Anatomy of Stroke or Cerebral Angiography 101

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UNIVERSITY OF CALGARY

Disclosure

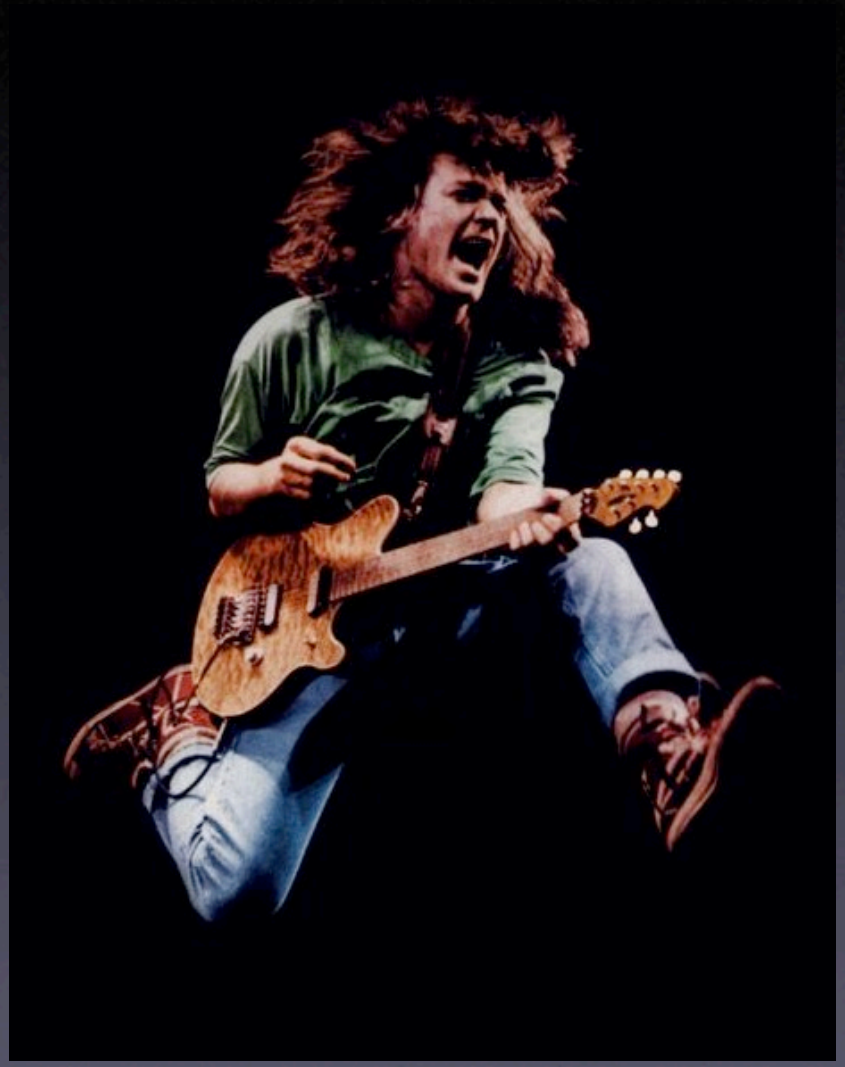
- I have no direct financial interest in the products or companies discussed today.

Goals

- Basics of Angiography
- Review of cerebrovascular anatomy
  - Arterial
  - Capillary & Venous - Another time!

Questions

- 1. What are the branches of the ICA? PCA?
- 2. What are some of the common intracranial and extracranial vascular collateral pathways?
- 3. What is the risk of a cerebral angiogram?
- 4. Who are these men and what links them together?



Radiology

- Catheter-based Cerebral Angiography
- CT-Angiography
- MR-Angiography

Egas Moniz (1874-1955)

Cerebral Angiography

- Catheter-based injection of the arterial brain circulation
- Typically inject 4-8 cc of non-iodinated contrast into carotid or vertebral arteries
- Biplanar x-ray angiography enables anterior-posterior (AP) and lateral views simultaneously

Biplanar Angiography

- AP
- Lateral
- Oblique
- Rotational

Patient Preparation

- NPO for at least 4-6 hours
- Rule out
  - Contrast allergy: History
  - Renal insufficiency: Serum Creatinine

Access

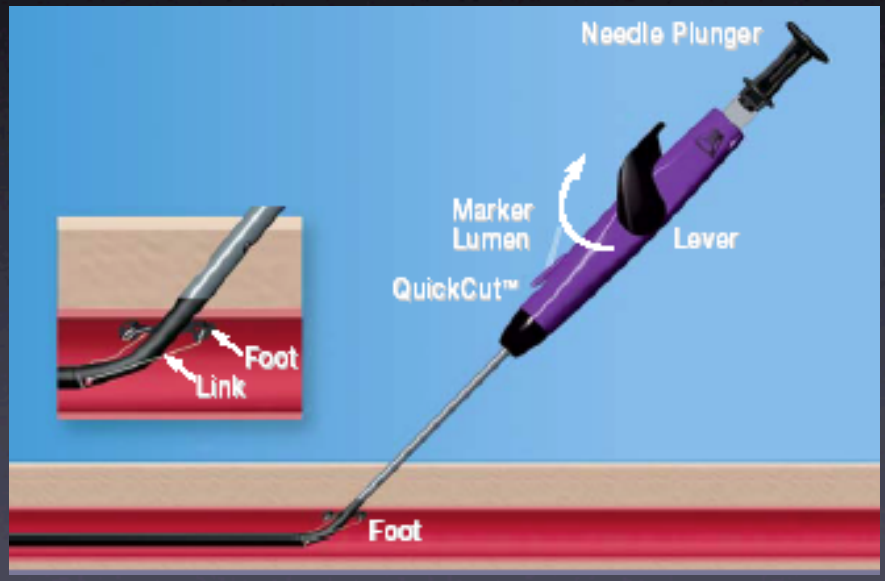
- Femoral Artery Puncture
  - Local anesthetic
- Can be uncomfortable!
  - Feeling of "hotness" in face
  - IV sedation/analgesia

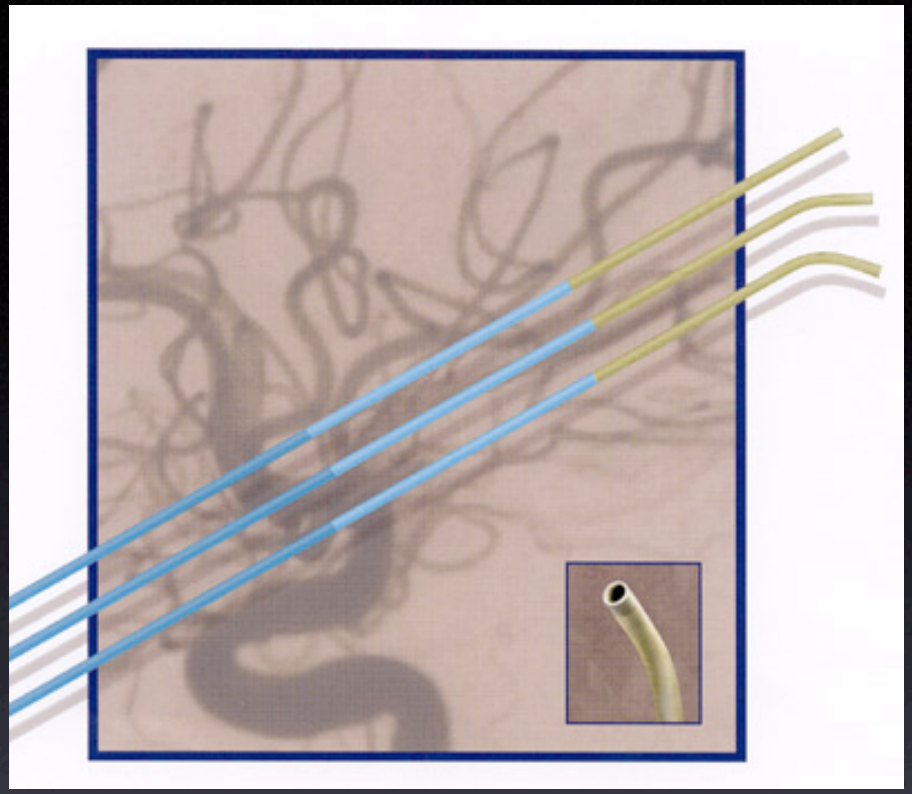
Complications

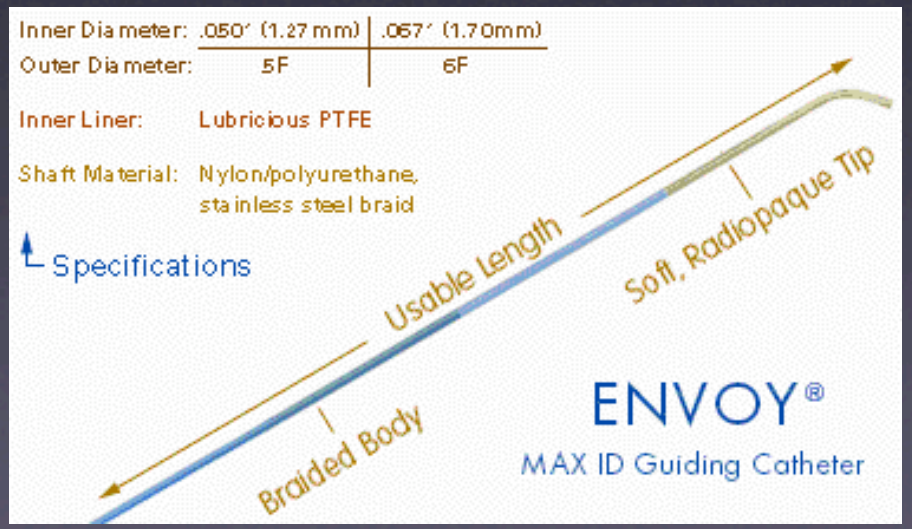
- Contrast reaction - 1/30000 anaphylaxis
- Thromboembolic stroke - 0.3-0.5%
- Femoral neuropathy - 1-5%

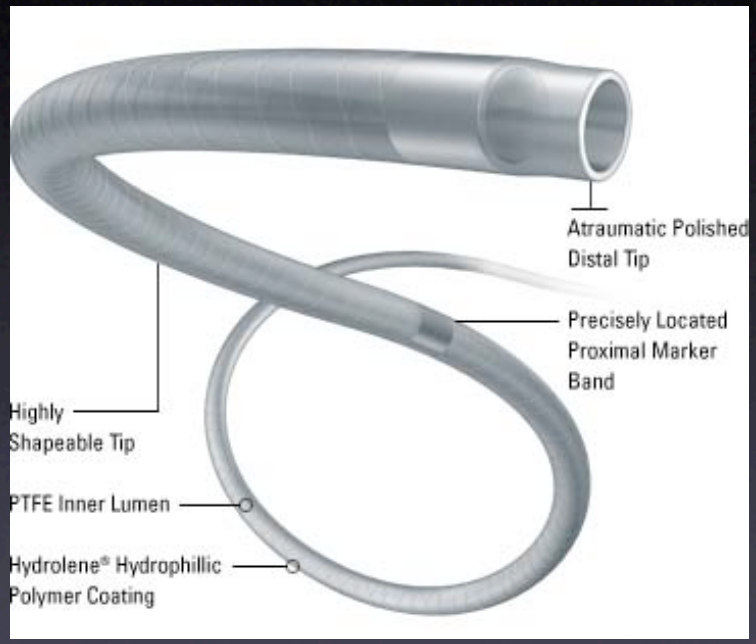
Post-procedure

- Supine with leg straight for 4-6 hours
  - May be difficult for patients with back pain
  - Can percutaneously suture the artery and mobilize the patient immediately









Guide Catheters & Microcatheters

Cerebrovascular Anatomy

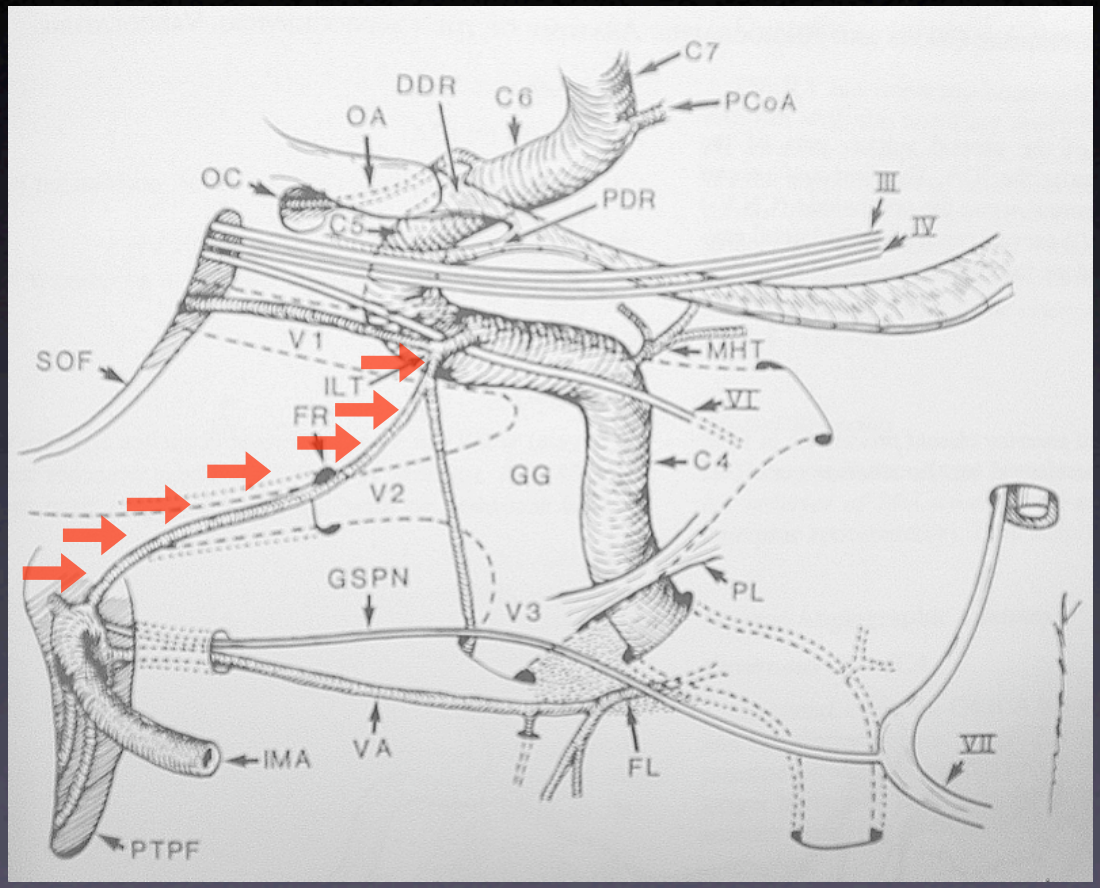
- Anterior Circulation
  - Internal Carotid
  - External Carotid
- Posterior Circulation
  - Vertebrobasilar

Carotid bifurcation

- Carotid bifurcation at C3-6
  - Internal Carotid
    - No cervical branches
  - External Carotid

Internal Carotid

- C1 Cervical
- C2 Petrous
- C3 Lacerum
- C4 Cavernous
- C5 Clinoid
- C6 Ophthalmic
- C7 Communicating (Terminal)



Anterior Circulation

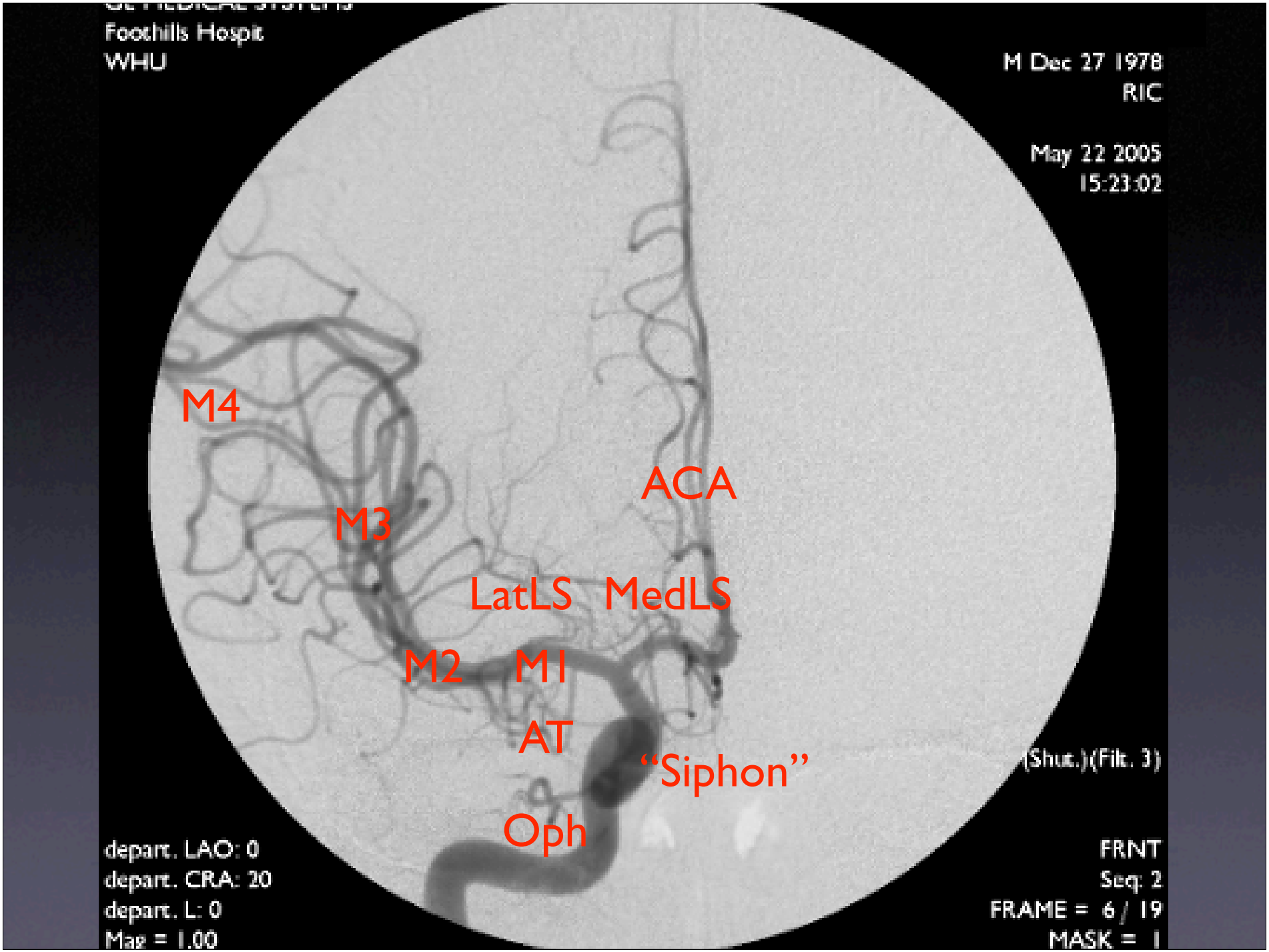
- Internal carotid artery
  - Superior hypophyseal
  - Ophthalmic
  - Posterior communicating
  - Anterior choroidal
  - ICA bifurcation

Anterior Cerebral Artery

- Medial lenticulostriates
- Anterior communicating
- Recurrent artery of Heubner
- Orbitofrontal
- Frontopolar
- Pericallosal
- Callosomarginal

Middle Cerebral Artery

- Lateral lenticulostriate
- Anterior temporal
- MCA bifucation (M1-4)
- Insular
- Frontal
- Temporal
- Parietal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M4
M3
ACA
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M2
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Oph
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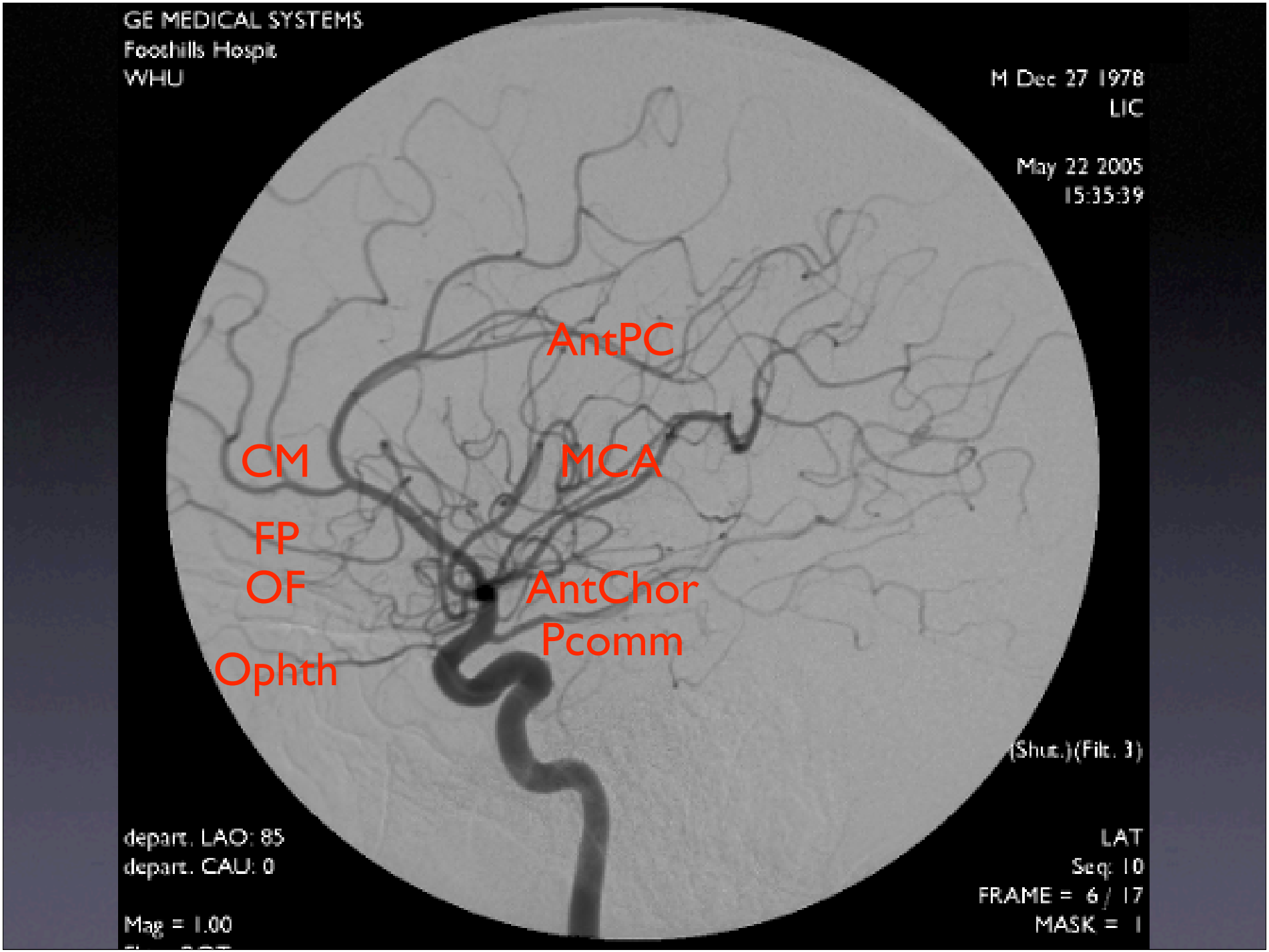
AI
RAH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FP
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Pcomm
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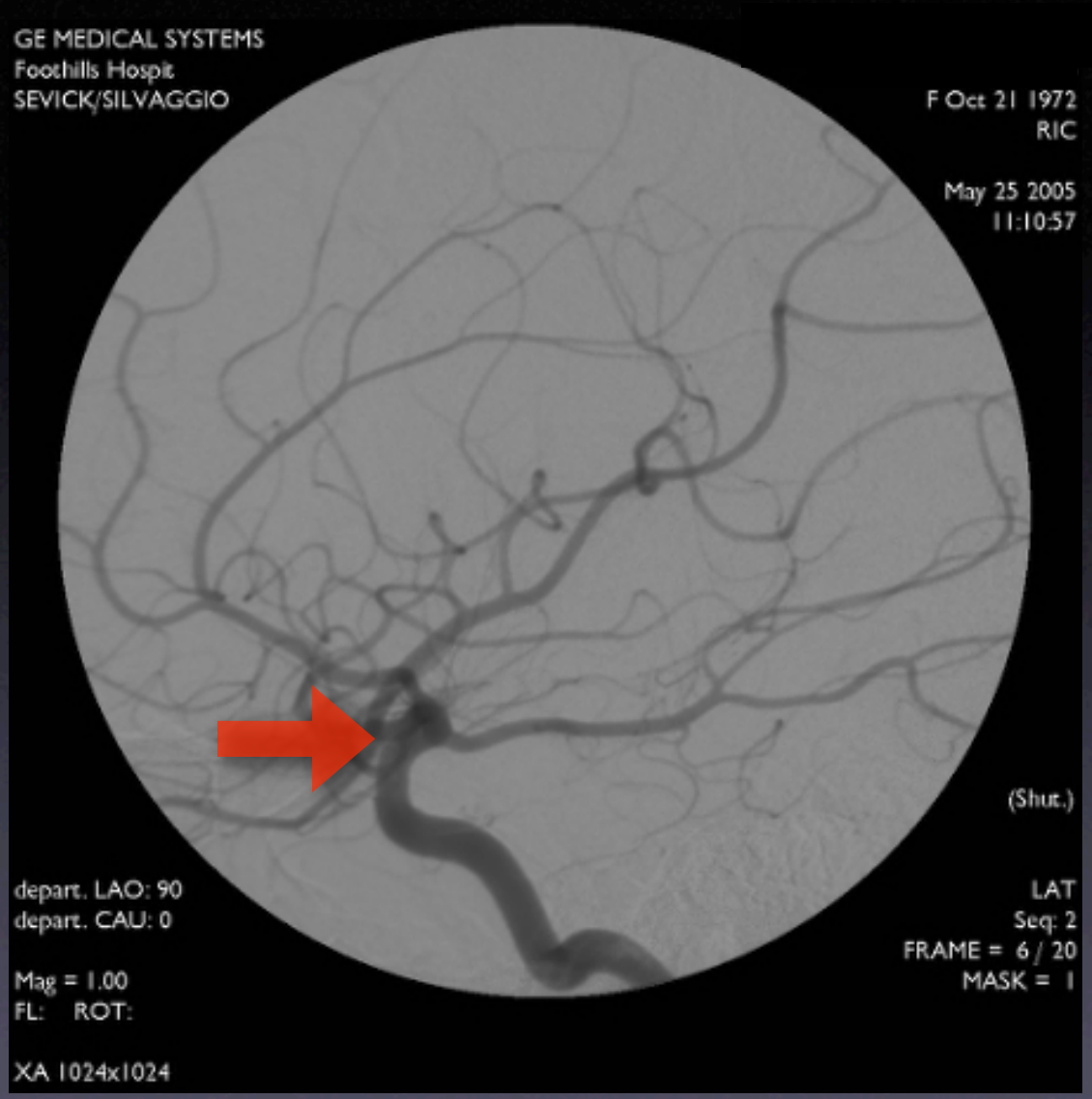
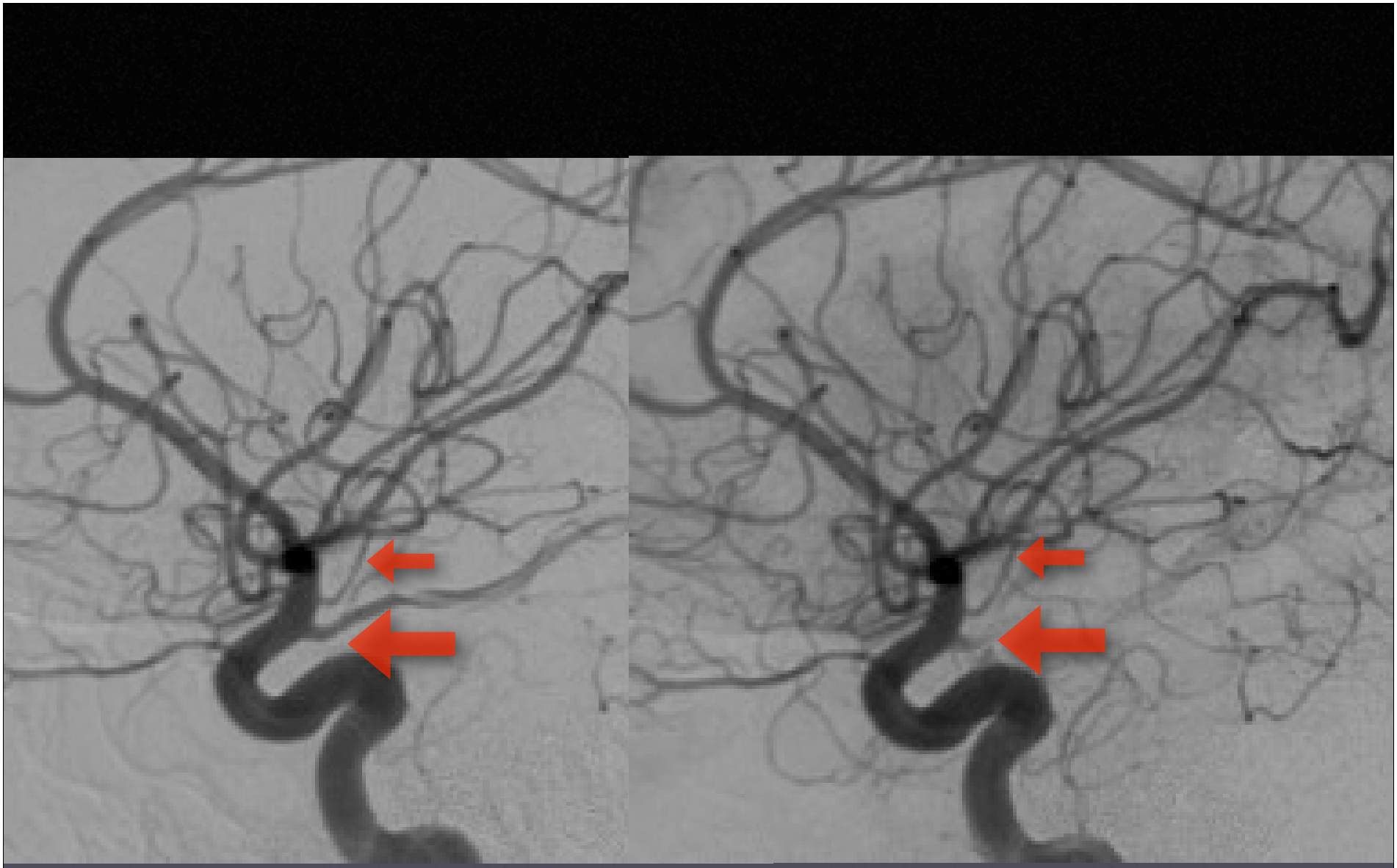
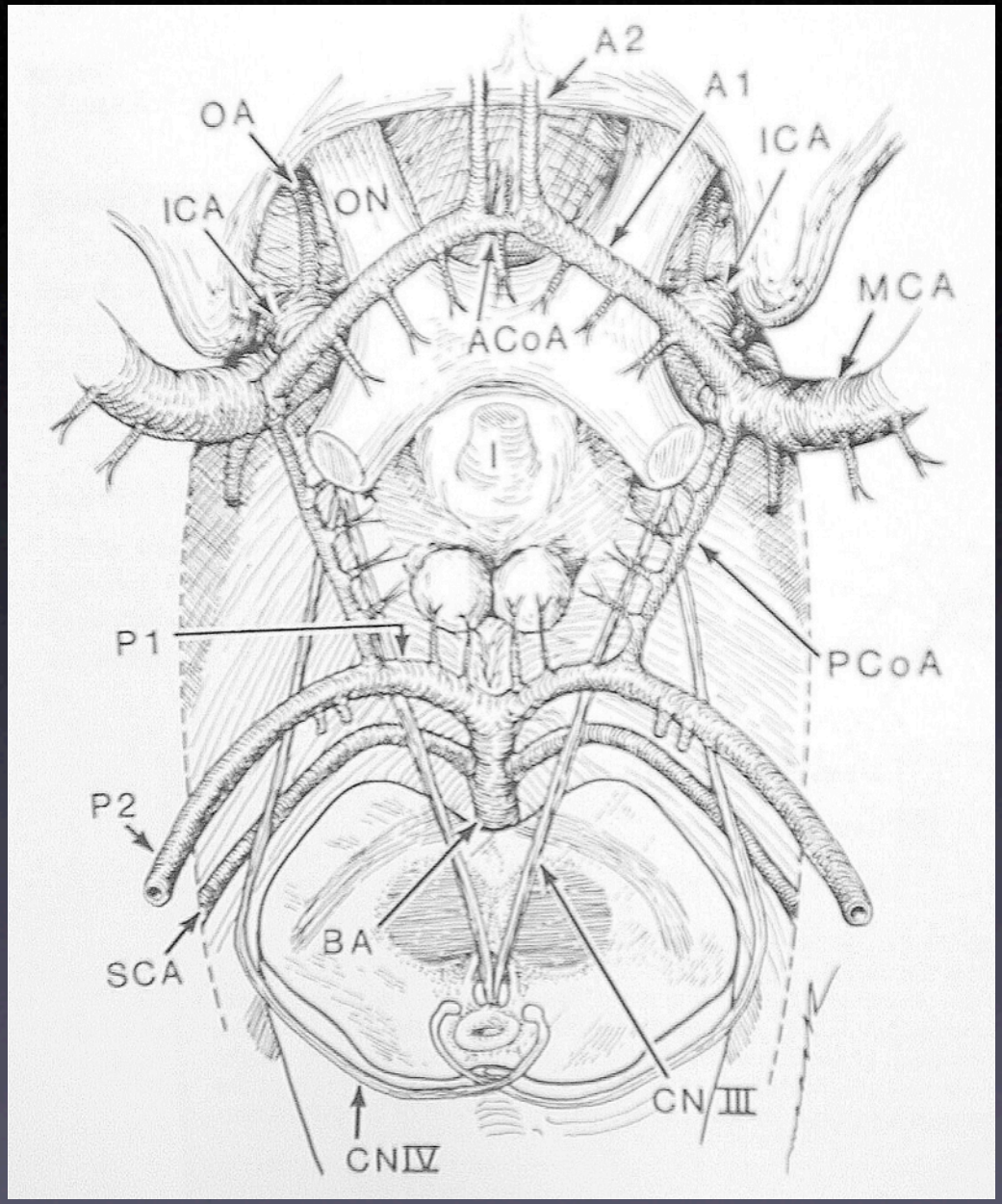


"Dominant" Pcomm



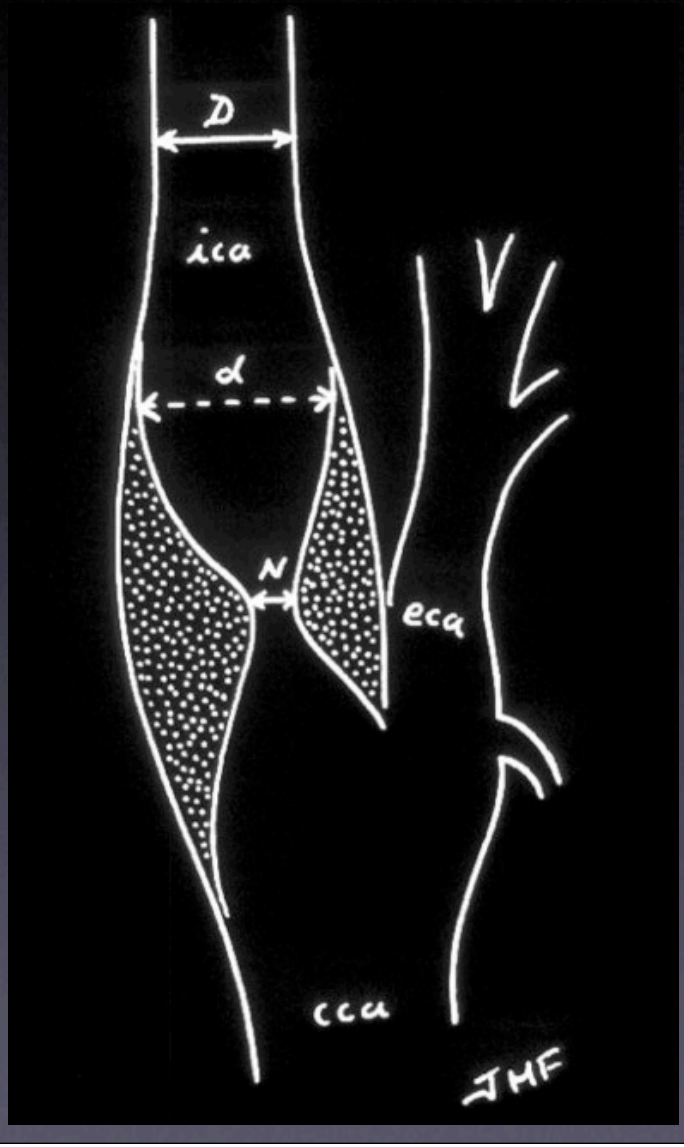
P-comm versus Ant Choroidal?

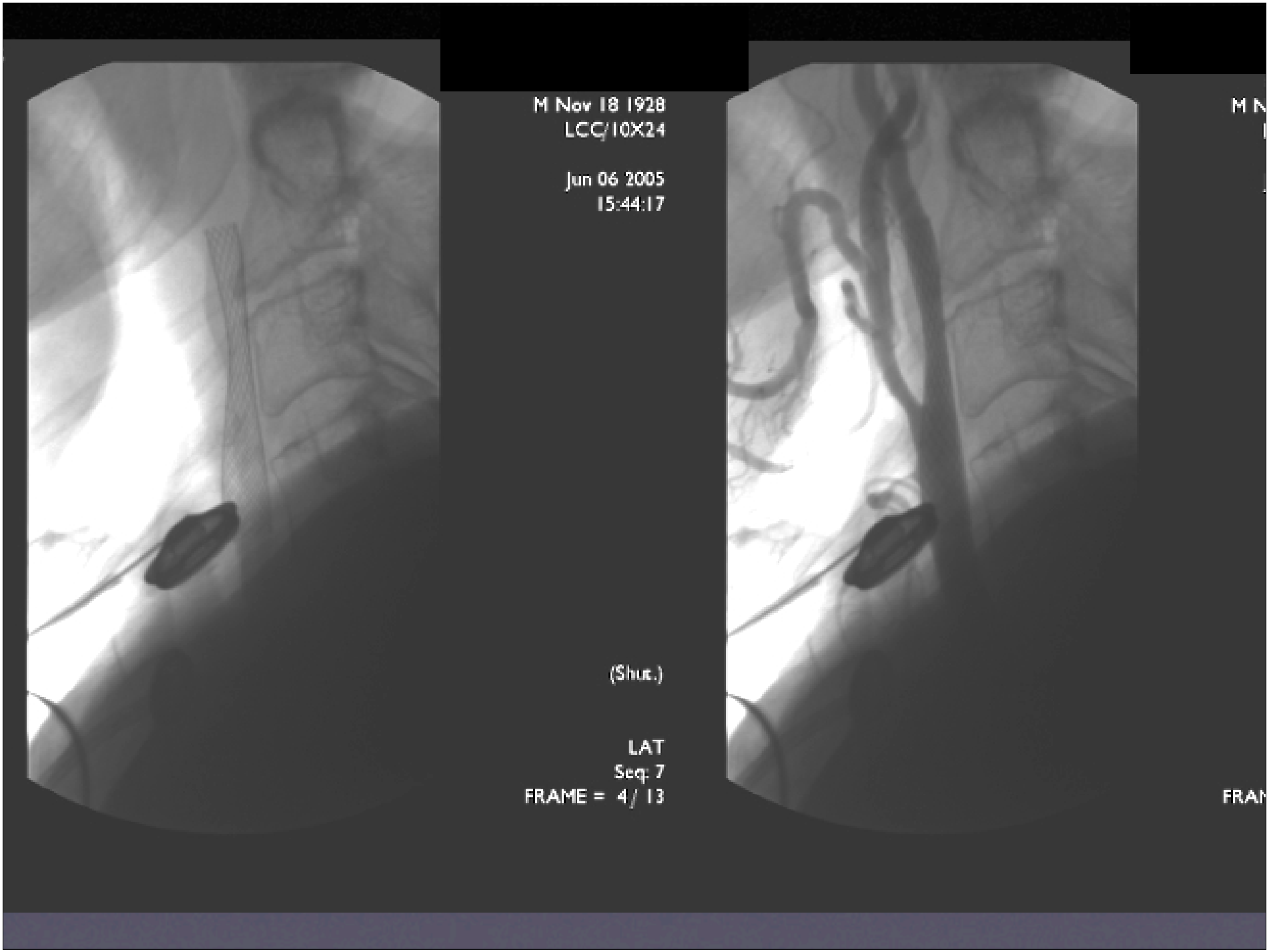

A2
A1
OA
ICA
ON
ICA
MCA
ACoA
I
P1
PCoA
P2
BA
SCA
CN III
CN IV

Conditions & Cases

Carotid Stenosis

- Atherosclerotic narrowing at the cervical carotid bifurcation
- Treated by endarterectomy or stenting

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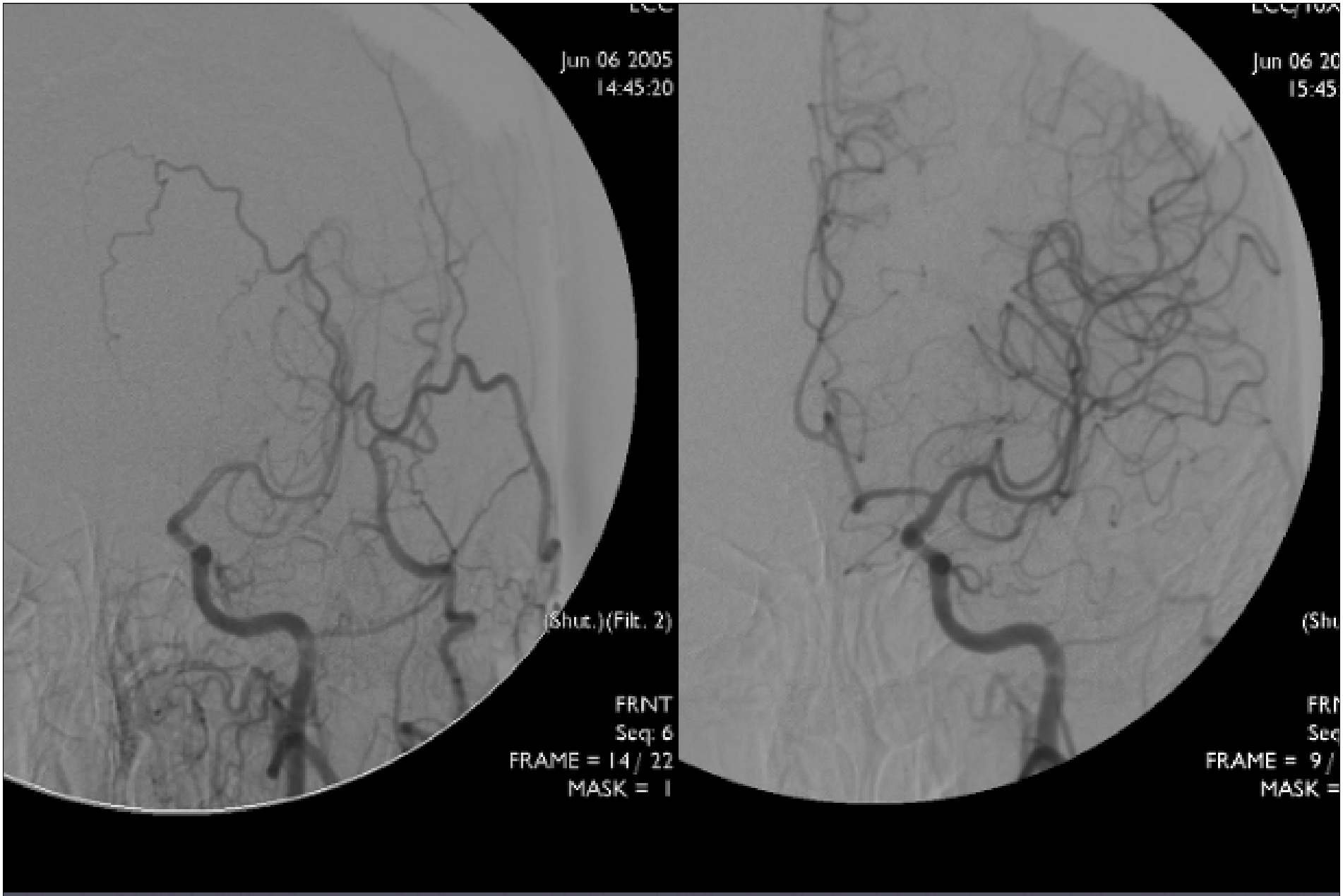
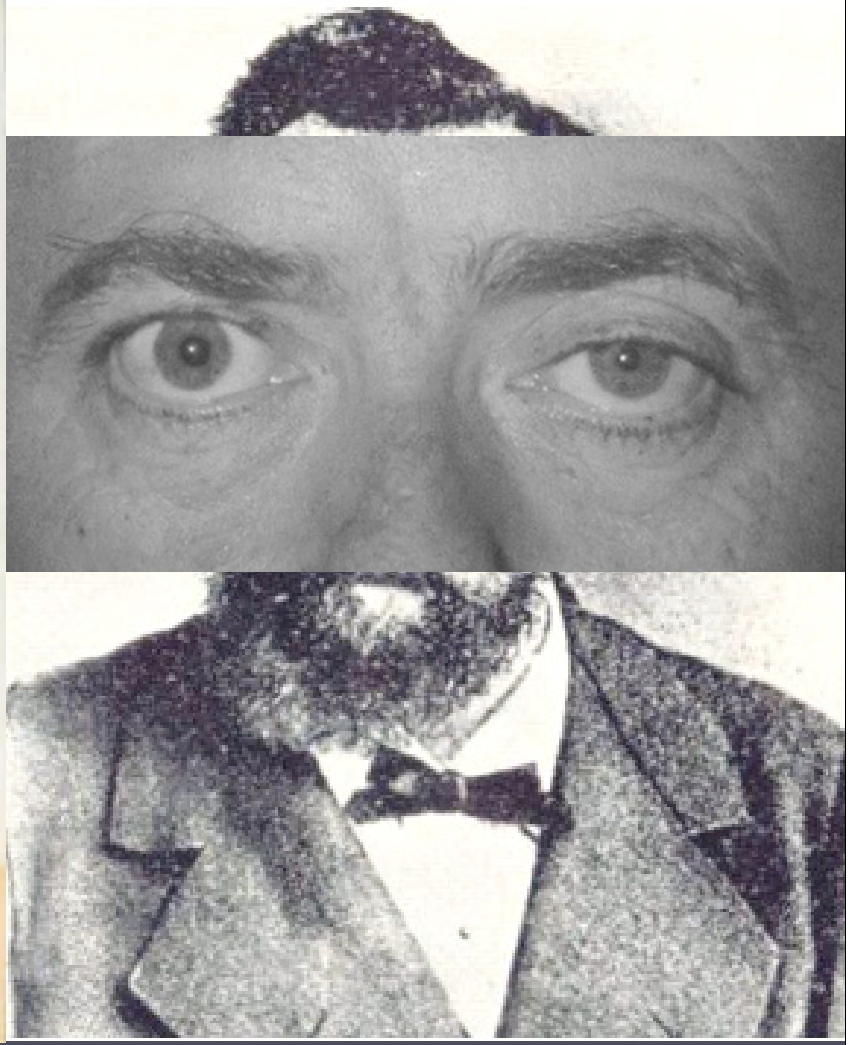


Pre-stent

Post-stent

Who are these men?

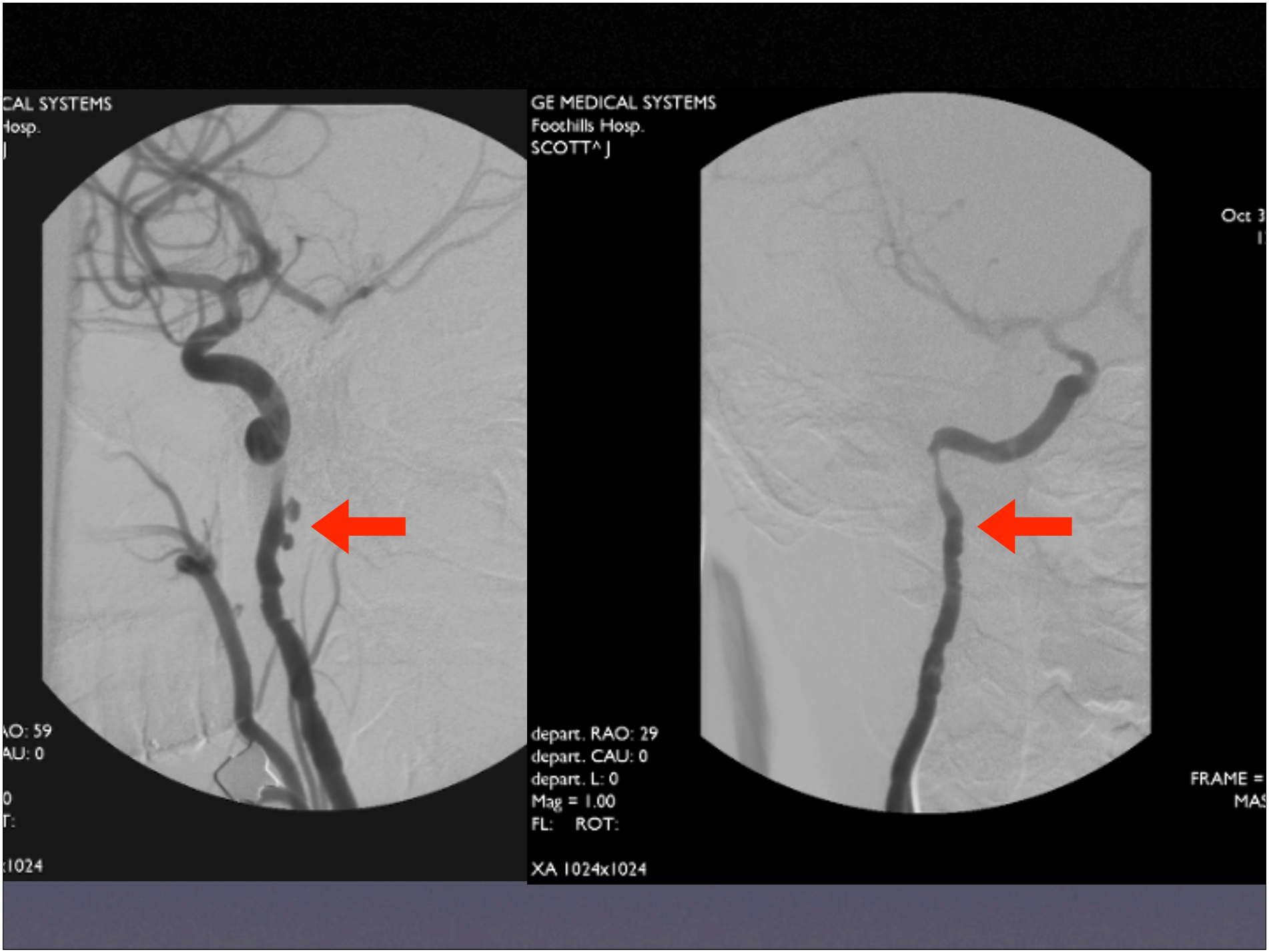
Eddie Van Halen



Johann Horner

Carotid Dissection

- 29 year old woman
- Front-row seats at Van Halen reunion concert
- 2 hours of voluntary forceful repeated neck flexion and extension (“head-banging”)
- Awoke with neck pain and left Horner’s syndrome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AU: 0
1024
GE MEDICAL SYSTEMS
Foothills Hosp.
SCOTT^ J
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depart. L: 0
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XA 1024x1024
Oct 3
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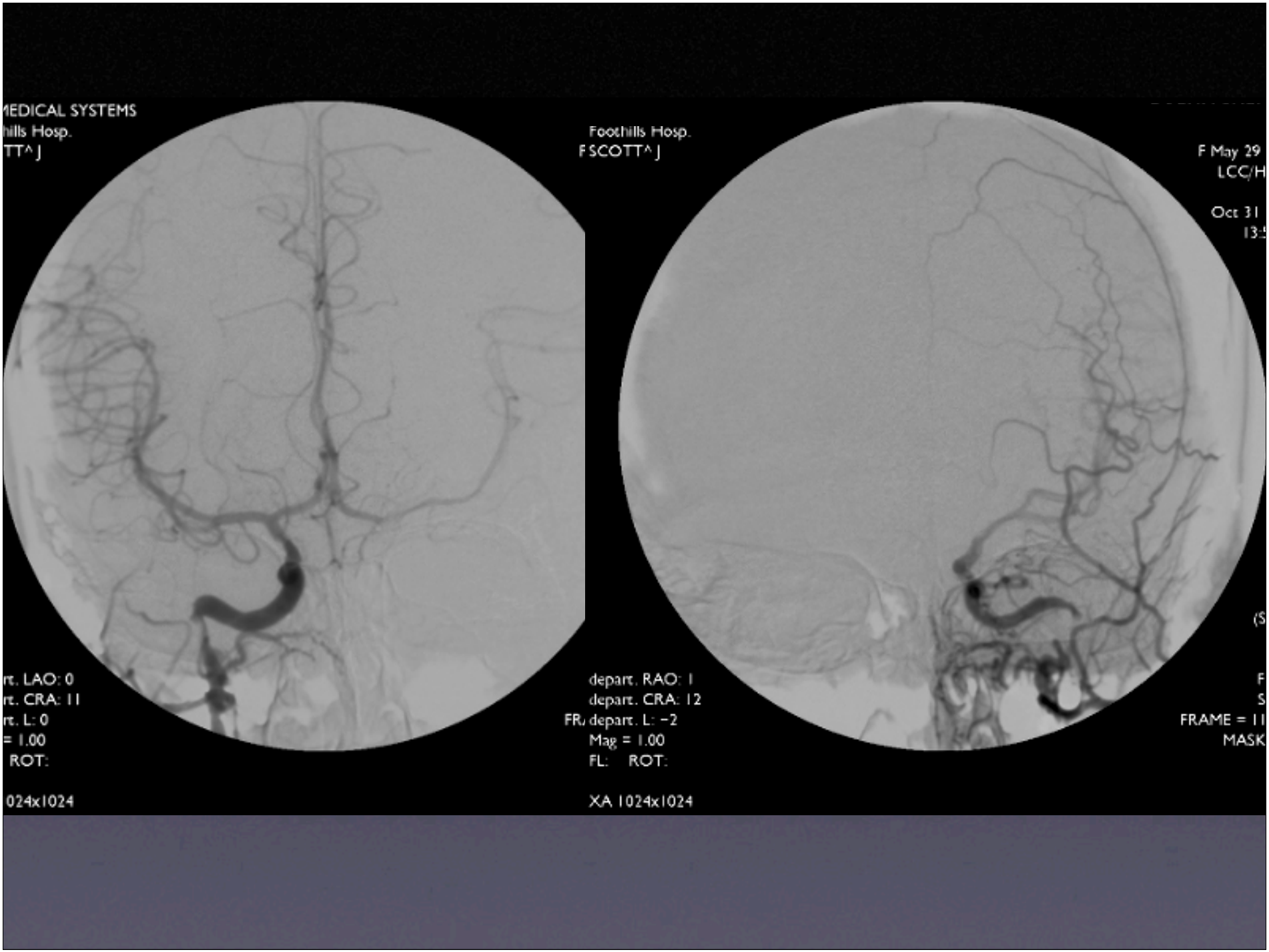
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hills Hosp.
TT^J
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Foothills Hosp.
FSCOTT^J
F May 29
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Oct 31
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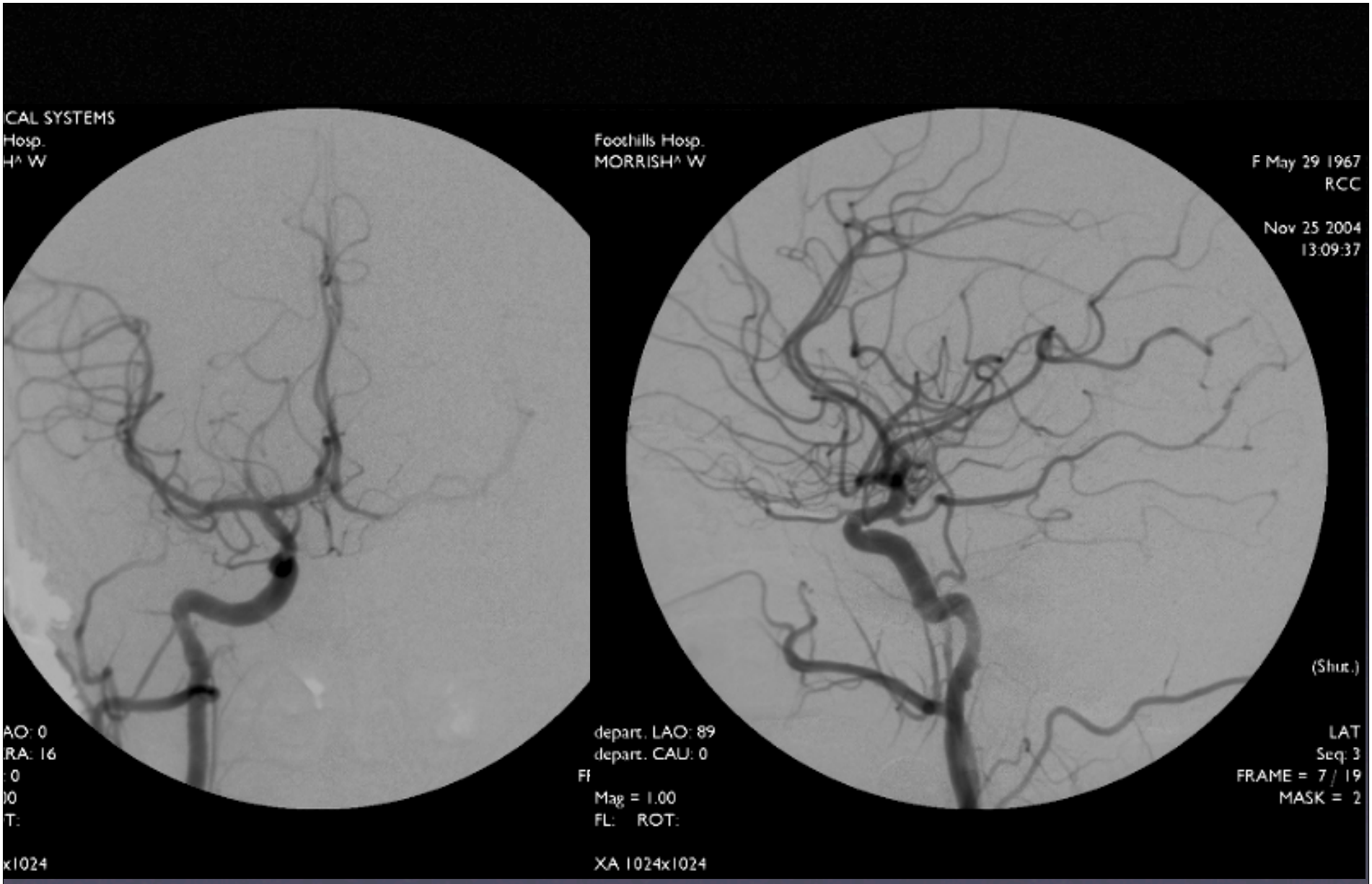
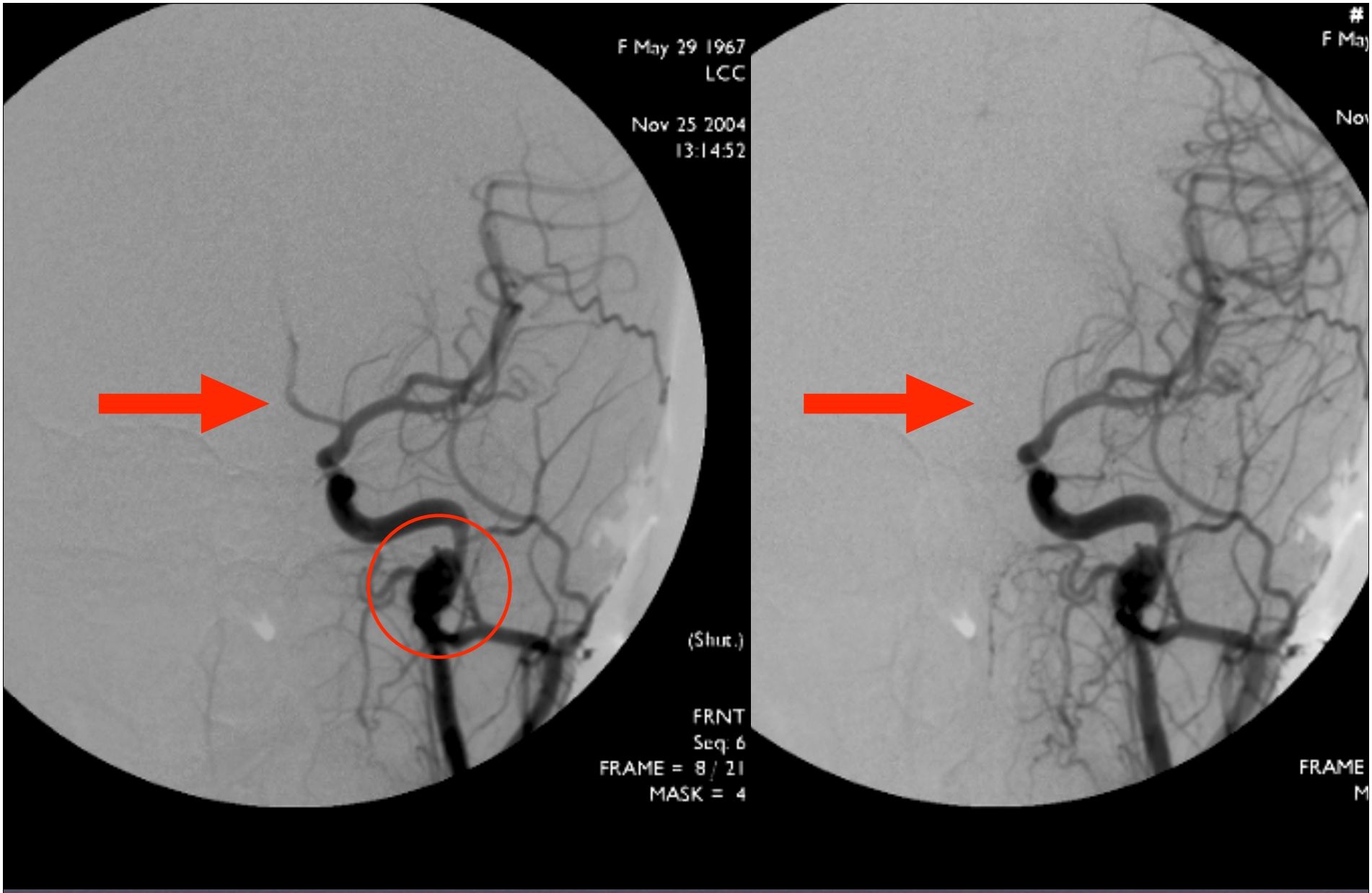


1 month later



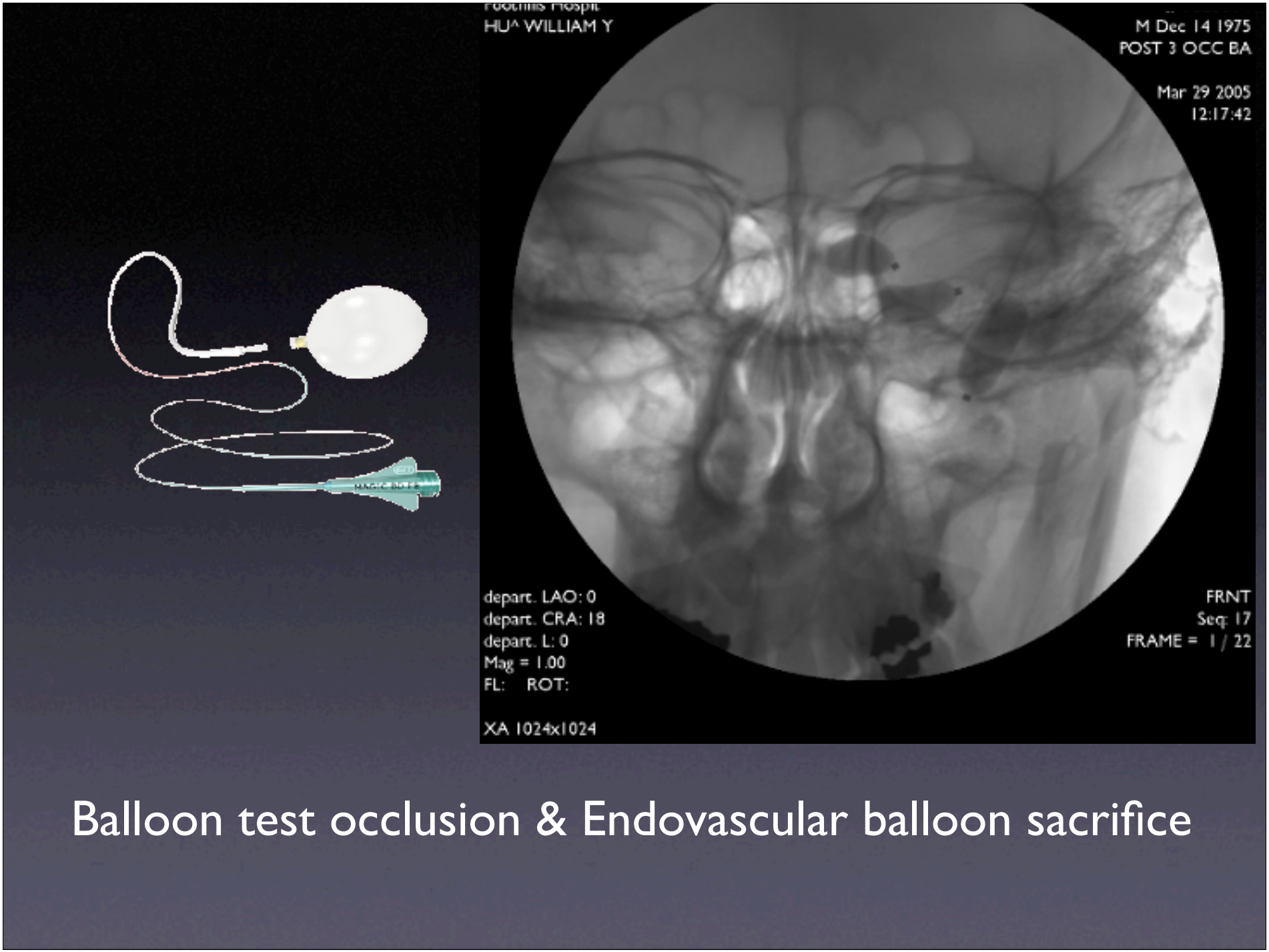
1 month later

6 months later

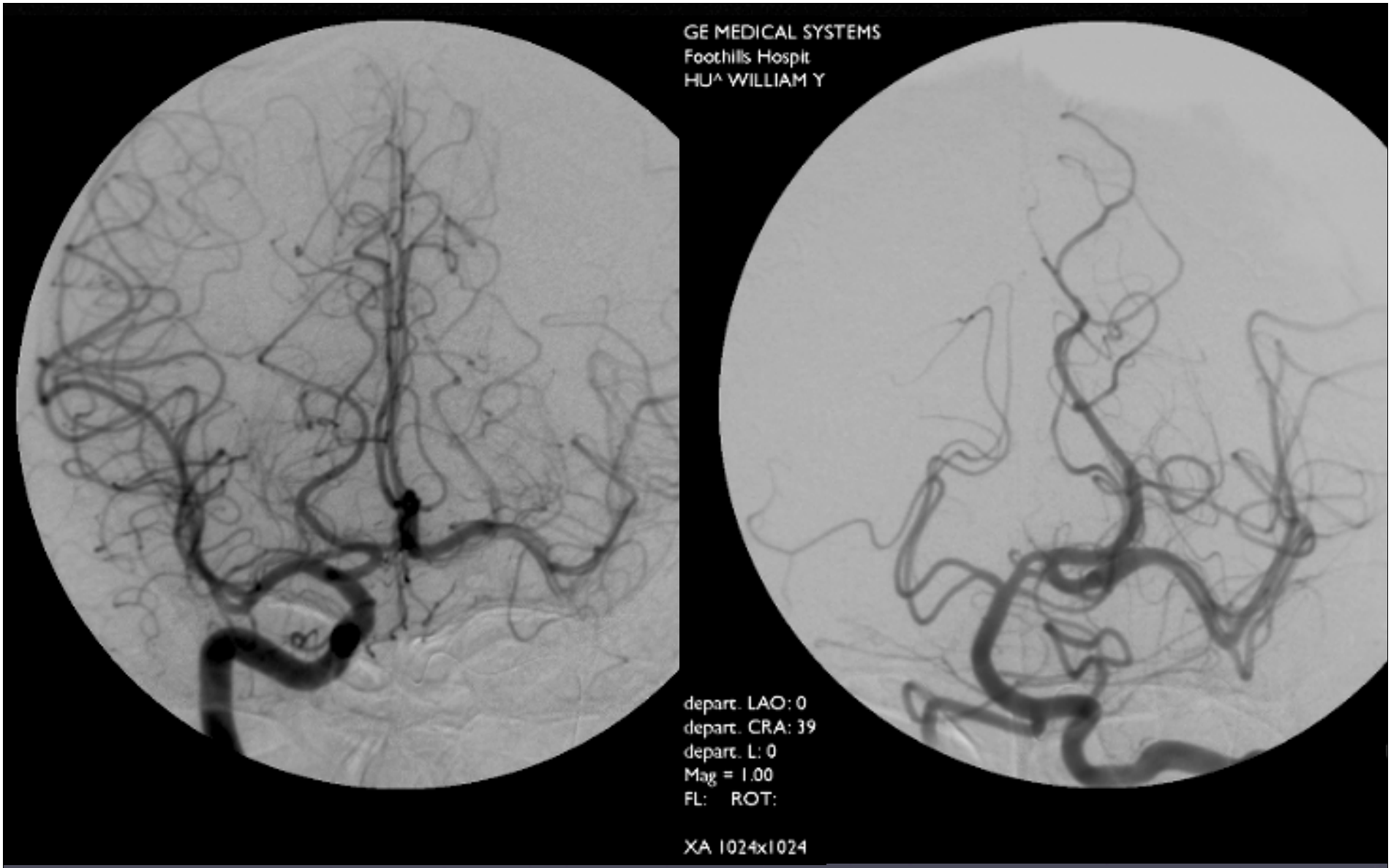
Case

- 26 year old man with headache and known fusiform cavernous carotid aneurysm
- Enlargement and erosion of skull base and sphenoid sinus


(Shut.)
MA



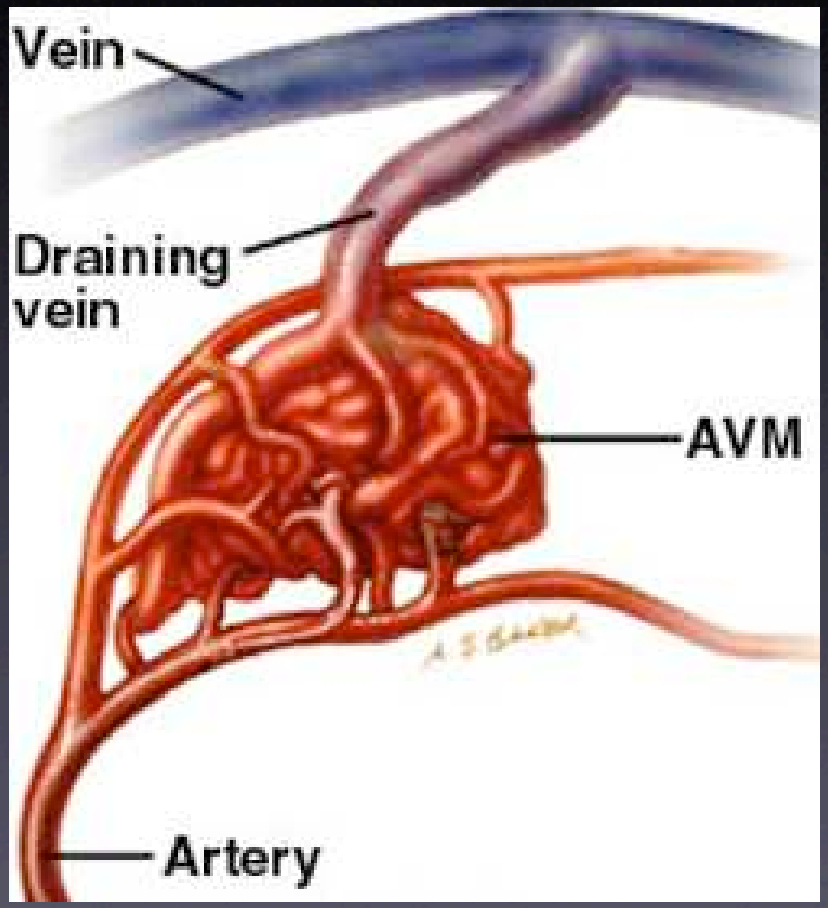
Balloon test occlusion & Endovascular balloon sacrifice

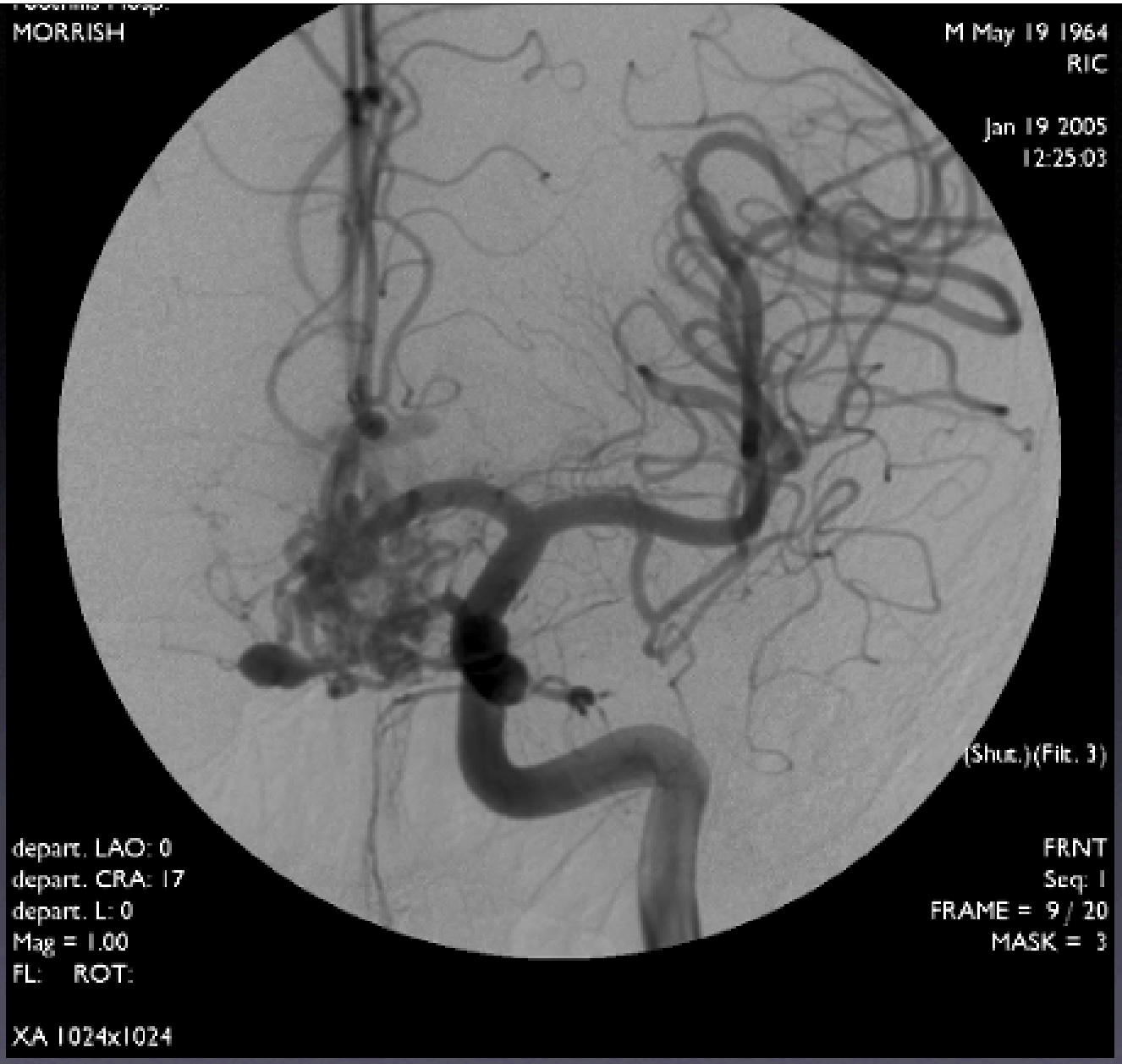


Acomm & Pcomm collateral flow

Brain AVM

- Congenital lesions
- A-V shunting
- No intervening brain parenchyma
- Surrounding brain frequently gliotic

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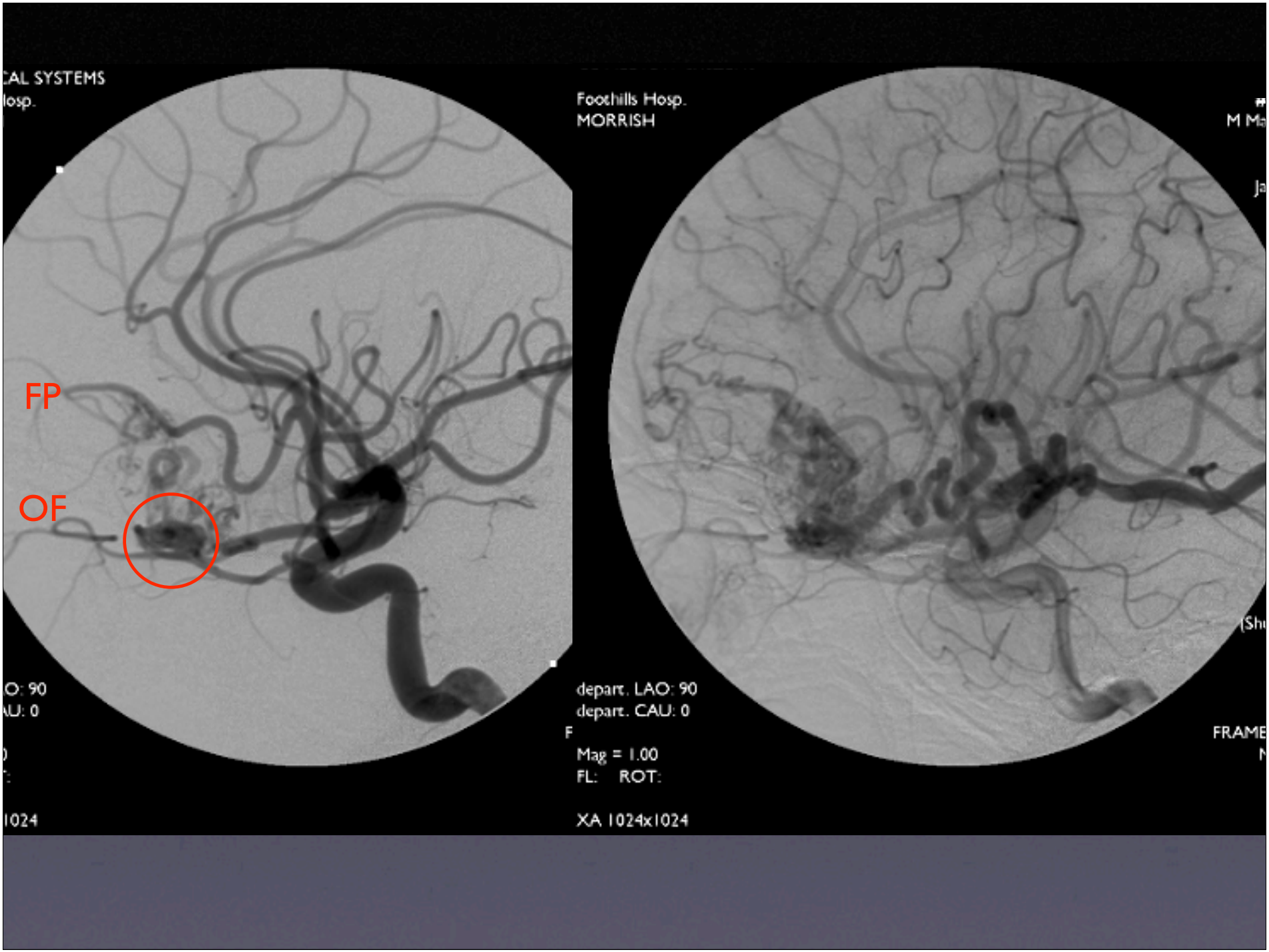
Frontal AVM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OF
Foothills Hosp.
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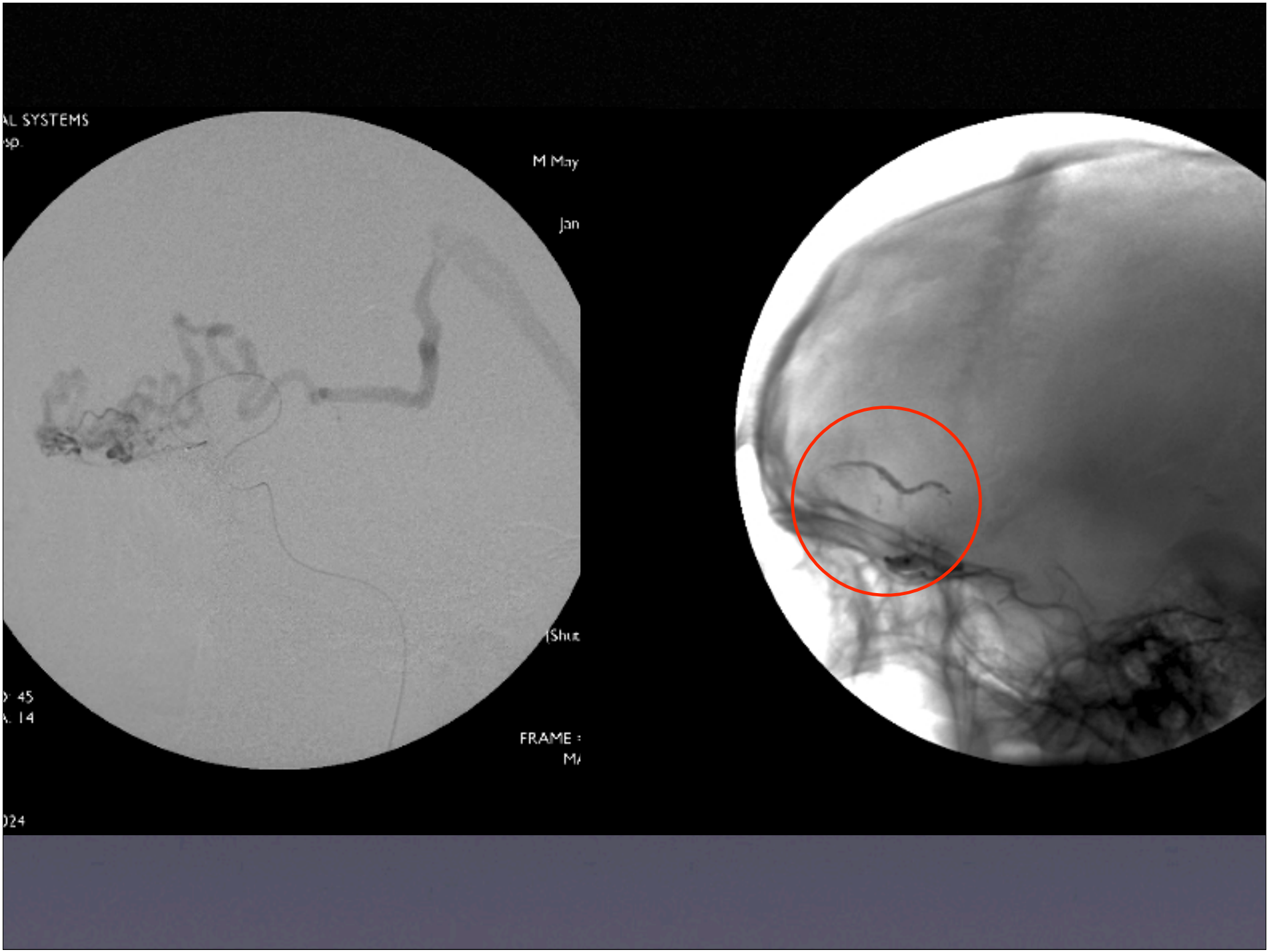
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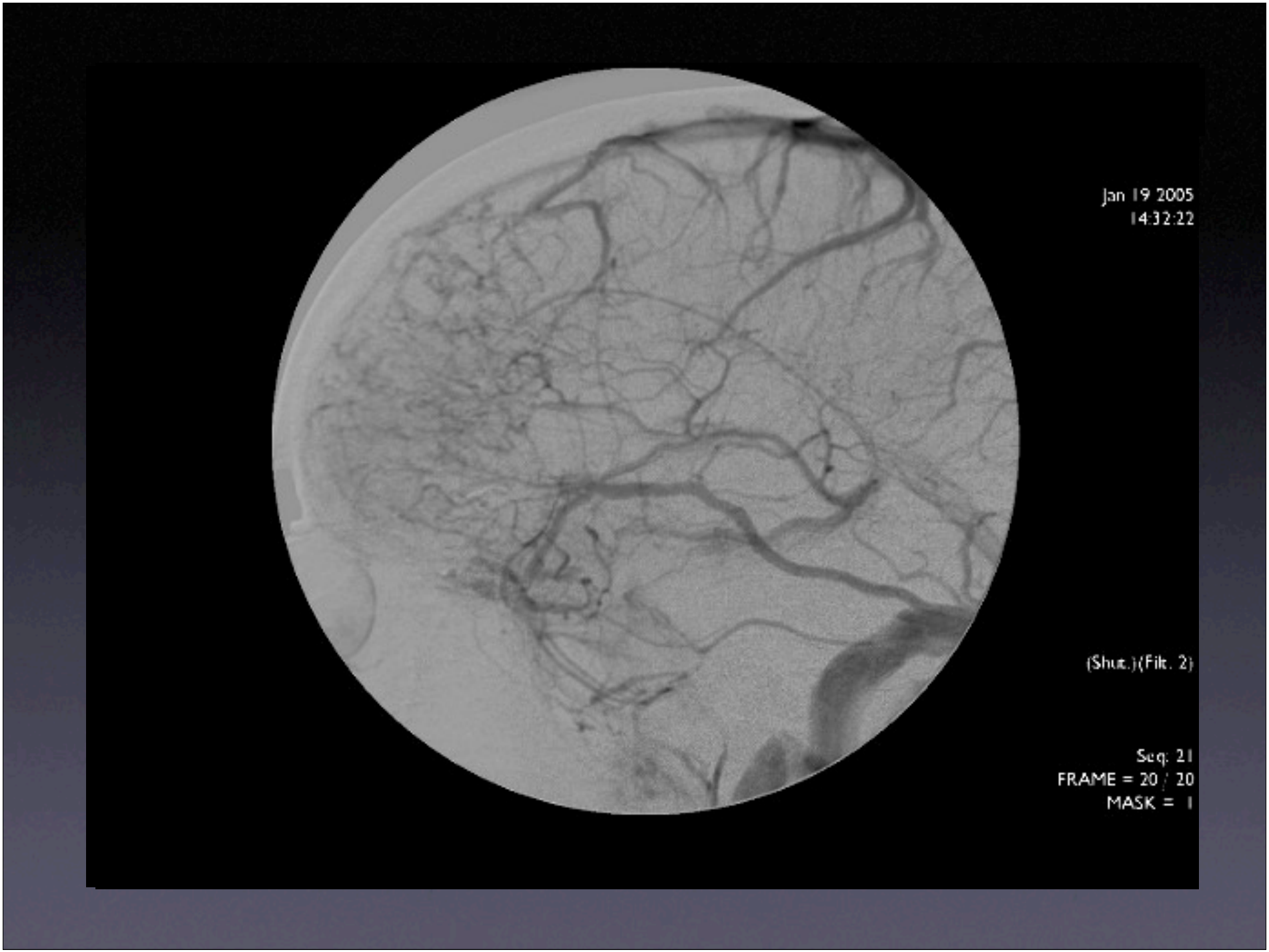
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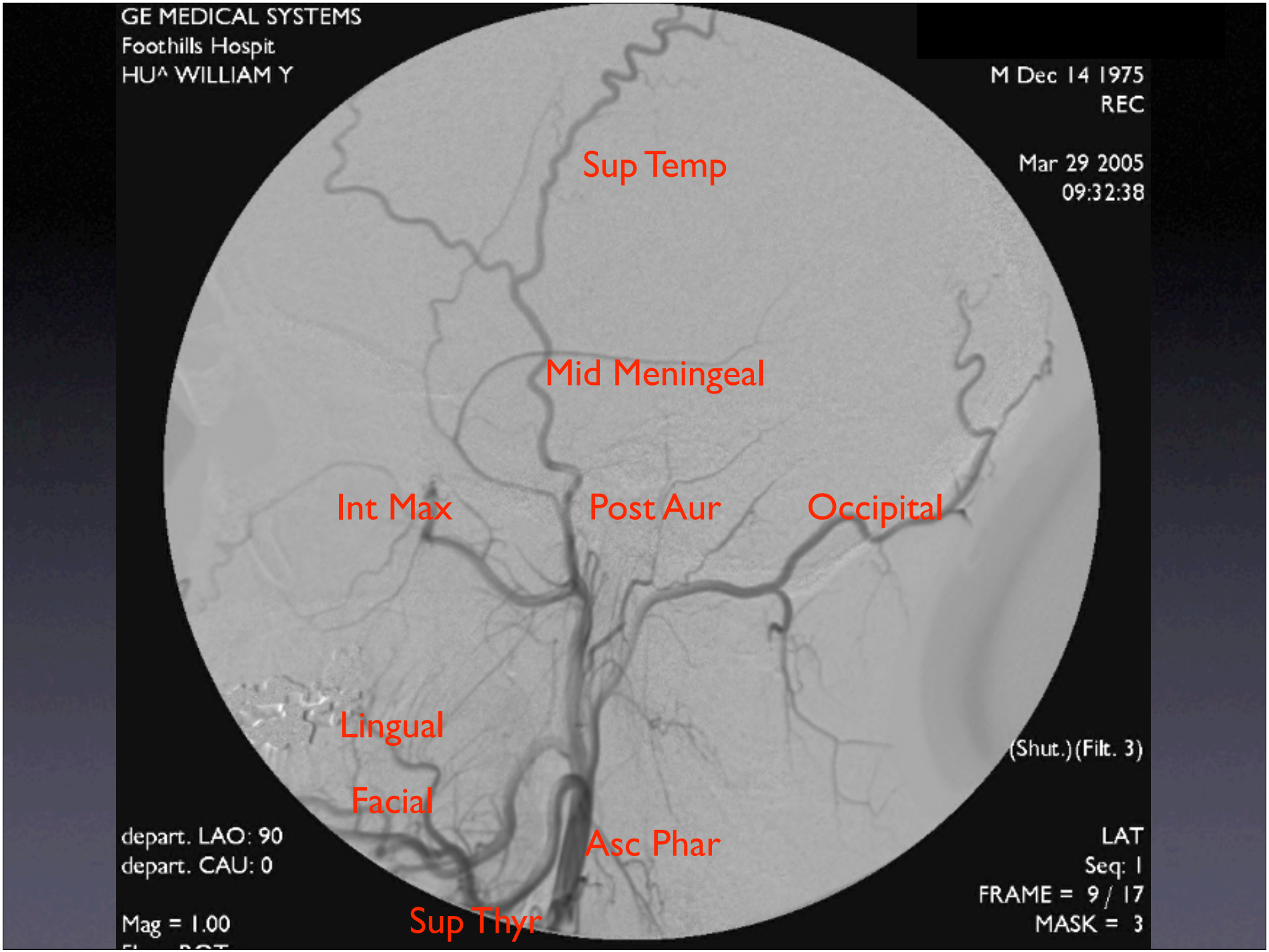
External Carotid

- Superior thyroidal
- Ascending pharyngeal
- Lingual
- Facial
- Occipital
- Post Auricular
- Superficial temporal
- Int Maxillary

"SALFOPS+M"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Foothills Hospit
HU^ WILLIAM Y
M Dec 14 1975
REC
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09:32:38
Sup Temp
Mid Meningeal
Int Max
Post Aur
Occipital
Lingual
Facial
Asc Phar
Sup Thyr
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depart. CAU: 0
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Seq: 1
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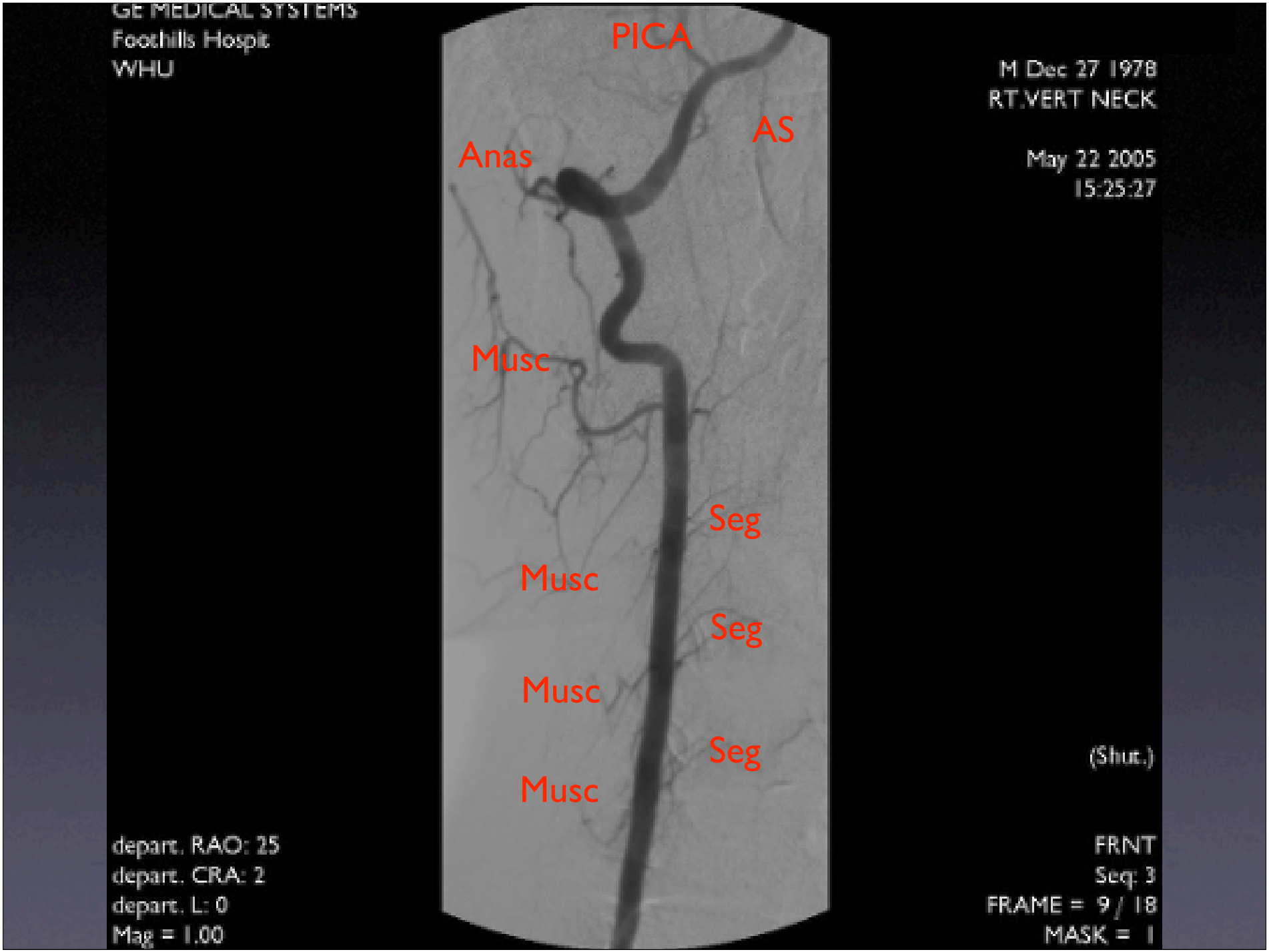
MASK = 3

Posterior Circulation

- Vertebral
- Posterior inferior cerebellar
- Vertebro-basilar junction
- Anterior inferior cerebellar
- Superior cerebellar
- Basilar apex
- Thalamo-striates

Posterior Cerebral Artery

- Thalamogeniculate
- Posterior communicating
- Medial occipital
  - Medial & lateral posterior choroidal
- Lateral occipital
  - Ant, middle, post inf temporal
- Parieto-occipital
- Calcarine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M Dec 27 1978
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May 22 2005
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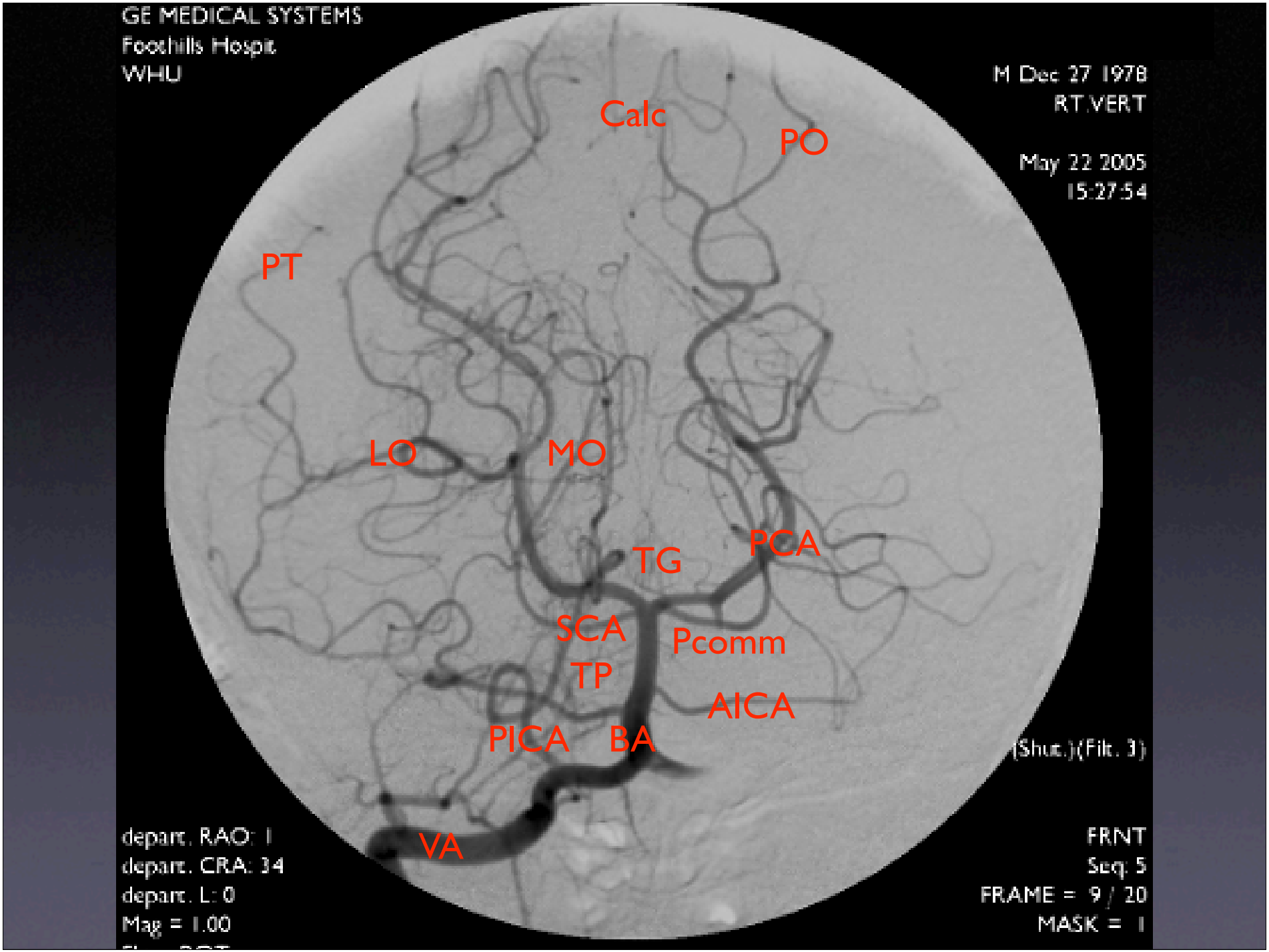
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May 22 2005
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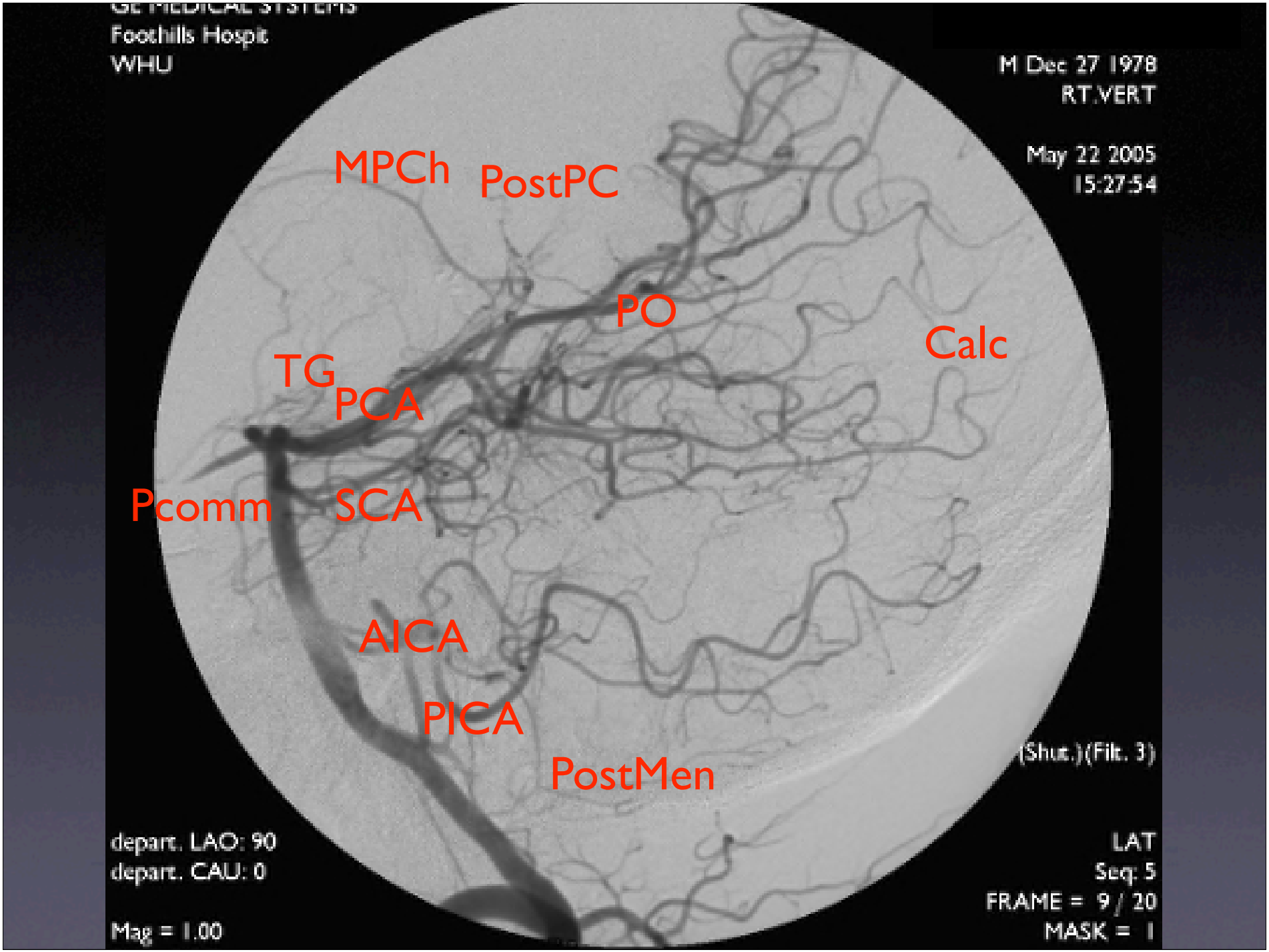
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M Dec 27 1978
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Case

- 59 year old man with 3 month hx of recent dizziness
- Presents acutely with "brain stem symptoms" (decreased LOC, visual disturbance, and right hemiparesis)
- Dx: Basilar thrombosis
- Think about: Collateral flow pathways to posterior circulation


Cor>Sag 10
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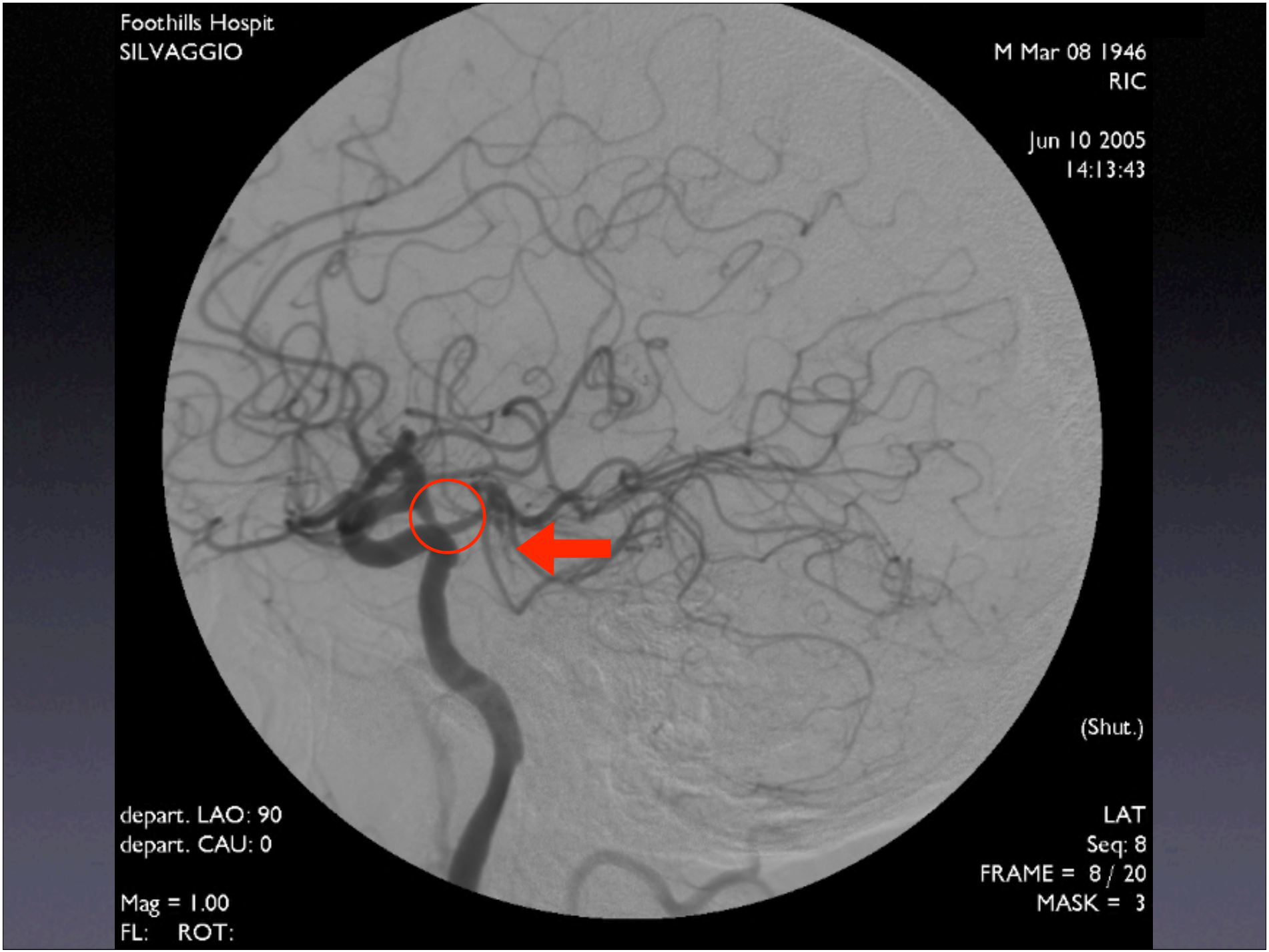
A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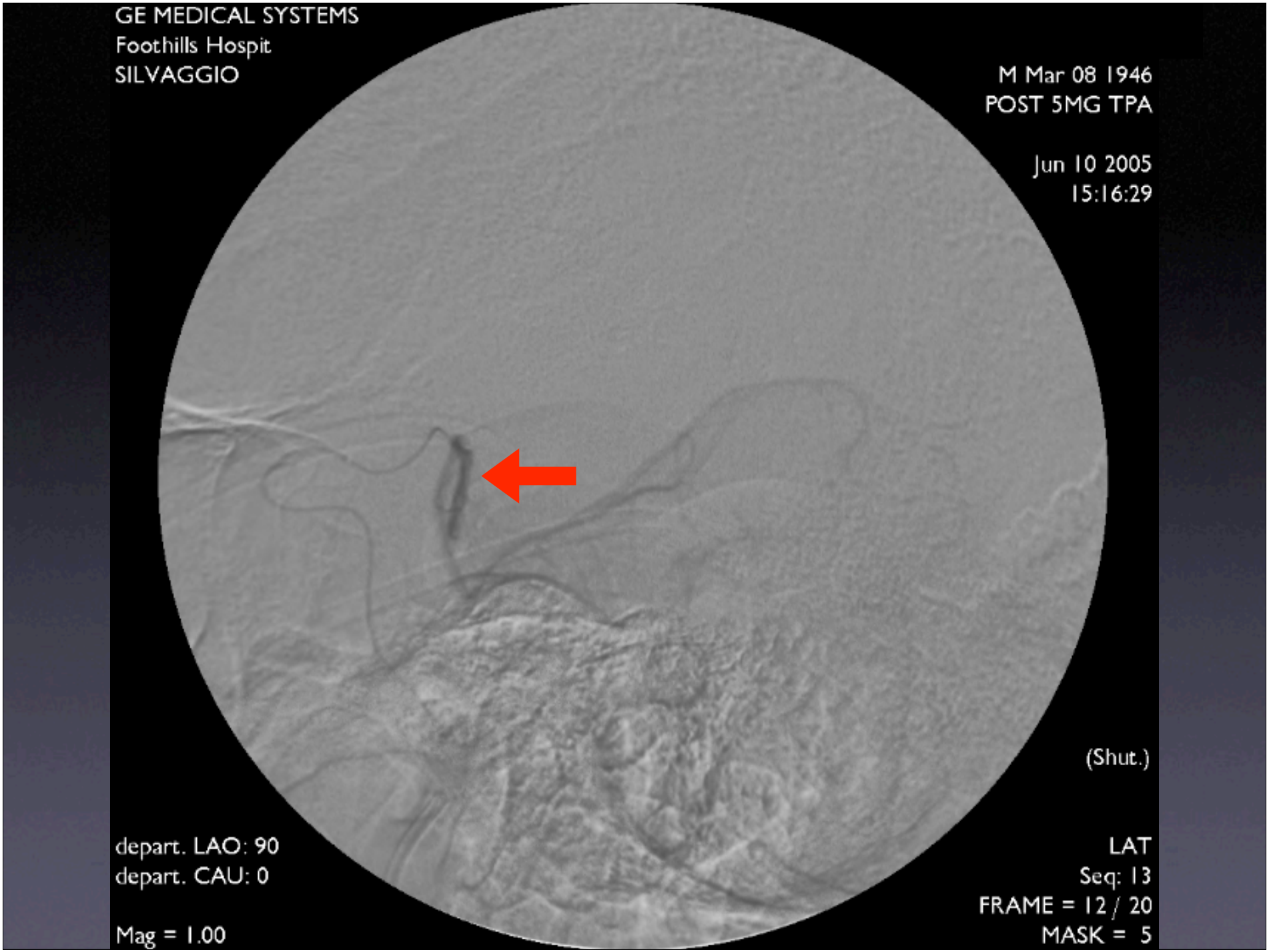
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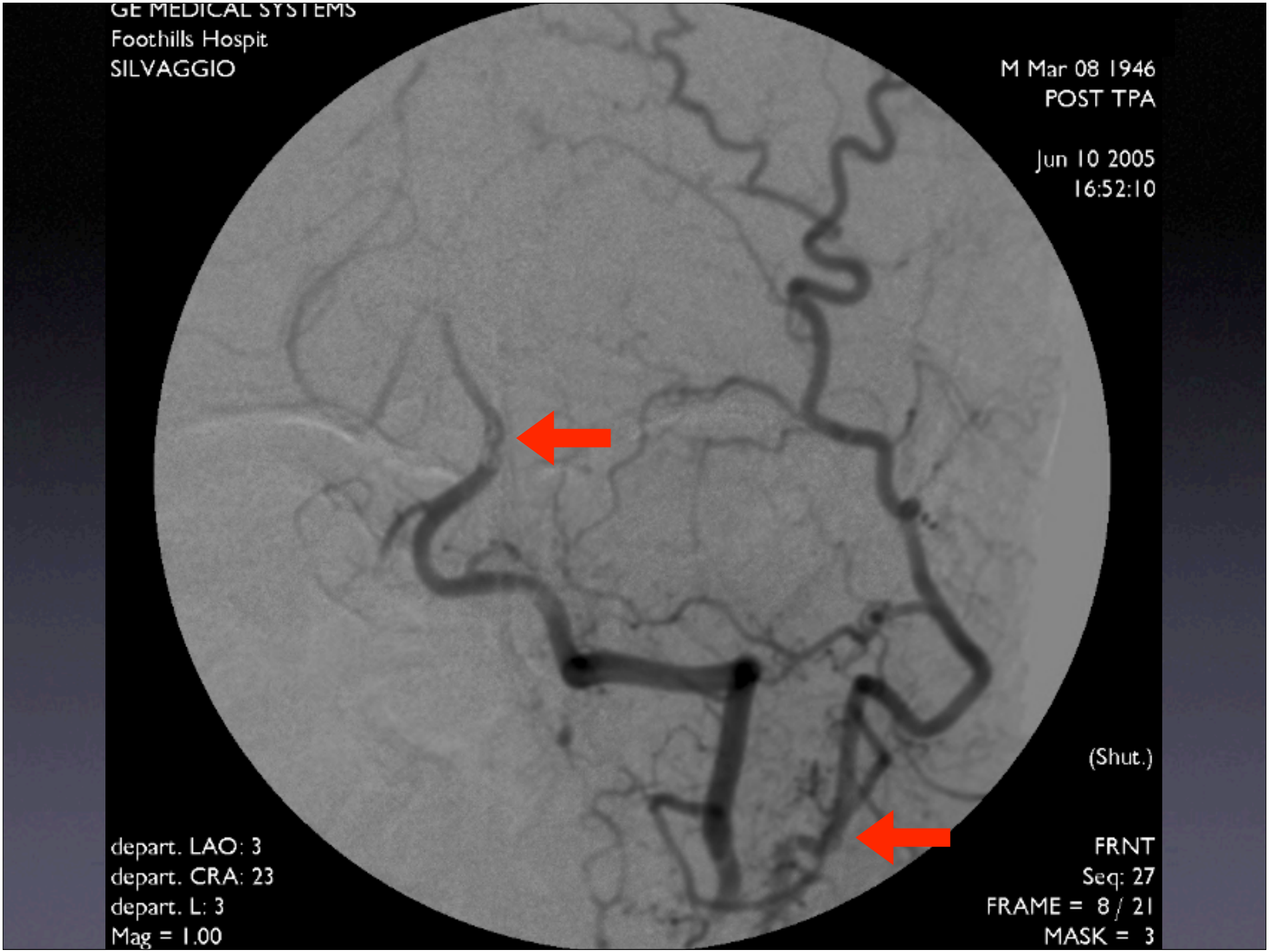
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Foothills Hospit
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POST TPA
Jun 10 2005
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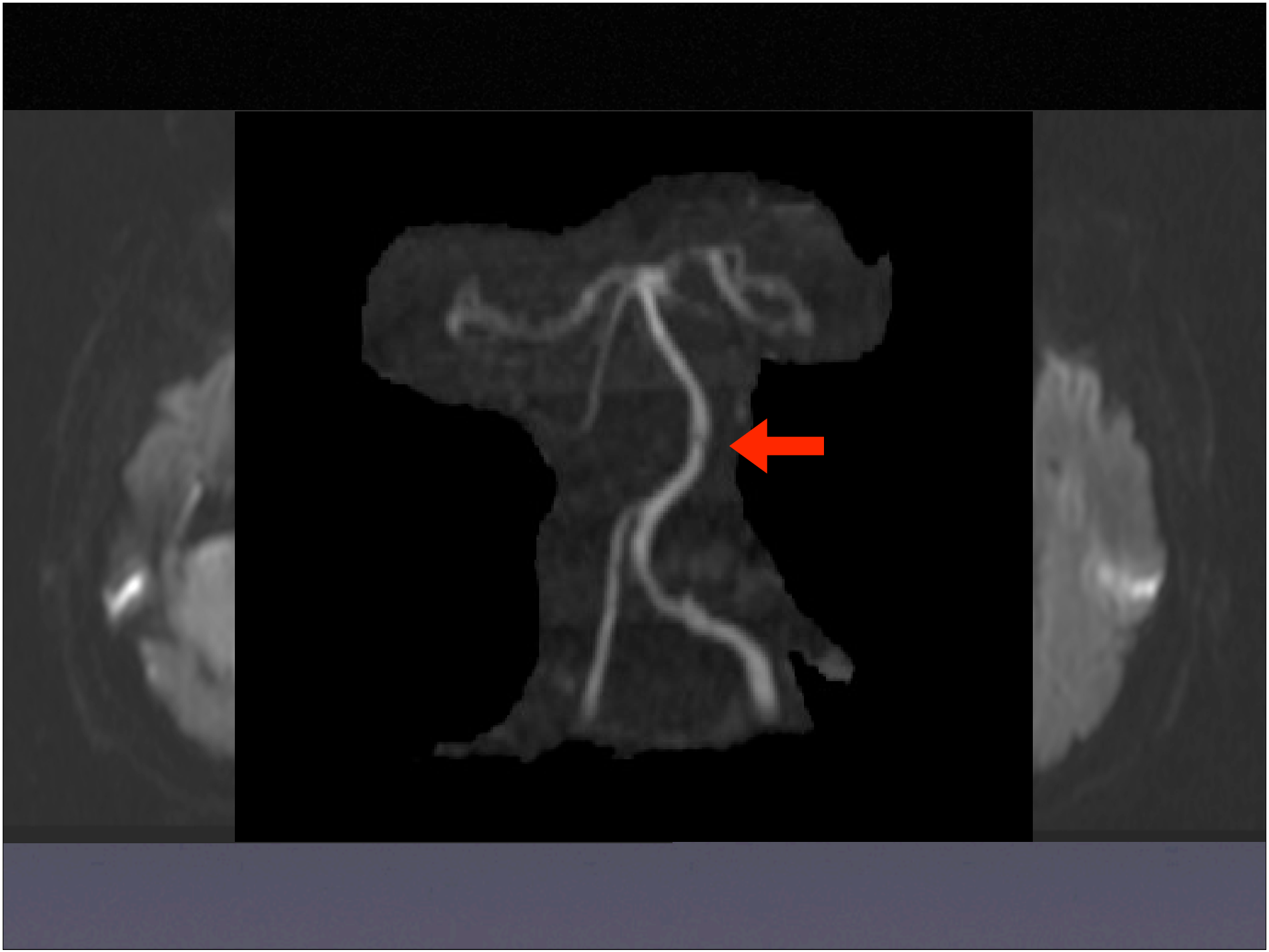

Comparison

	CTA	MRA	Catheter
Resolution	++	+	+++
Convenience	+++	++	+
Cost	++	++	+++
Risk	+	+	++

Thank you.