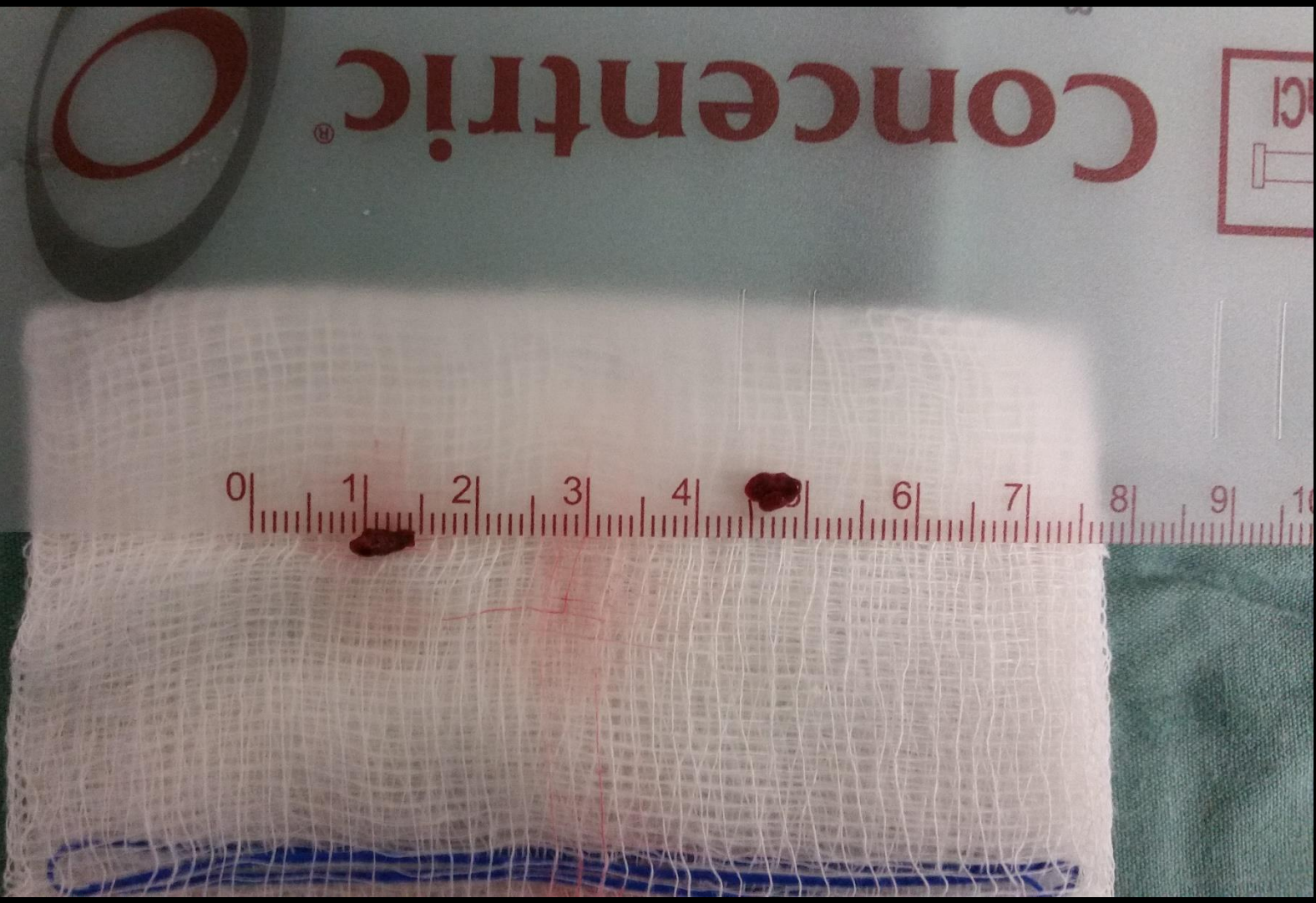


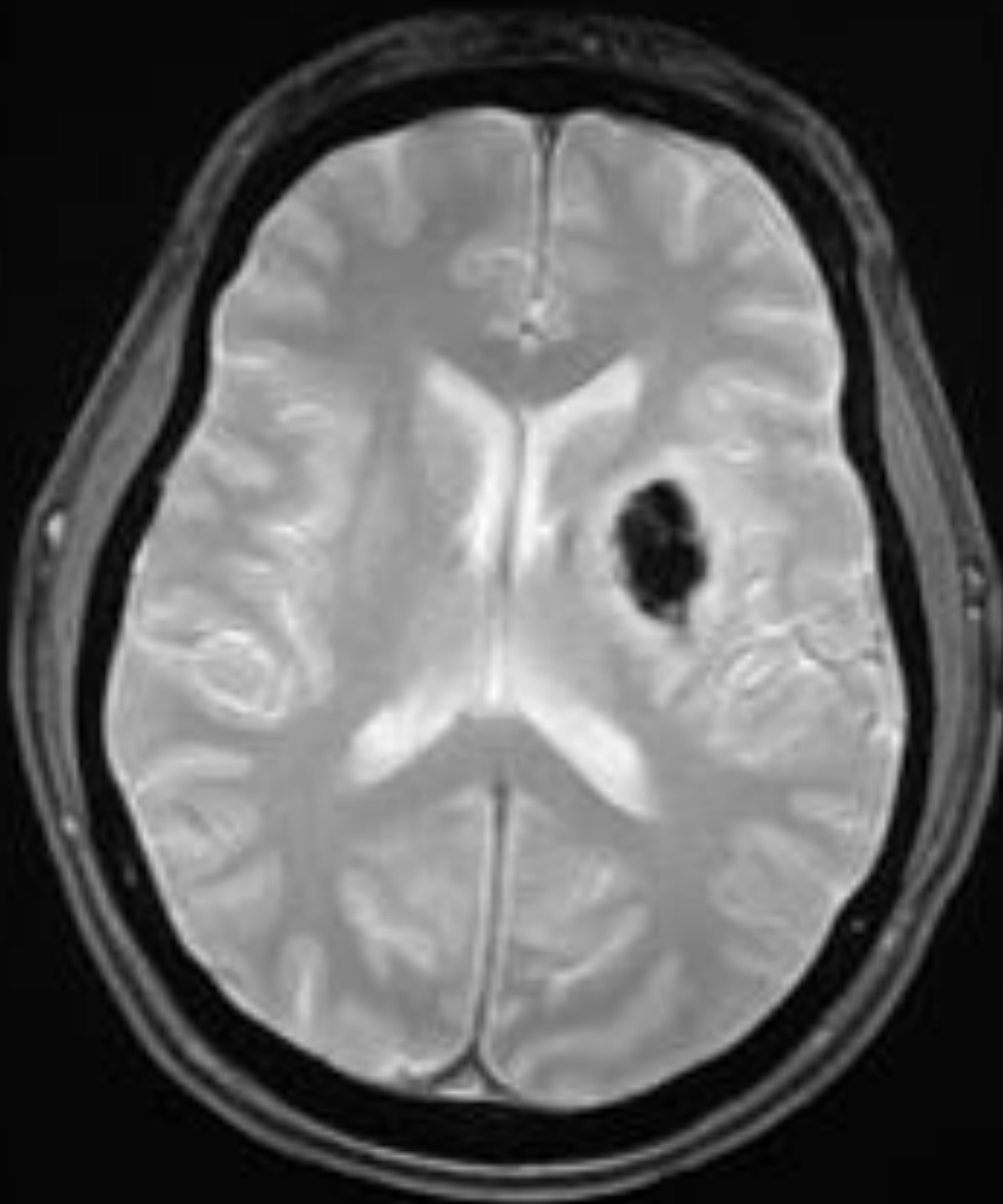


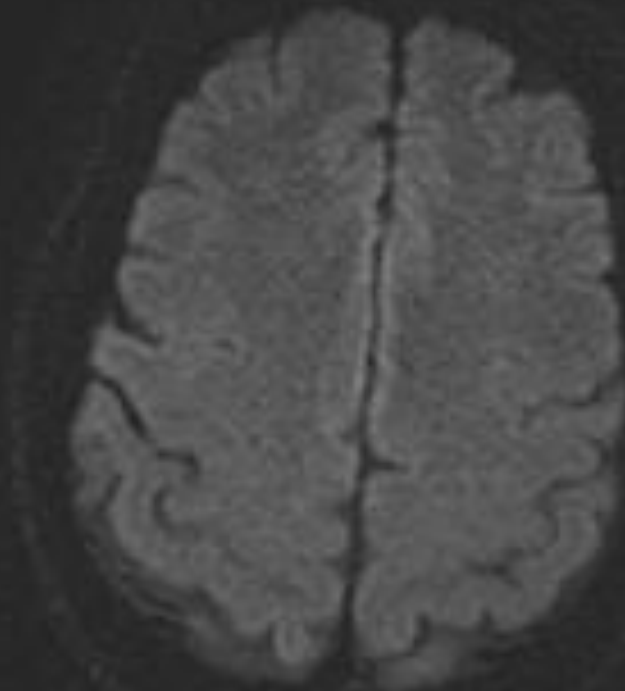
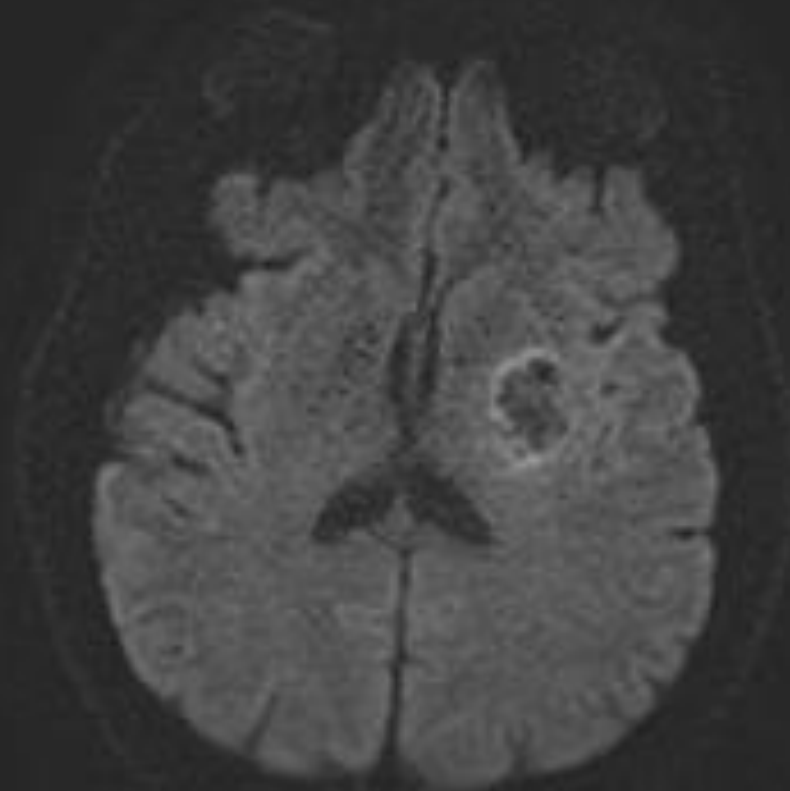












# Overview

- Review of the recent literature
  - Emphasis on what was studied, reasons for trial failures/successes and implications for imaging.
- Review Canadian practice guidelines
- Use the literature and national guidelines to develop a practical, acute imaging protocol

# References

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Thank You!