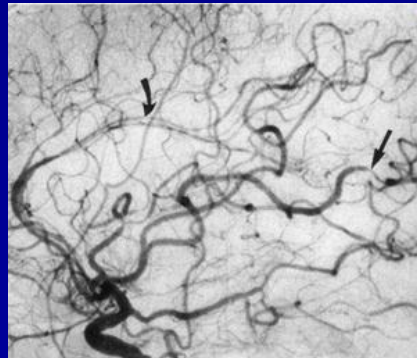


# Introduction to Neuroradiology

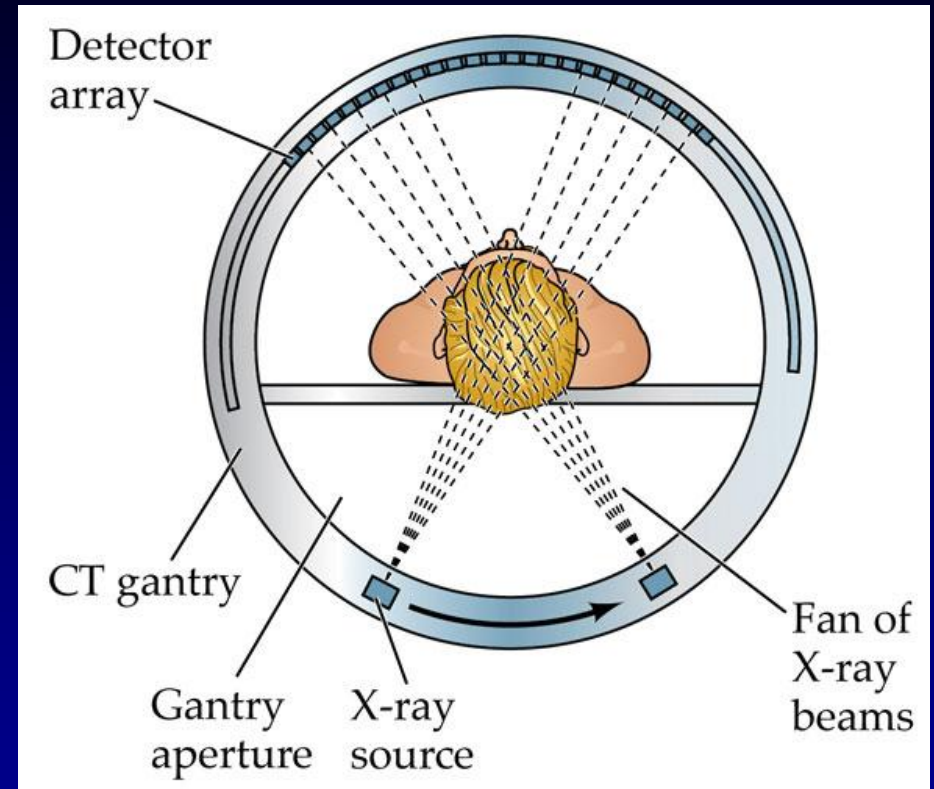
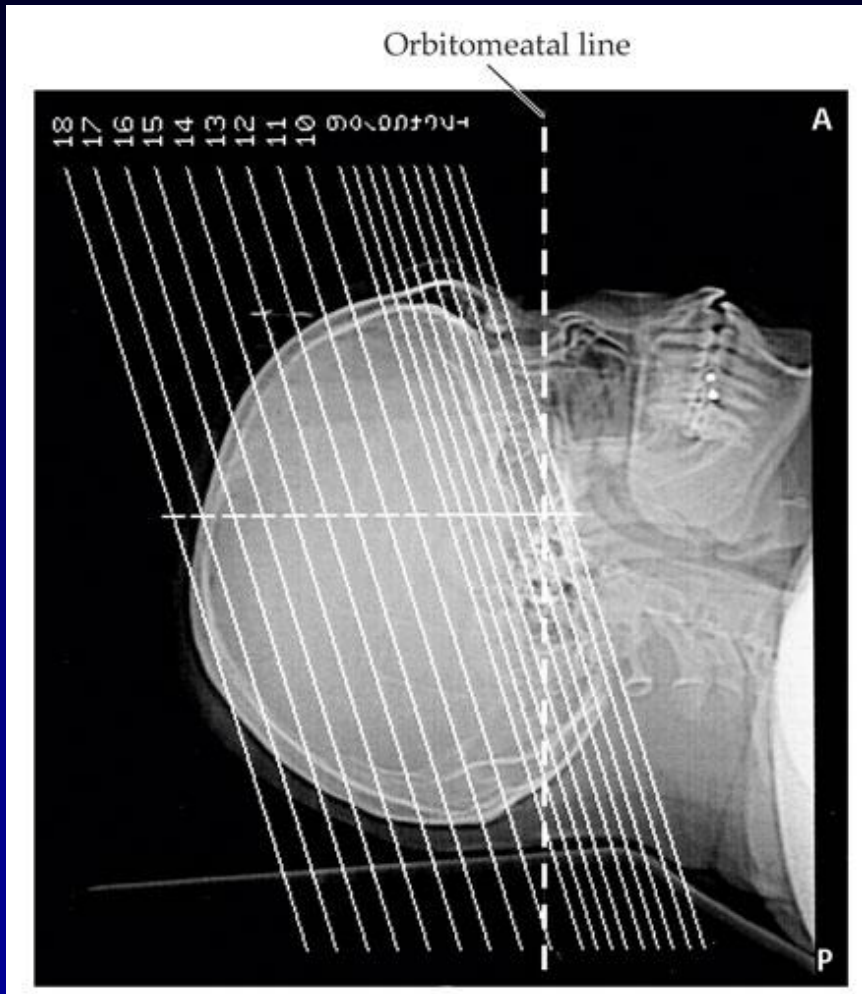


# Brain Imaging

## The basic imaging tools

- **Fluoroscopy/Radiography**
- **Computed Tomography**
- **Magnetic Resonance Imaging**
- **Digital Substraccion Angiography (DSA)**
- **Ultrasound**
- **Nuclear Medicine**

# Computerized Tomography (CT)

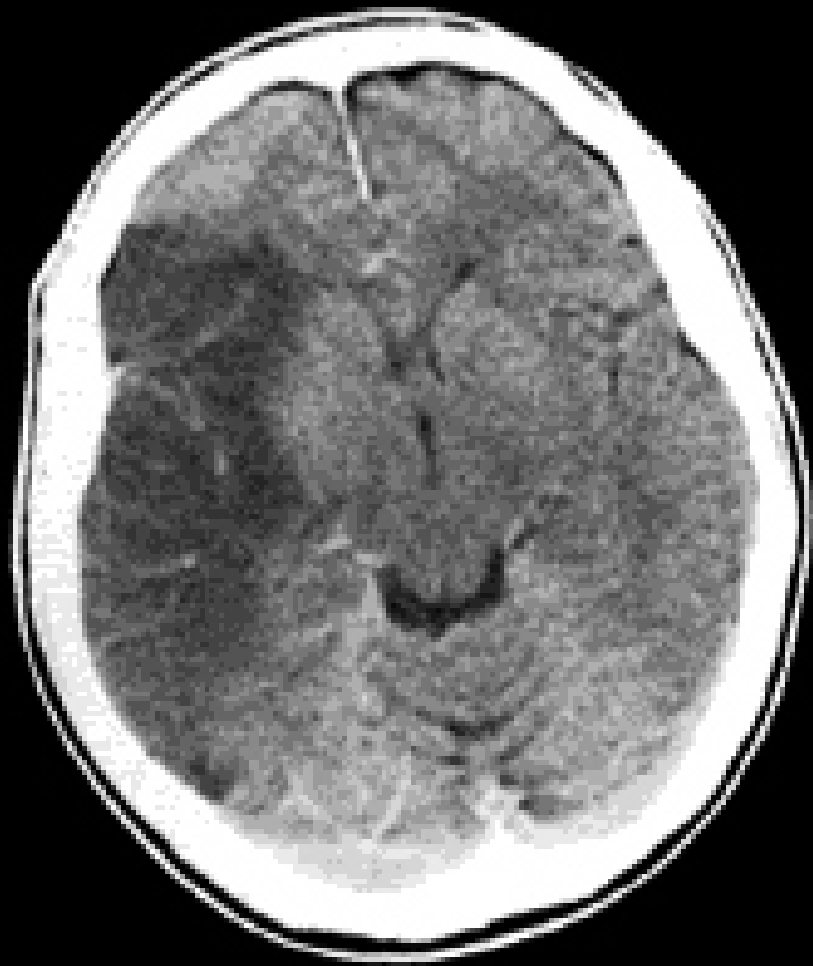


# Computed Tomography (CT, CAT)





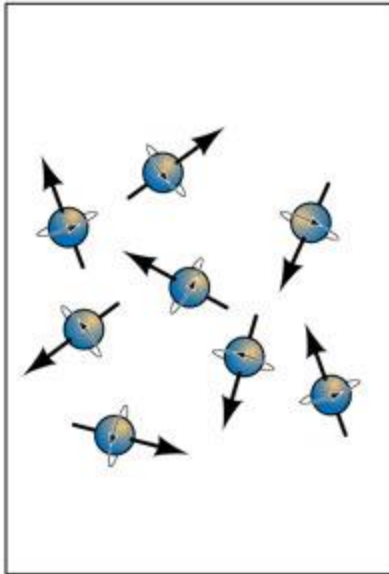
Intracerebral Hemorrhage



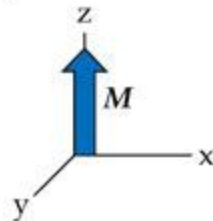


# MRI Function

(A) No external field

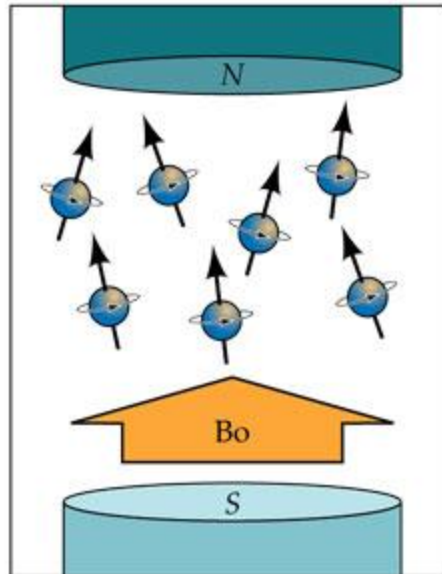


Net magnetization vector:  
 $M = 0$

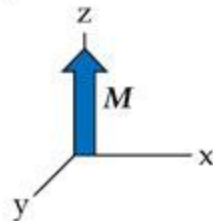


© 2002 Sinauer Associates, Inc.

(B) External field applied

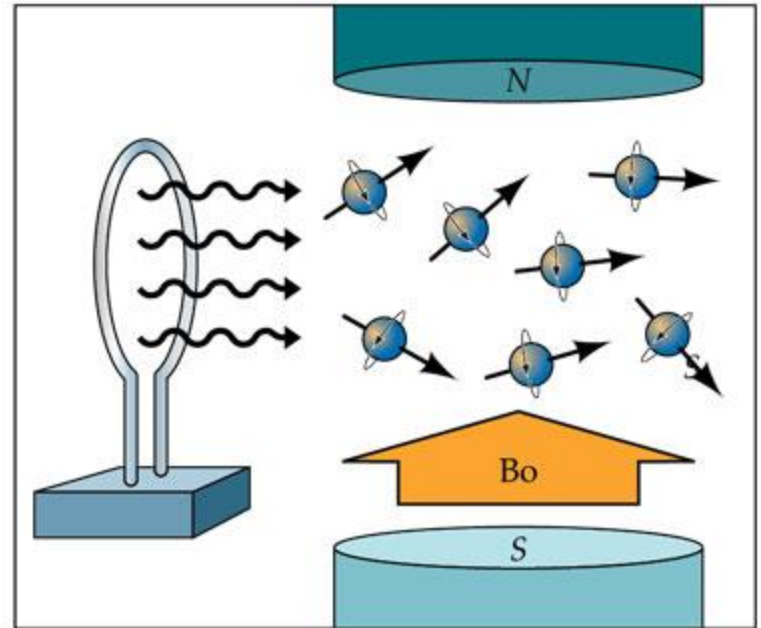


Net magnetization vector:

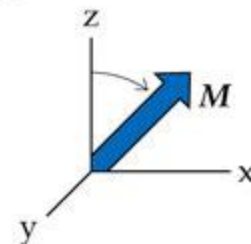


© 2002 Sinauer Associates, Inc.

(C) Radio frequency pulse given

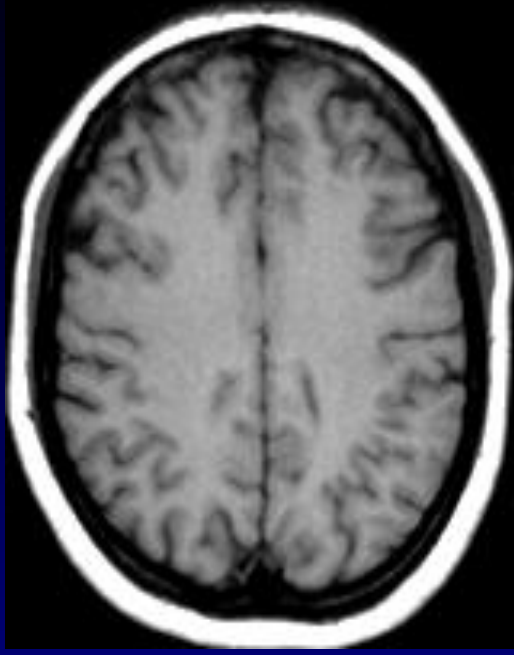


Net magnetization vector:



© 2002 Sinauer Associates, Inc.

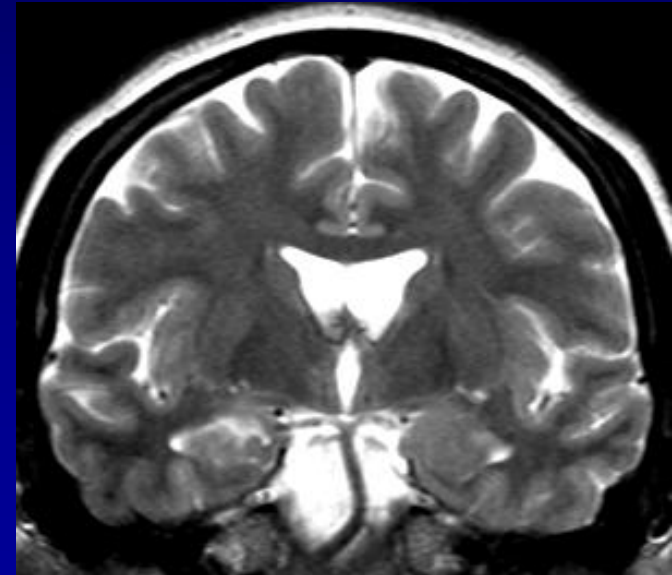
# MRI in the Brain



**Axial**

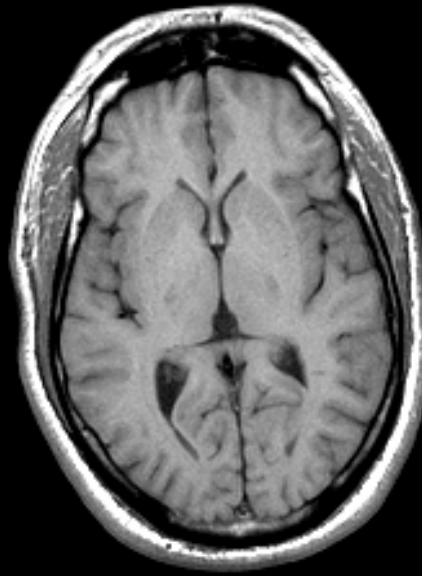


**Sagittal**



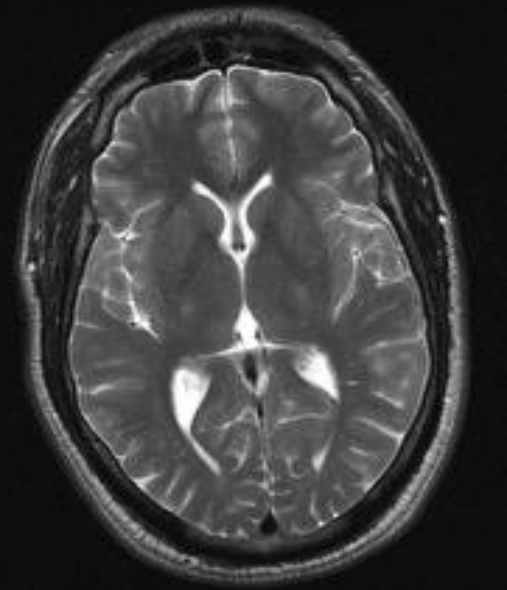
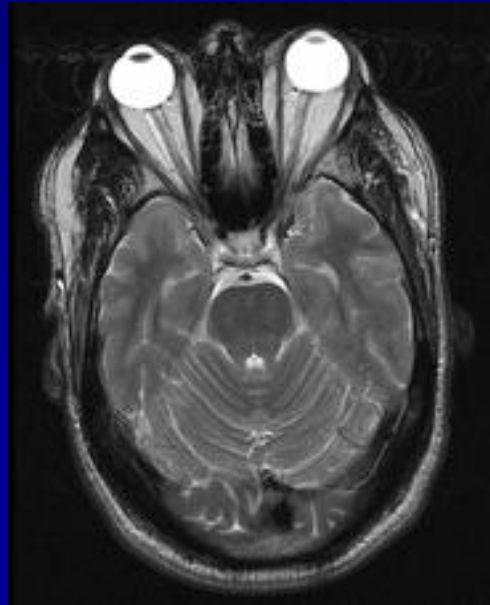
**Coronal**

# MAGNETIC RESONANCE IMAGING

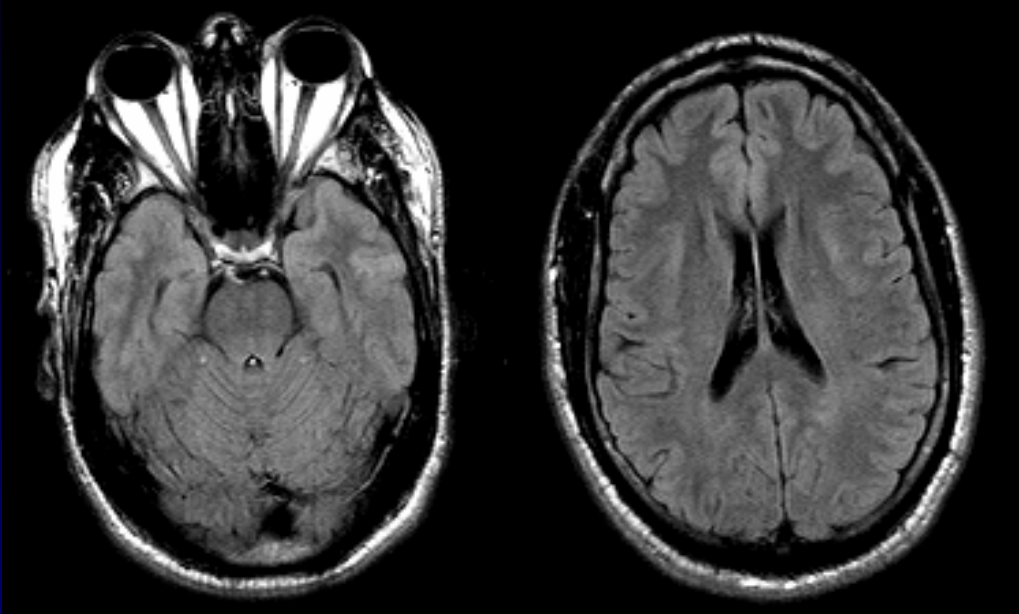


**T1WI**

**T2WI**

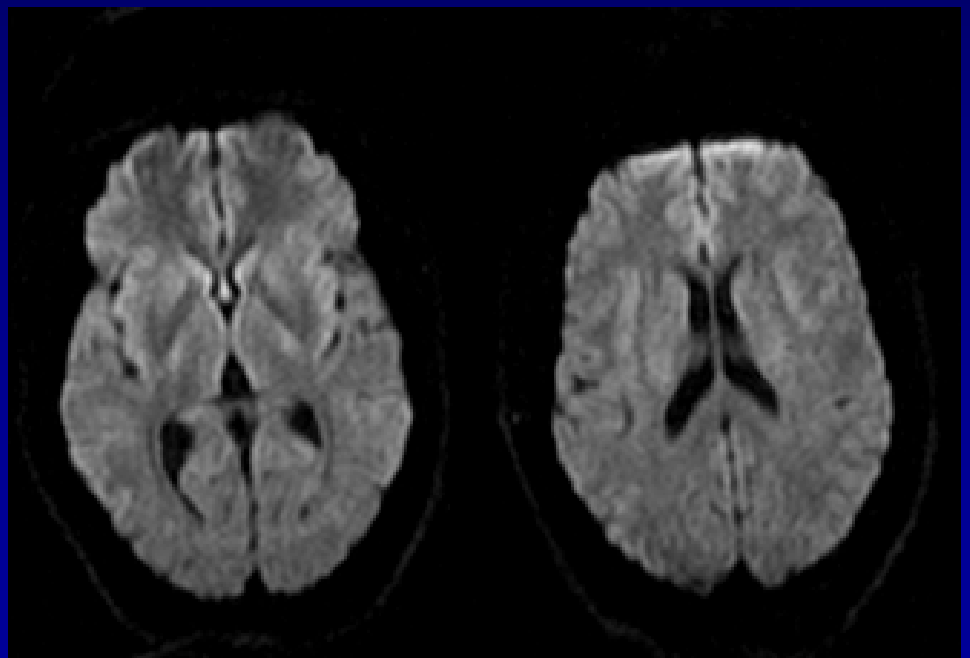


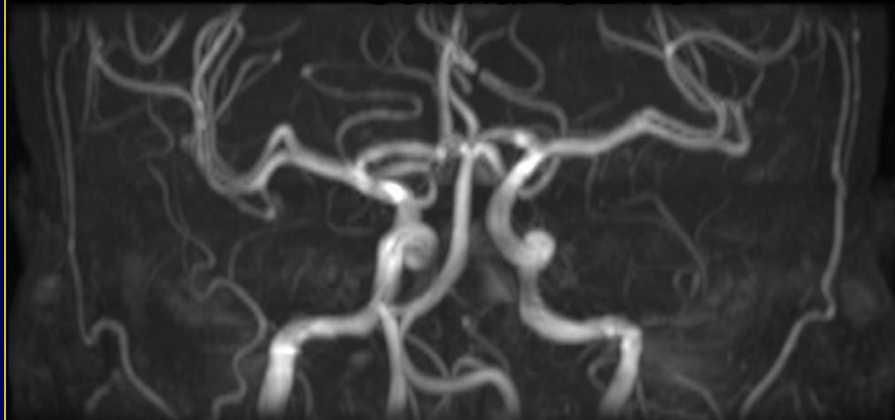




**FLAIR**

**DWI**





**MR Angiography**  
**Without contrast medium**

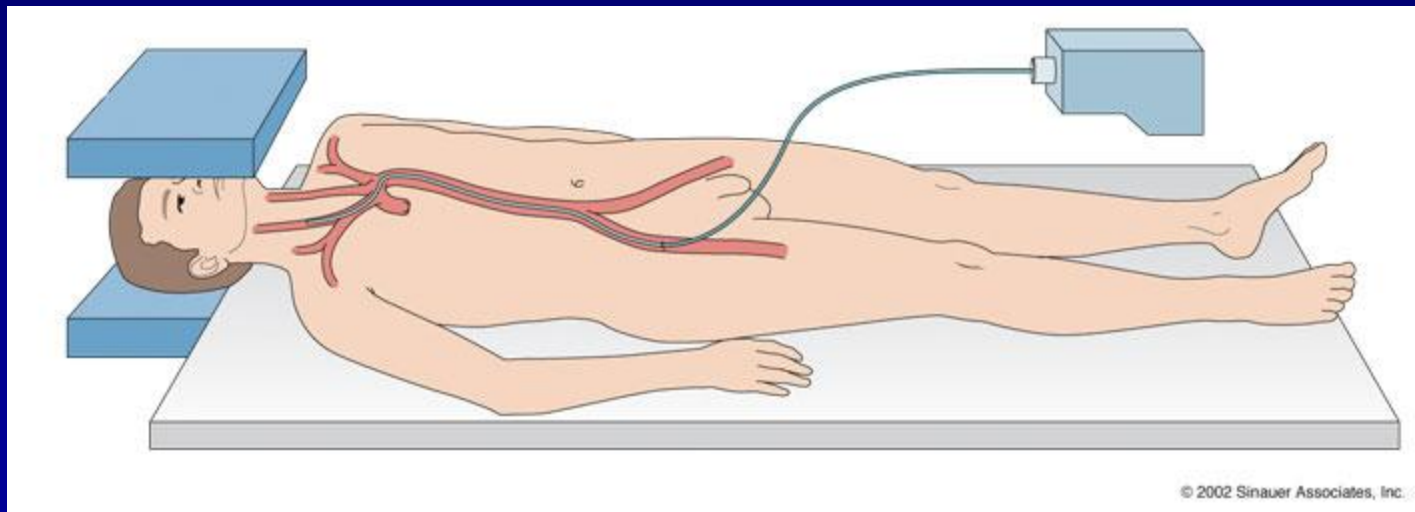


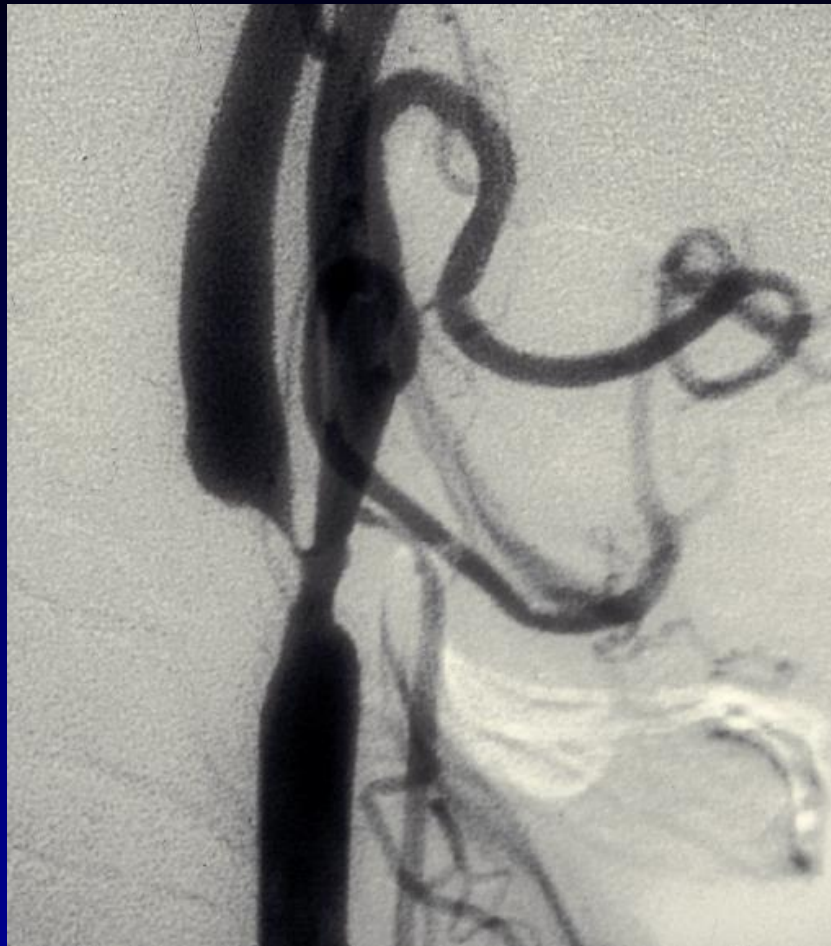


**MR Angiography  
With Gadolinium**

# Neuroangiography

**Invasive procedure requiring insertion of a catheter through the femoral artery up to the carotid. Iodinated contrast material is injected into the carotid and vertebral arteries bilaterally and sequential images are obtained.**





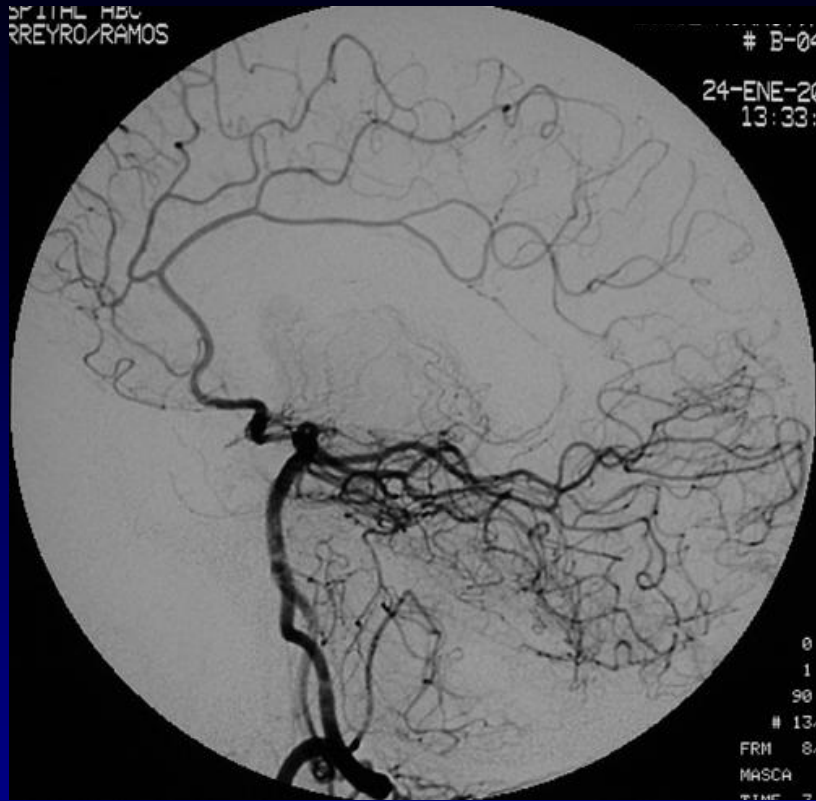
# DIGITAL SUBTRACTION ANGIOGRAPHY



HOSPITAL ABC  
RREYRO/RAMOS

# B-04

24-ENE-20  
13:33:



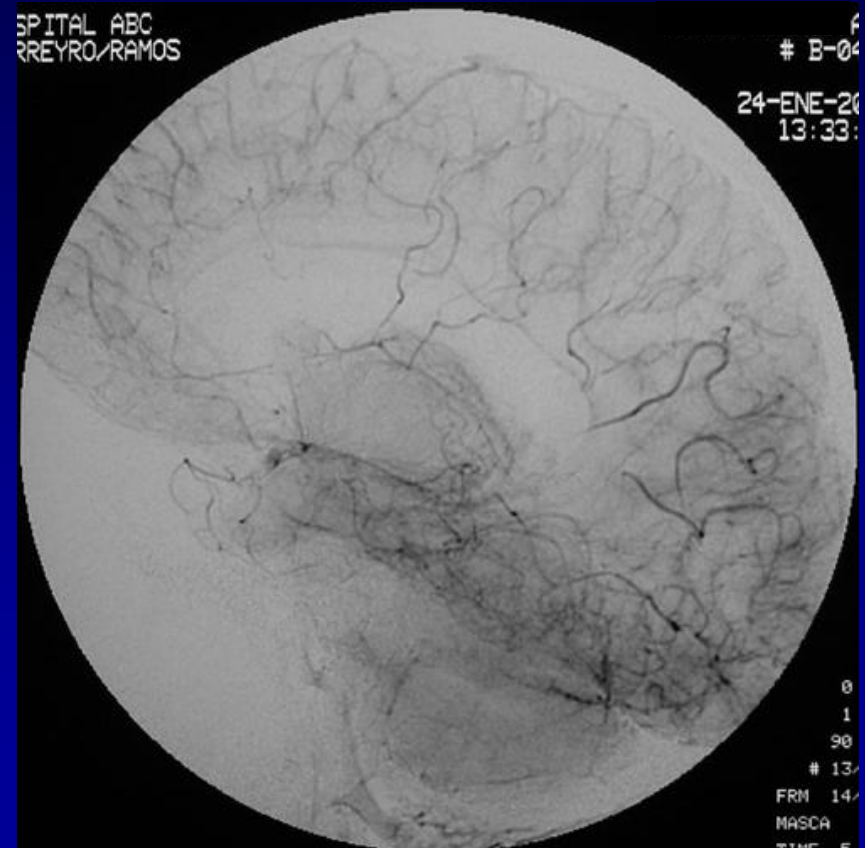
0  
1  
90  
# 13  
FRM 8  
MASCA  
TIME 7

# DIGITAL SUBTRACTION ANGIOGRAPHY

HOSPITAL ABC  
RREYRO/RAMOS

# B-04

24-ENE-20  
13:33:



0  
1  
90  
# 13  
FRM 14  
MASCA  
TIME 5

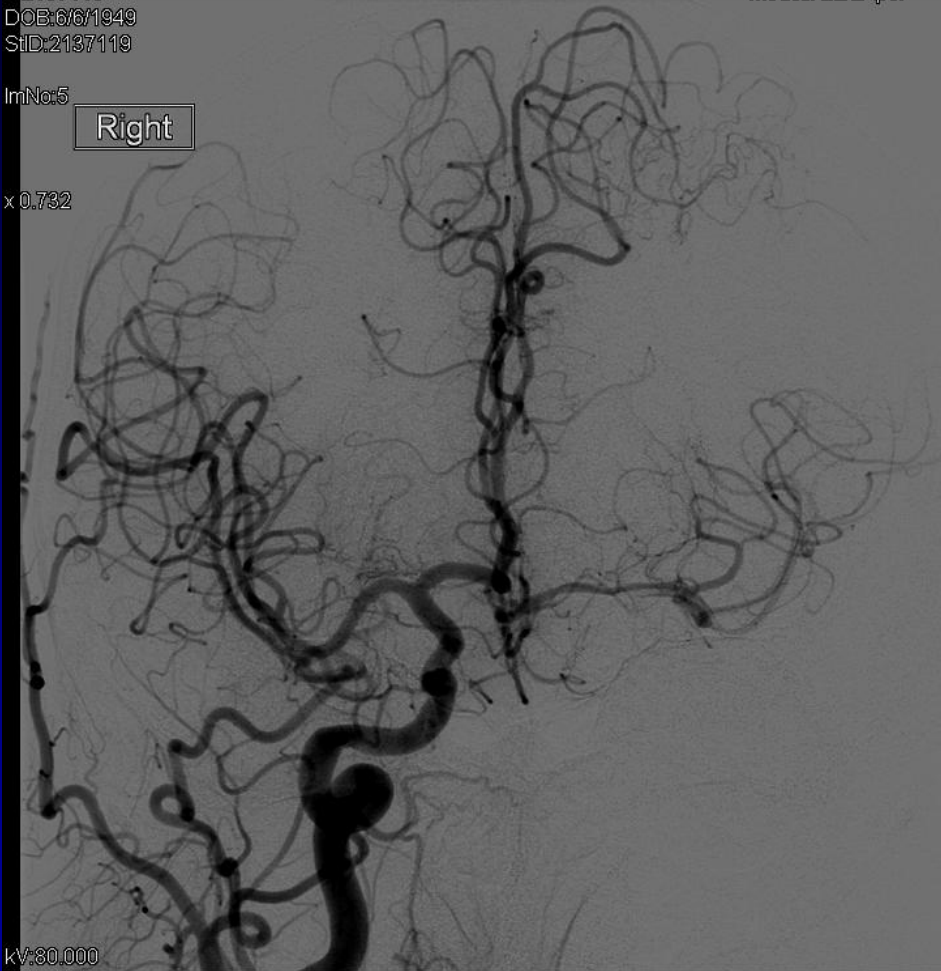
DOB: 6/6/1949  
SID: 2137119

ImNo: 5

Right

x 0.732

kV: 80.000



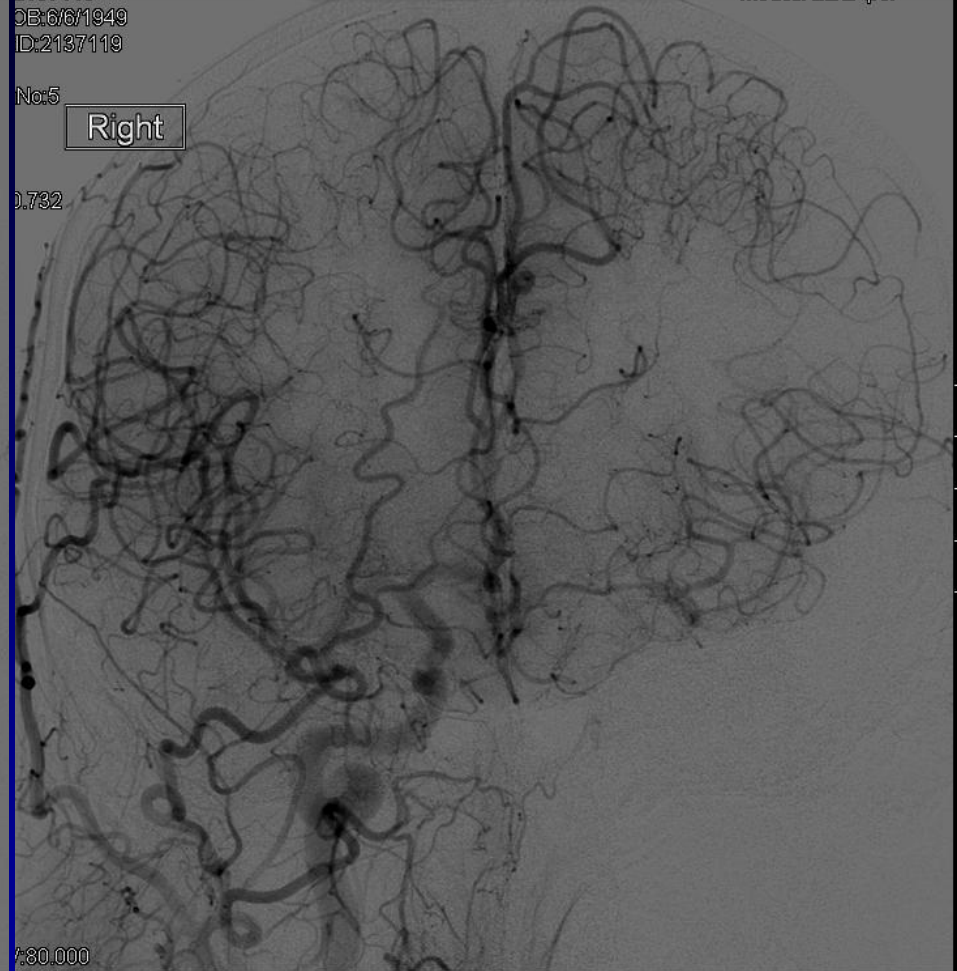
DOB: 6/6/1949  
ID: 2137119

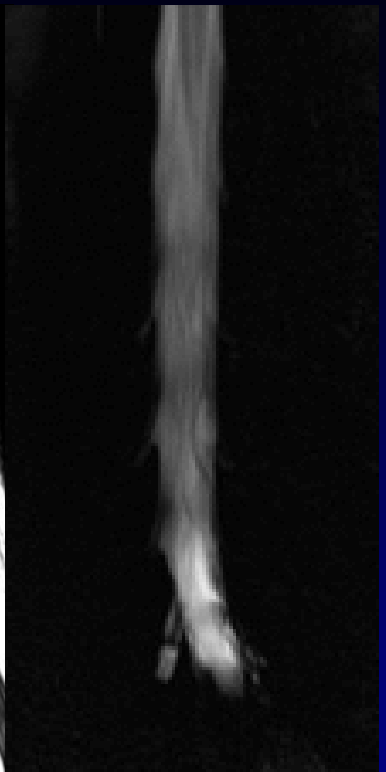
No: 5

Right

0.732

7:30.000



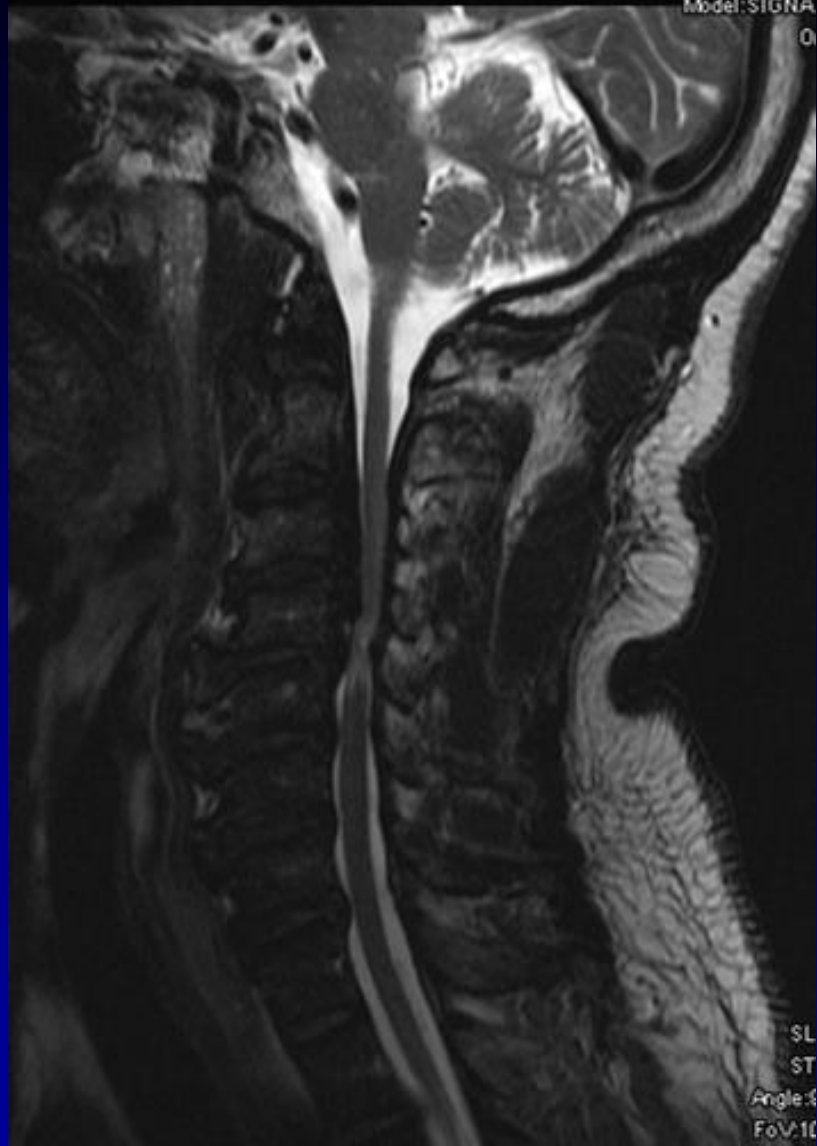


**MYELOGRAPHY**

**MYELO-TAC**  
**MYELO-MRI**

Model: SIGNA

0



19

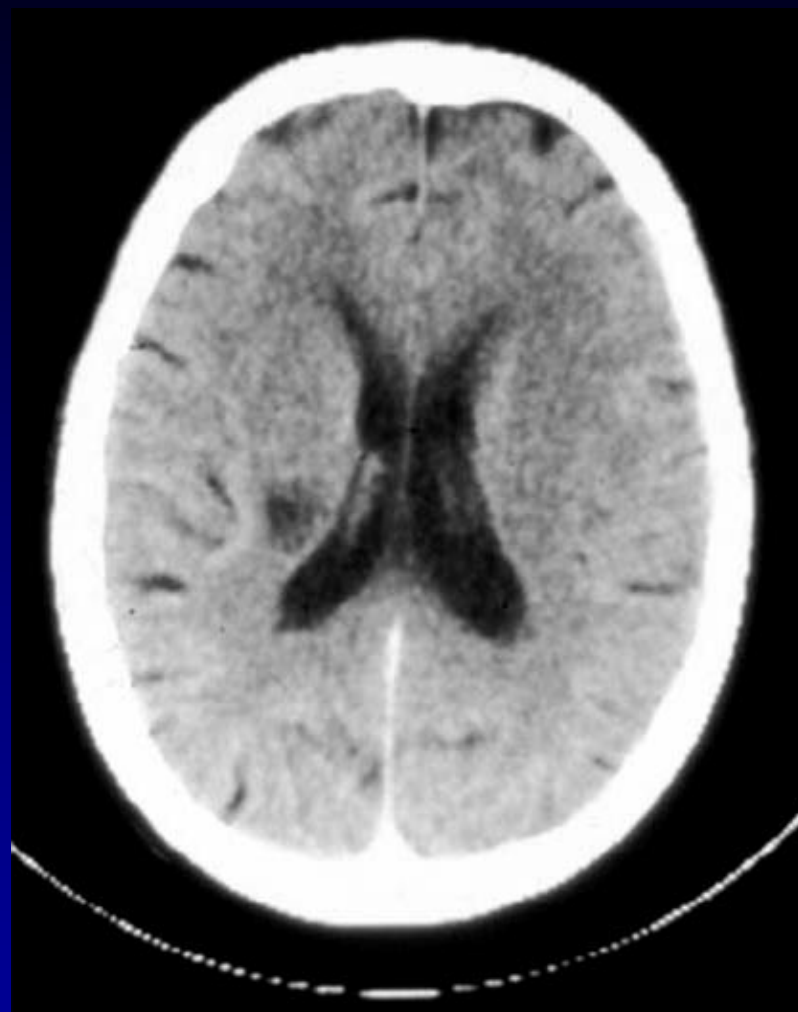
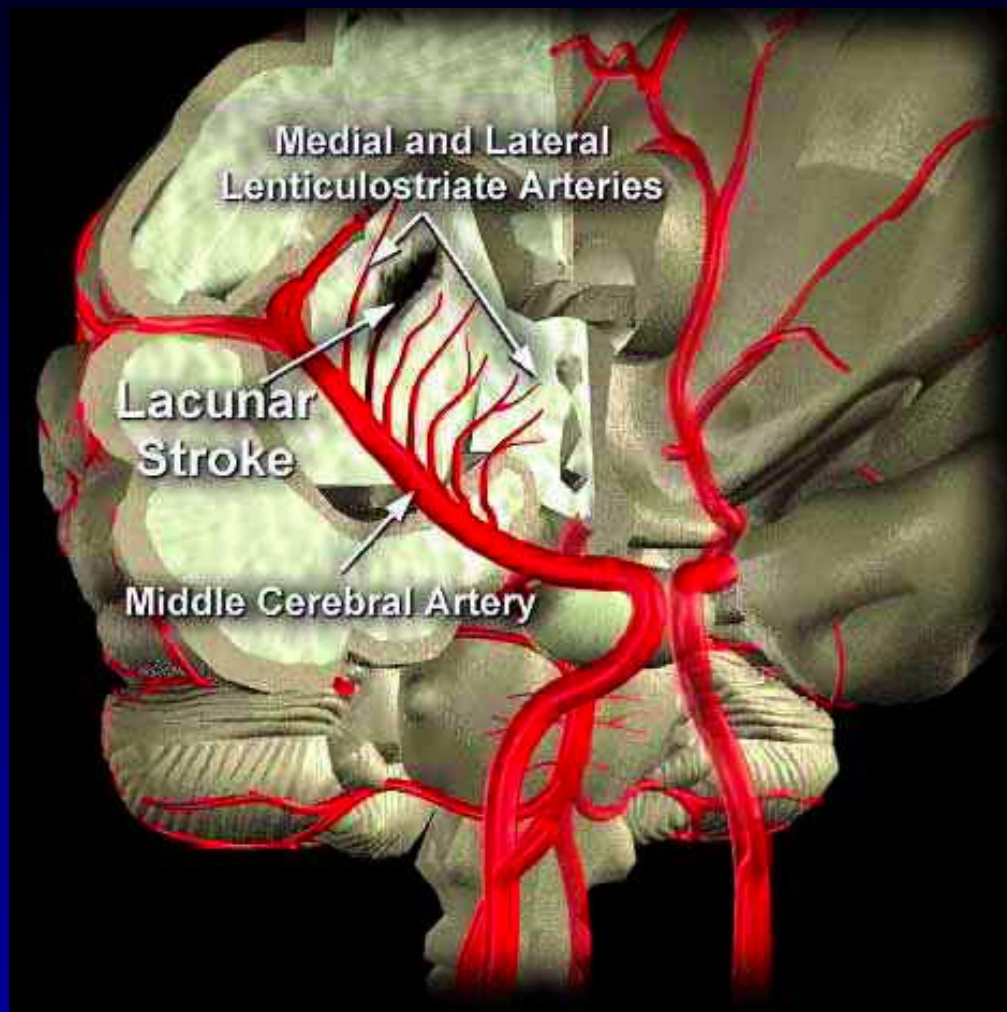
2



# CEREBRAL VASCULAR EVENT

- **ISCHEMIC**
- **HEMORRHAGIC**







**ACUTE INFARCT**

1



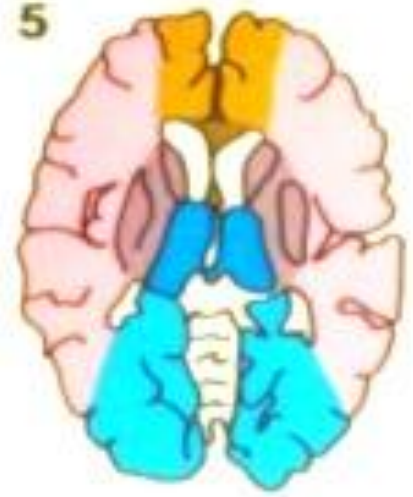
2



3



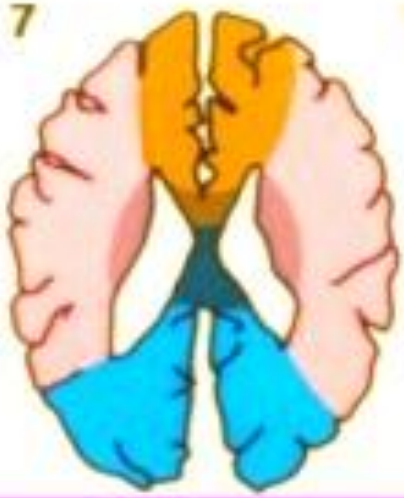
5



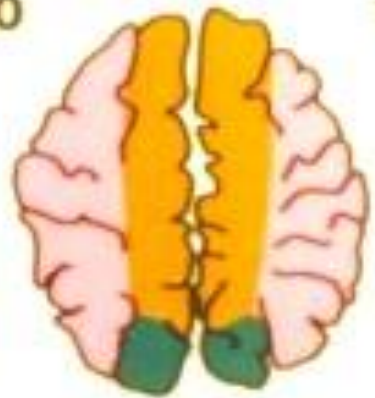
6



7



10



12

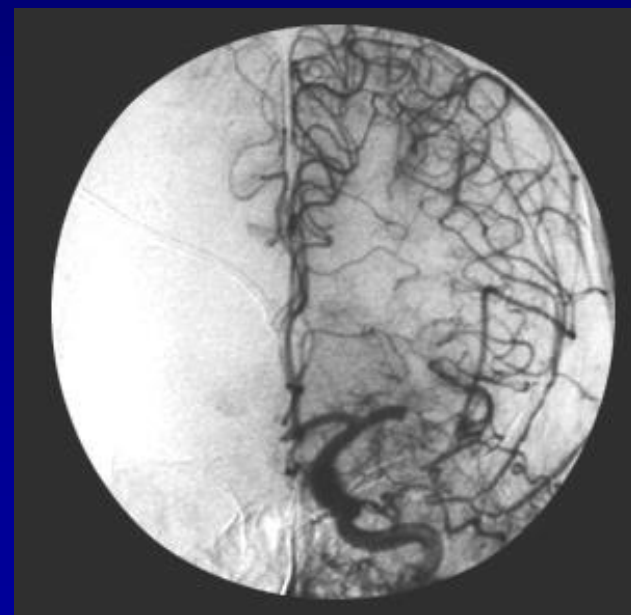


# EARLY SIGNS OF ISCHEMIC INFARCT

## CT

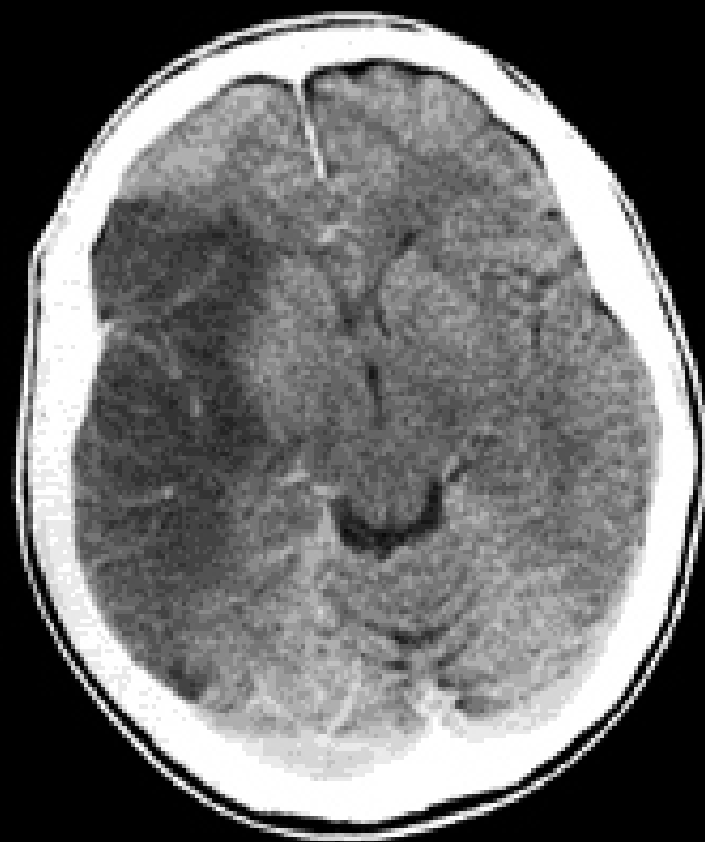
- LOSS OF DEFINITION BETWEEN GRAY AND WHITE MATTER
- ILL DEFINITION OF INTERNAL CAPSULE
- HYPERDENSE MIDDLE CEREBRAL ARTERY

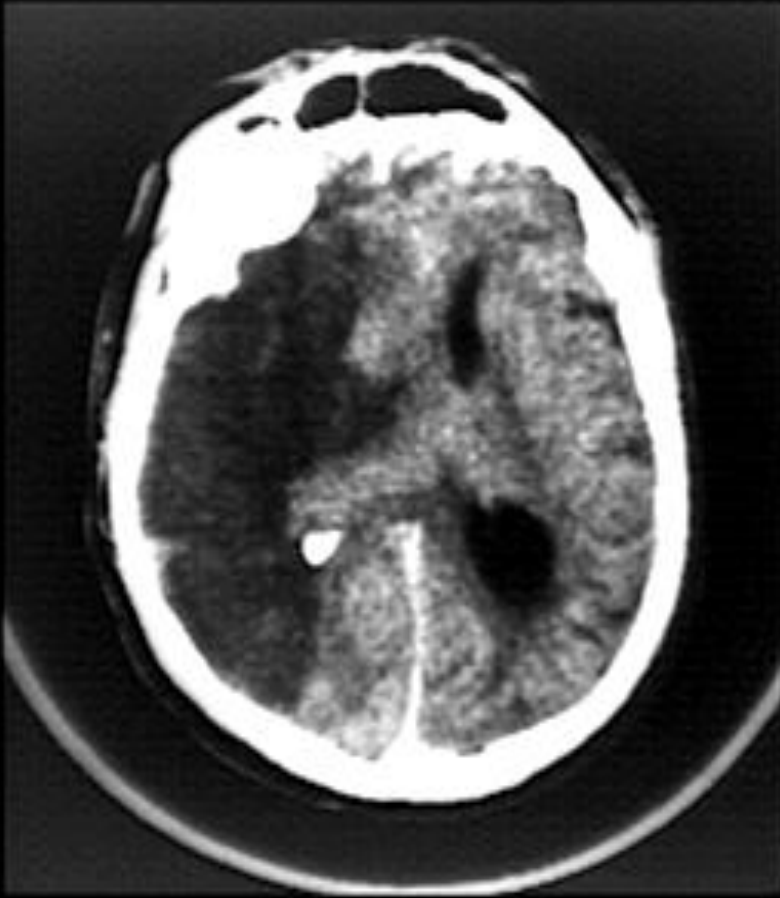




**HYPERDENSE MCA**







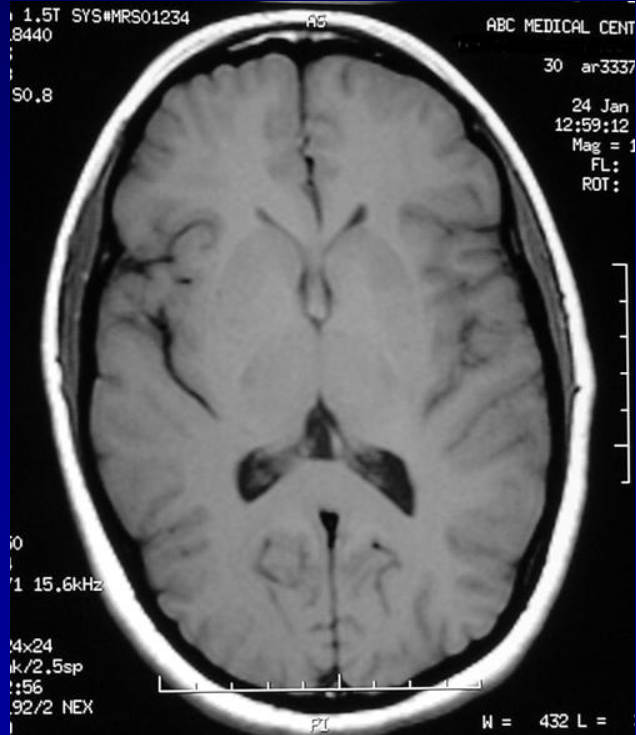
**CHRONIC INFARCT**

# EARLY SIGNS OF ISCHEMIC INFARCT

## MRI

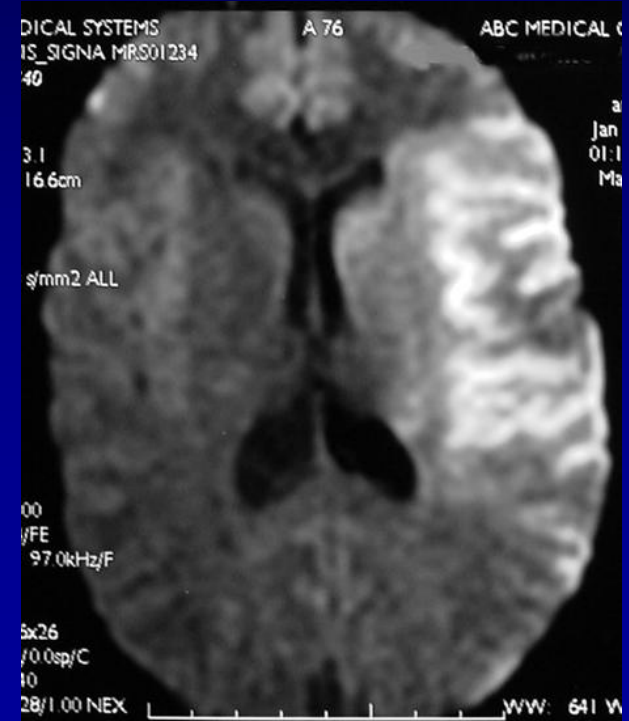
- T1 HYPOINTENSITY
- T2, FLAIR HYPERINTENSITY
- DWI HYPERINTENSITY
- DECREASED SIGNAL IN PERFUSION IMAGES

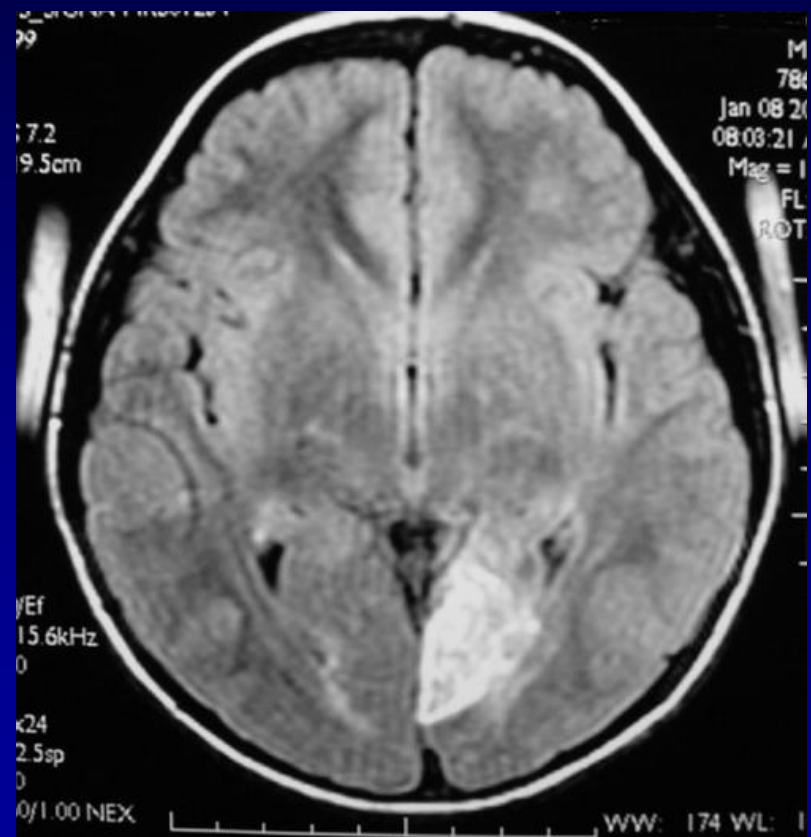
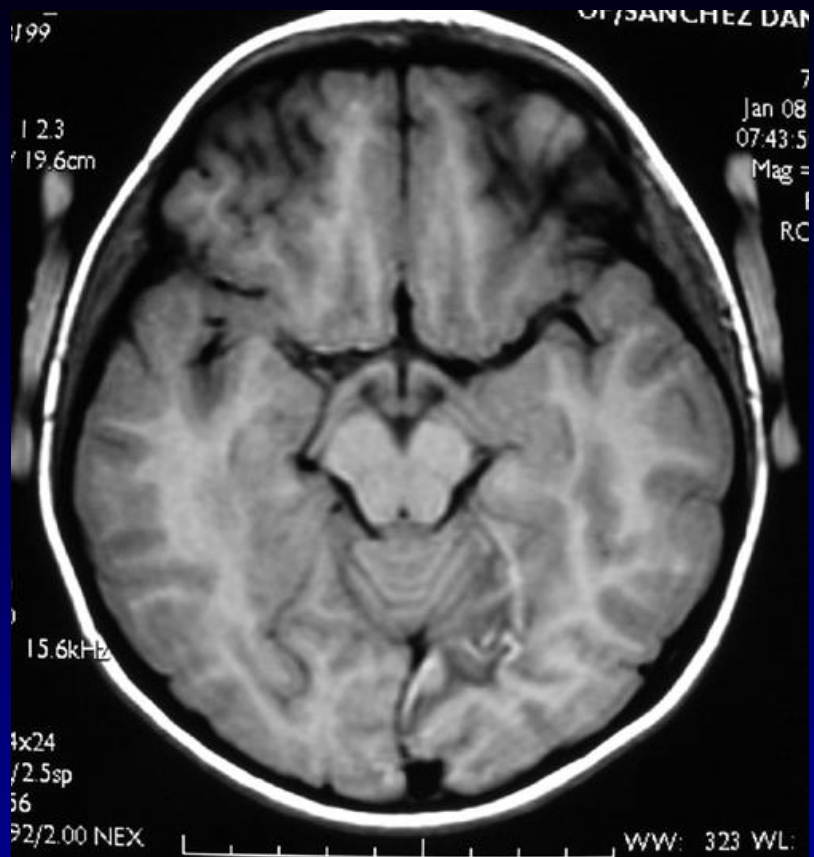
**T1**



**FLAIR**

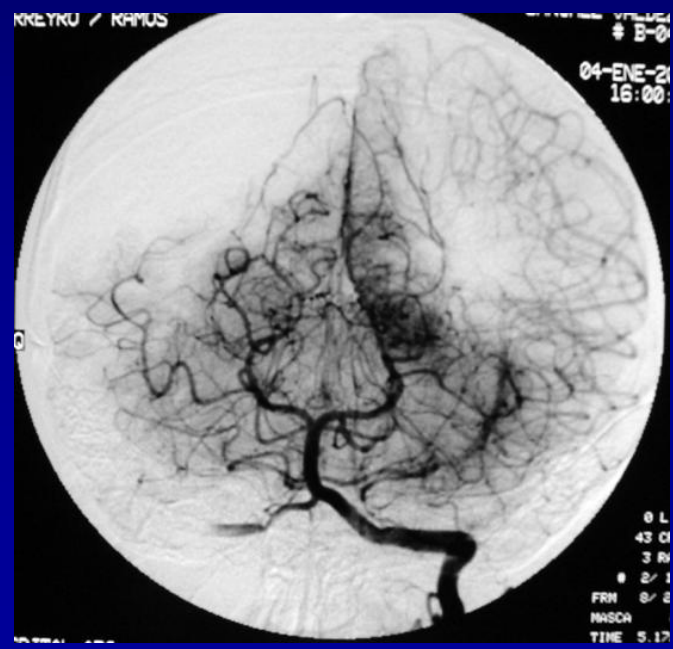
**DIFUSION**



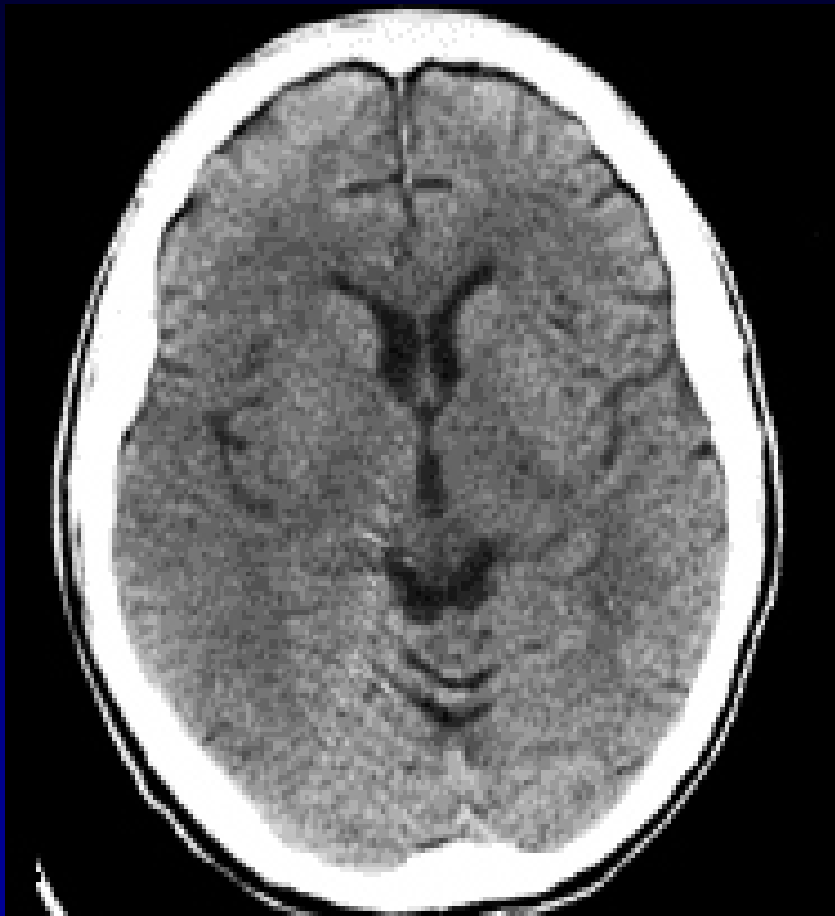


**SUBACUTE INFARCT**



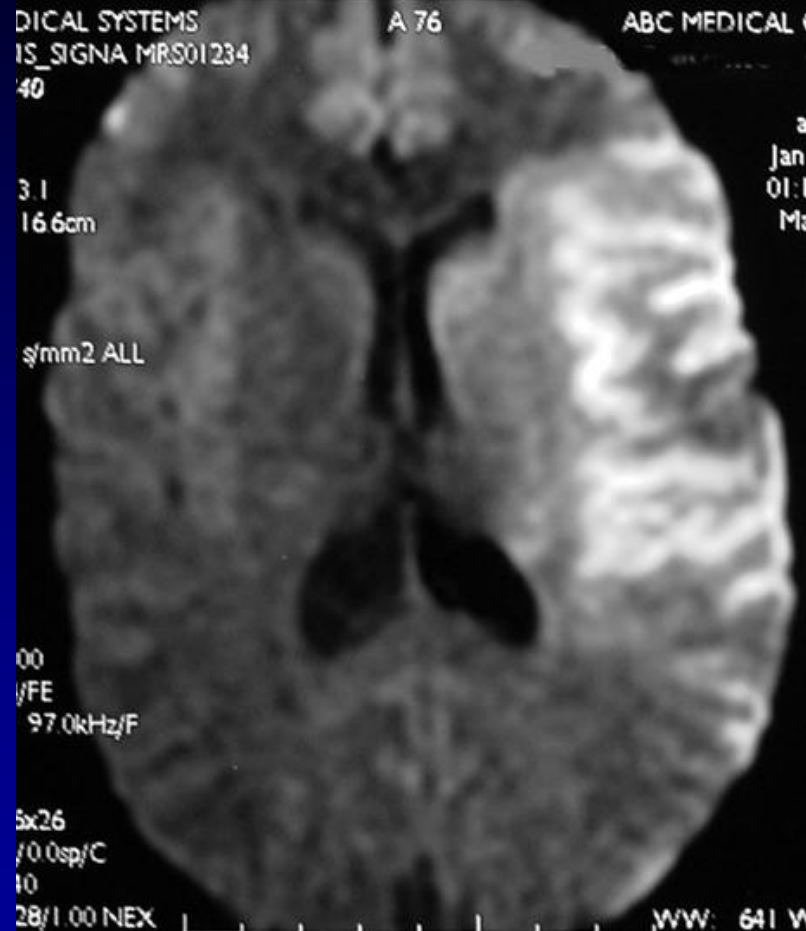


# LUXURY PERFUSION



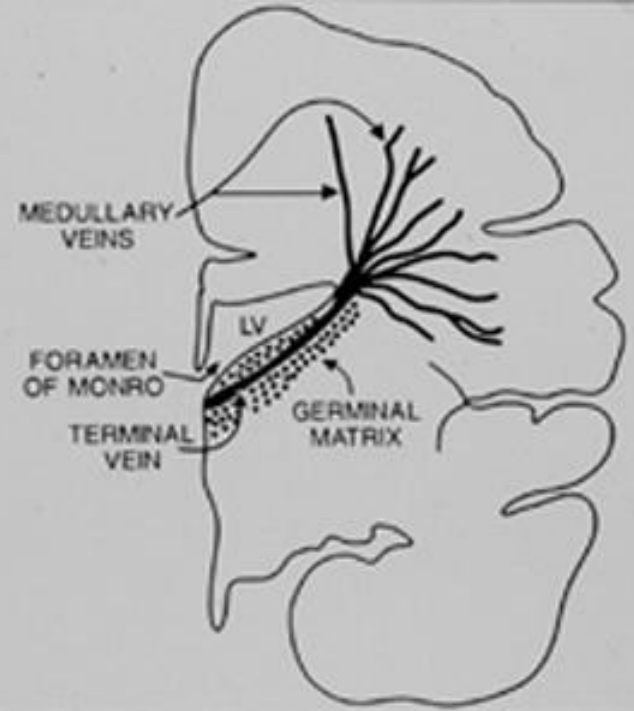
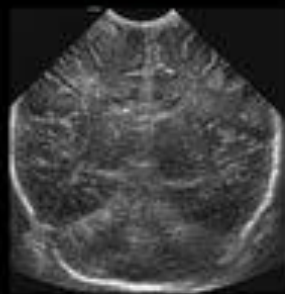
**CT**

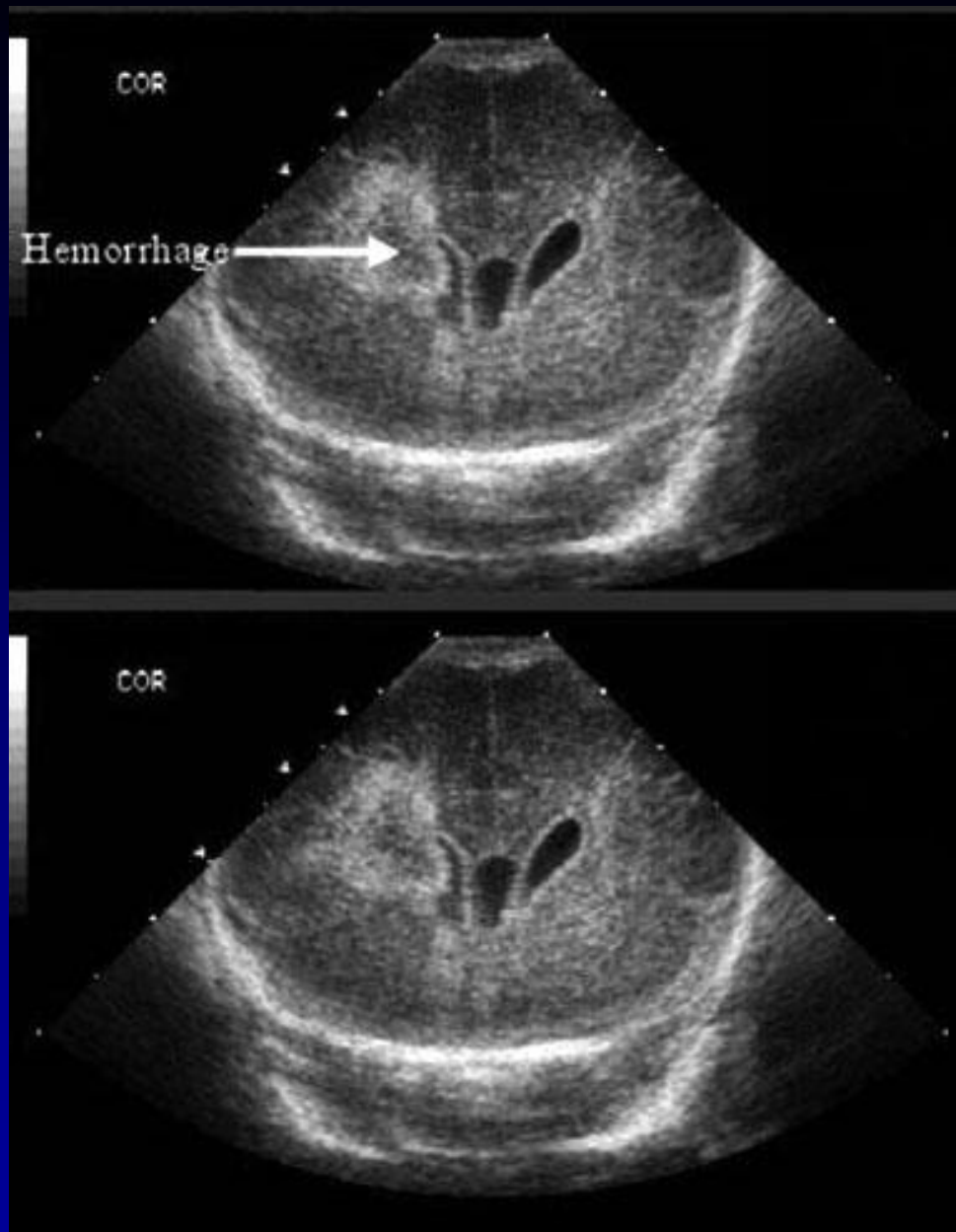
Hours



**DWI**

Minutes





Ventricular hemorrhage and parenchymal infarct





# CEREBRO VASCULAR EVENT

**ISCHEMIC**

**THROMBO EMBOLIC**

**VASCULITIS**

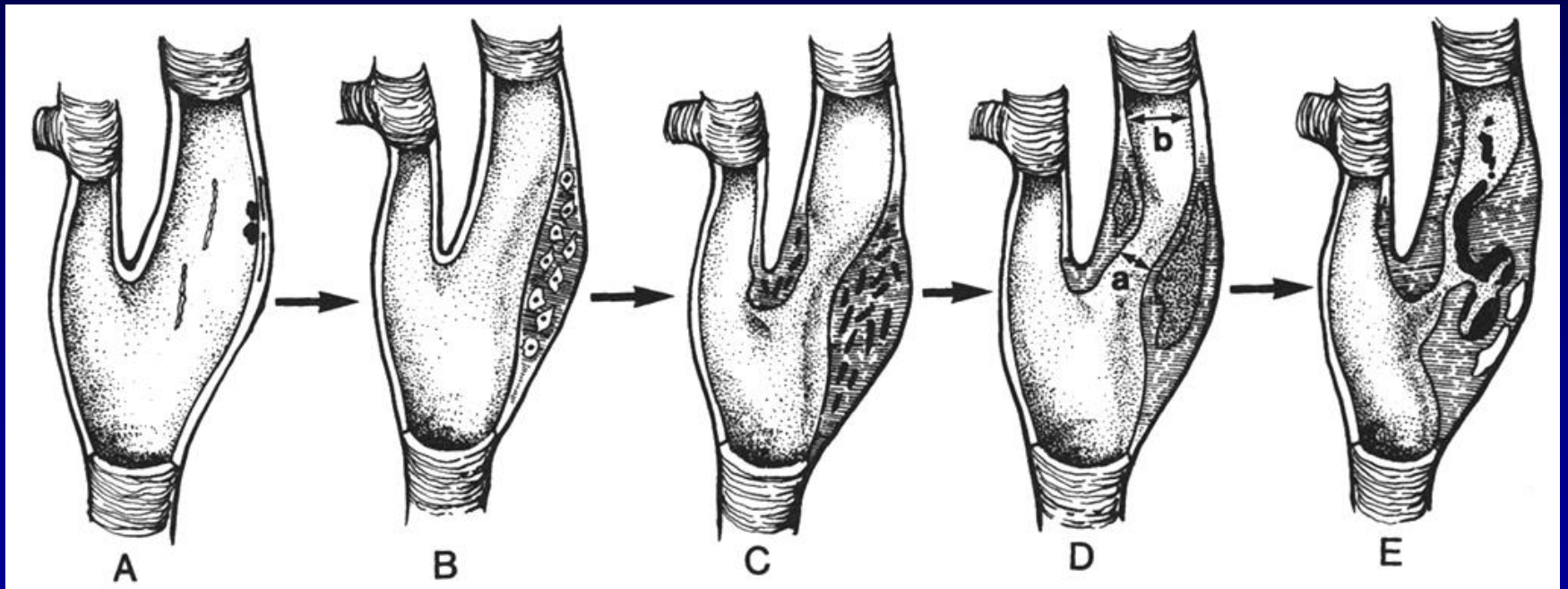
**DISSECTION**

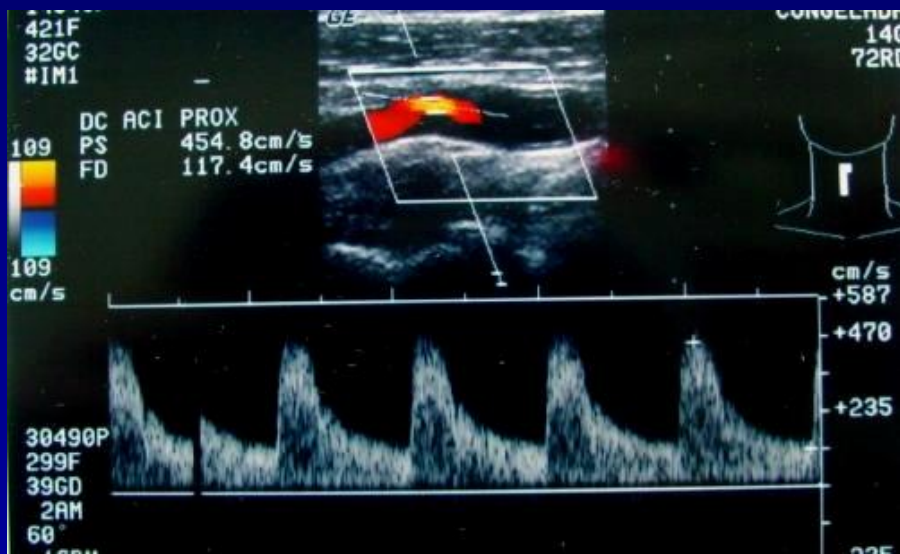
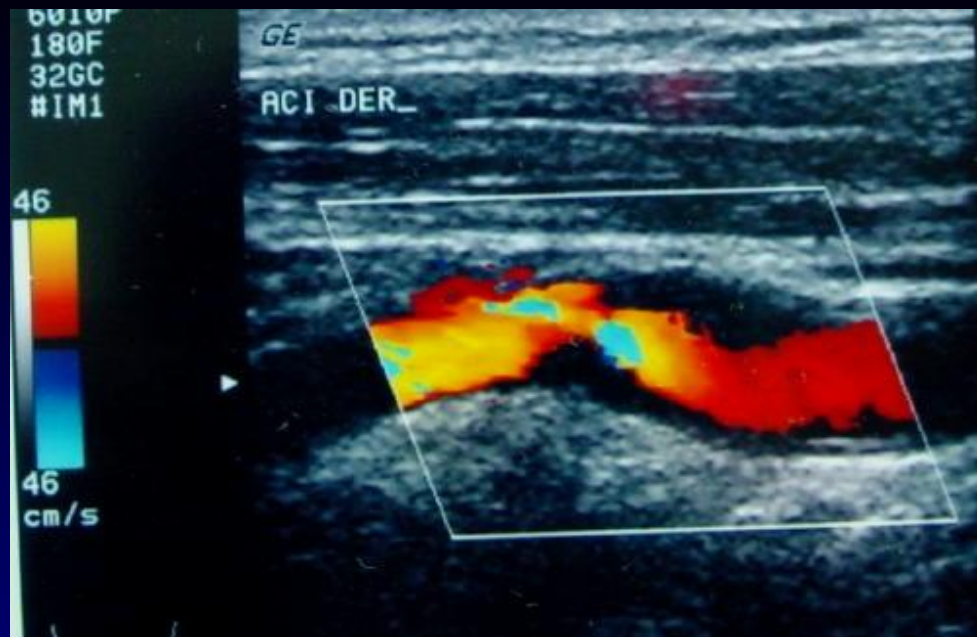
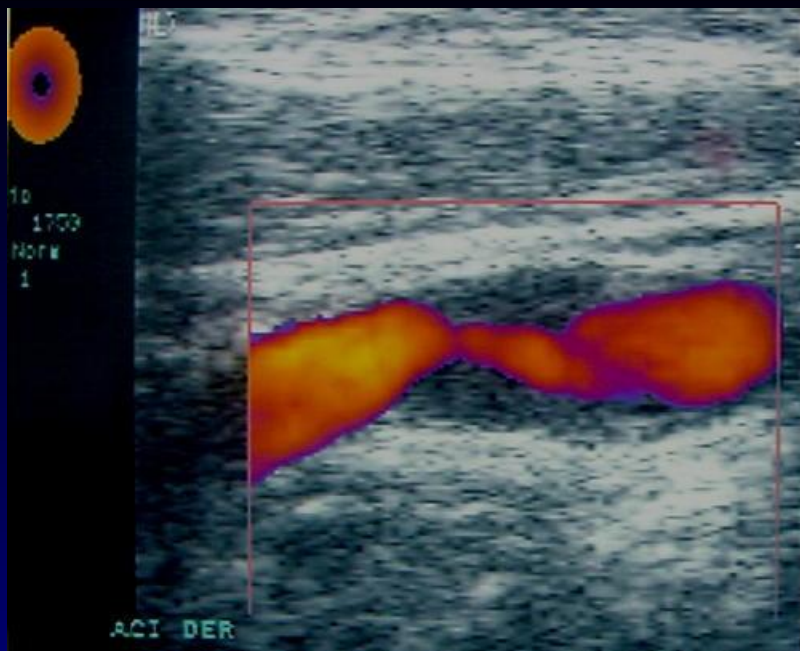
**FIBROMUSCULAR DISPLASIA**

**VENOUS THROMBOSIS**

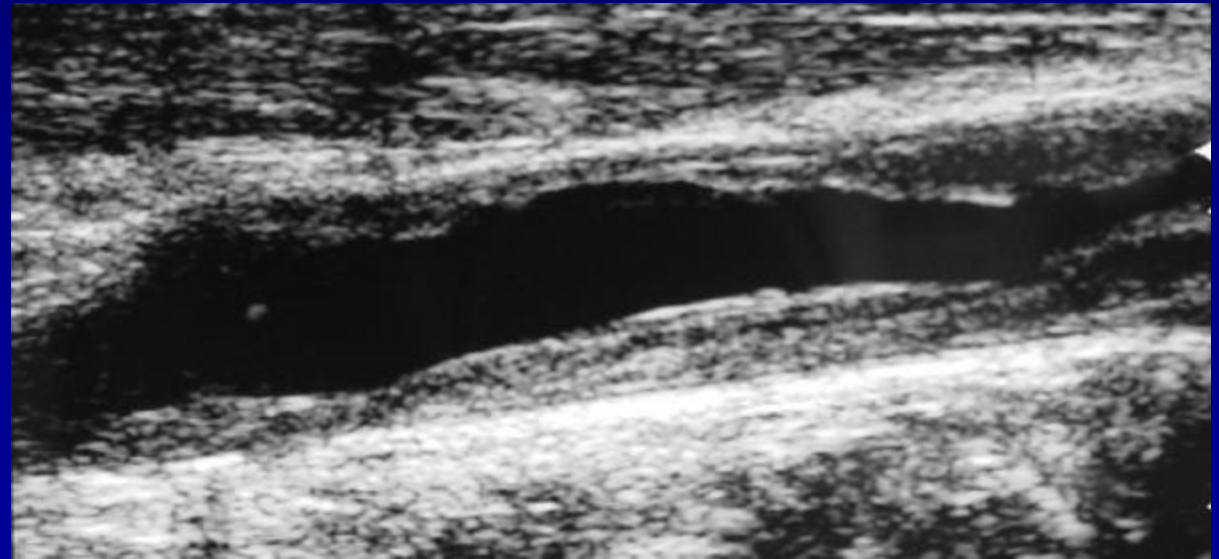
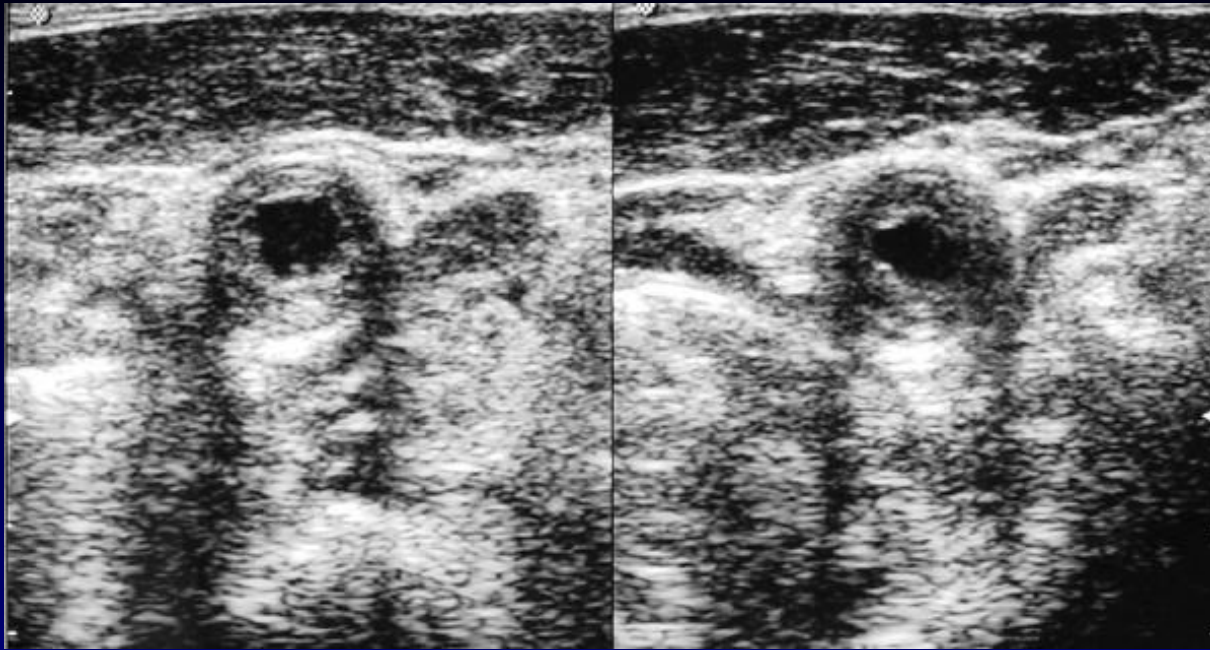
**ANOXIA**

# ATHEROSCLEROTIC PLAQUE



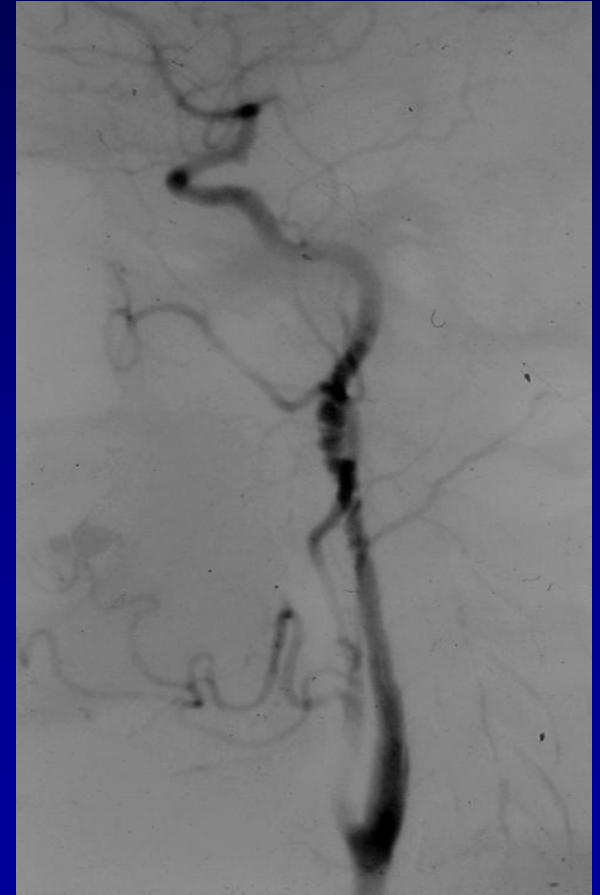


# COLOR AND PULSED DOPPLER ULTRASOUND



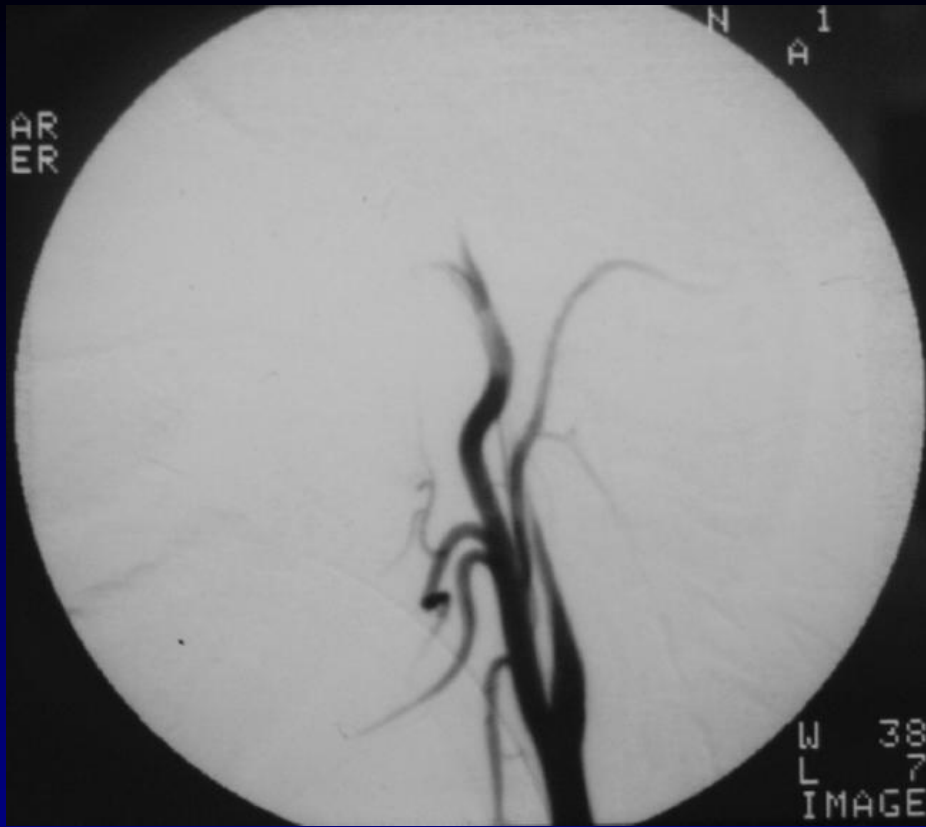
**B MODE  
ULTRASOUND**



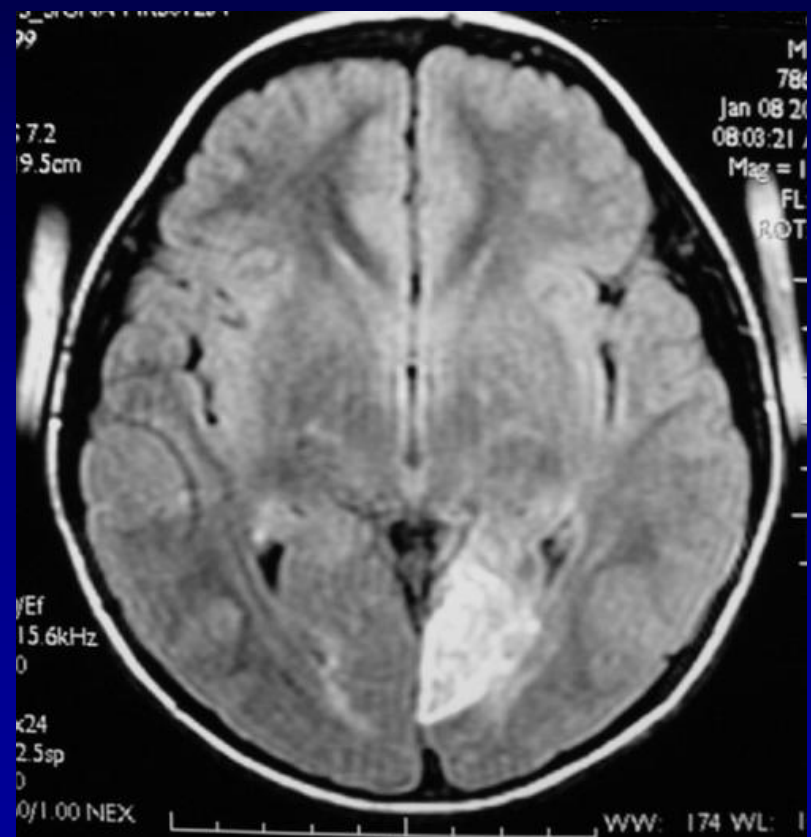
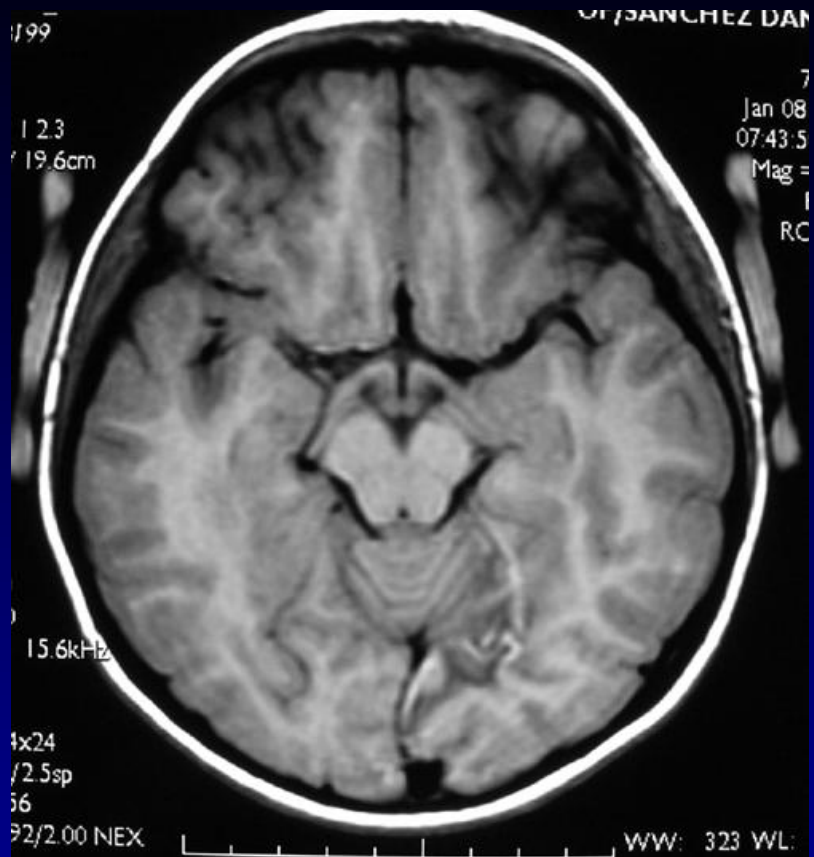


**FIBROMUSCULAR  
DISPLASIA**



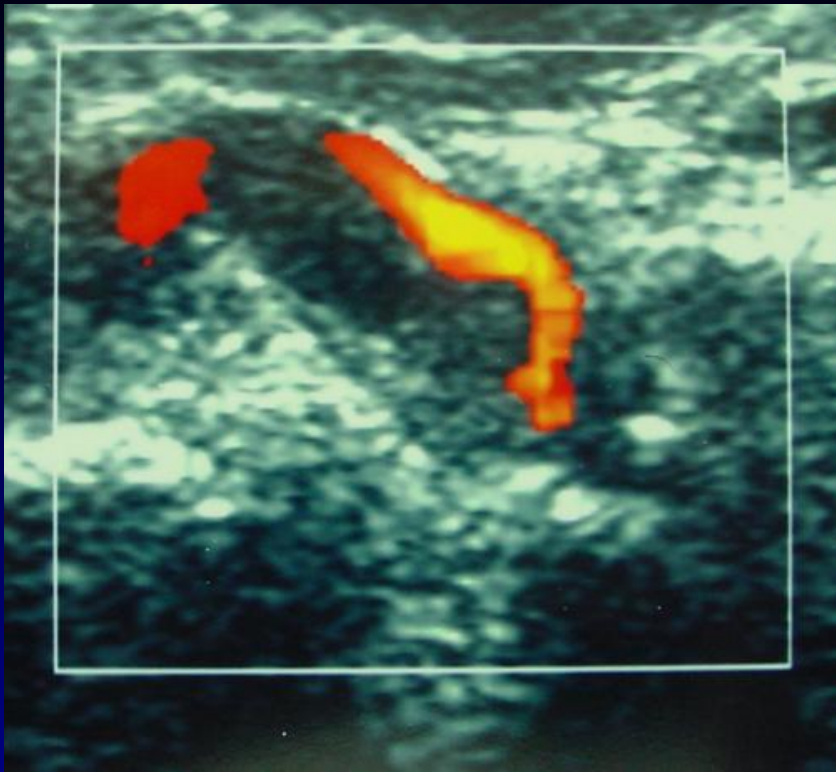


**DISSECTION**

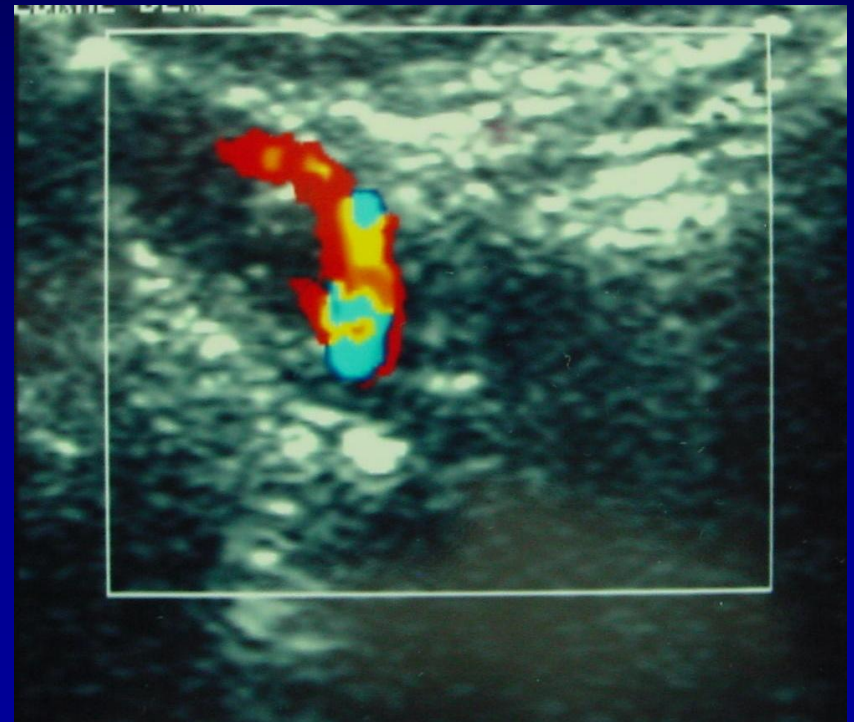


**SUBACUTE INFARCT**

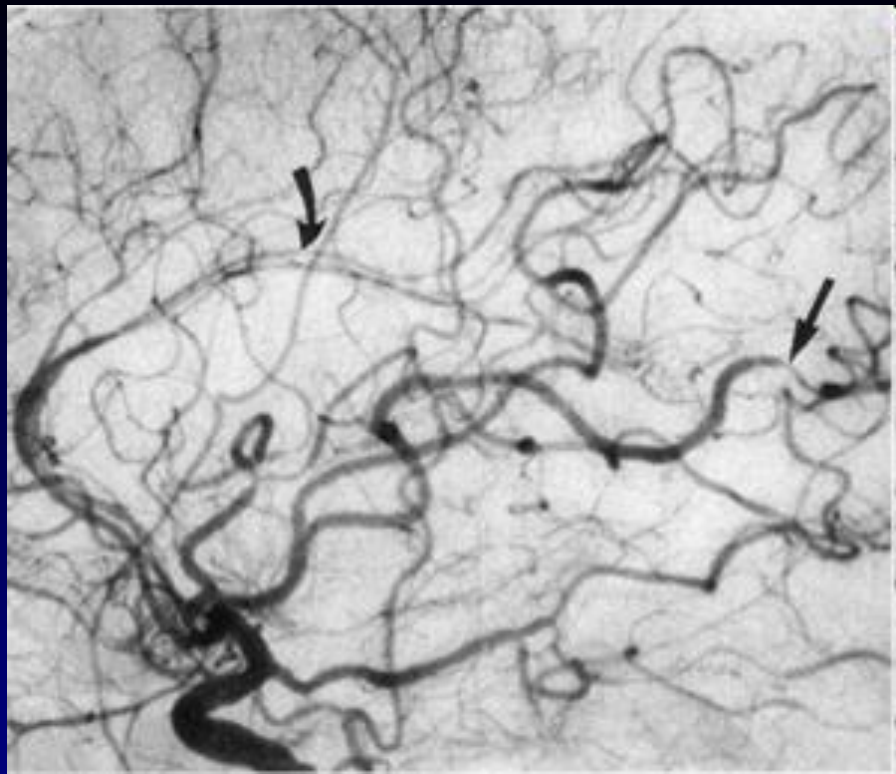




# VERTEBRAL ARTERY DISSECTION







**VASCULITIS**





Superior Sagittal Sinus

Vein of Trolard

Thalamostriate Vein

Internal Cerebral Vein

Vein of Galen

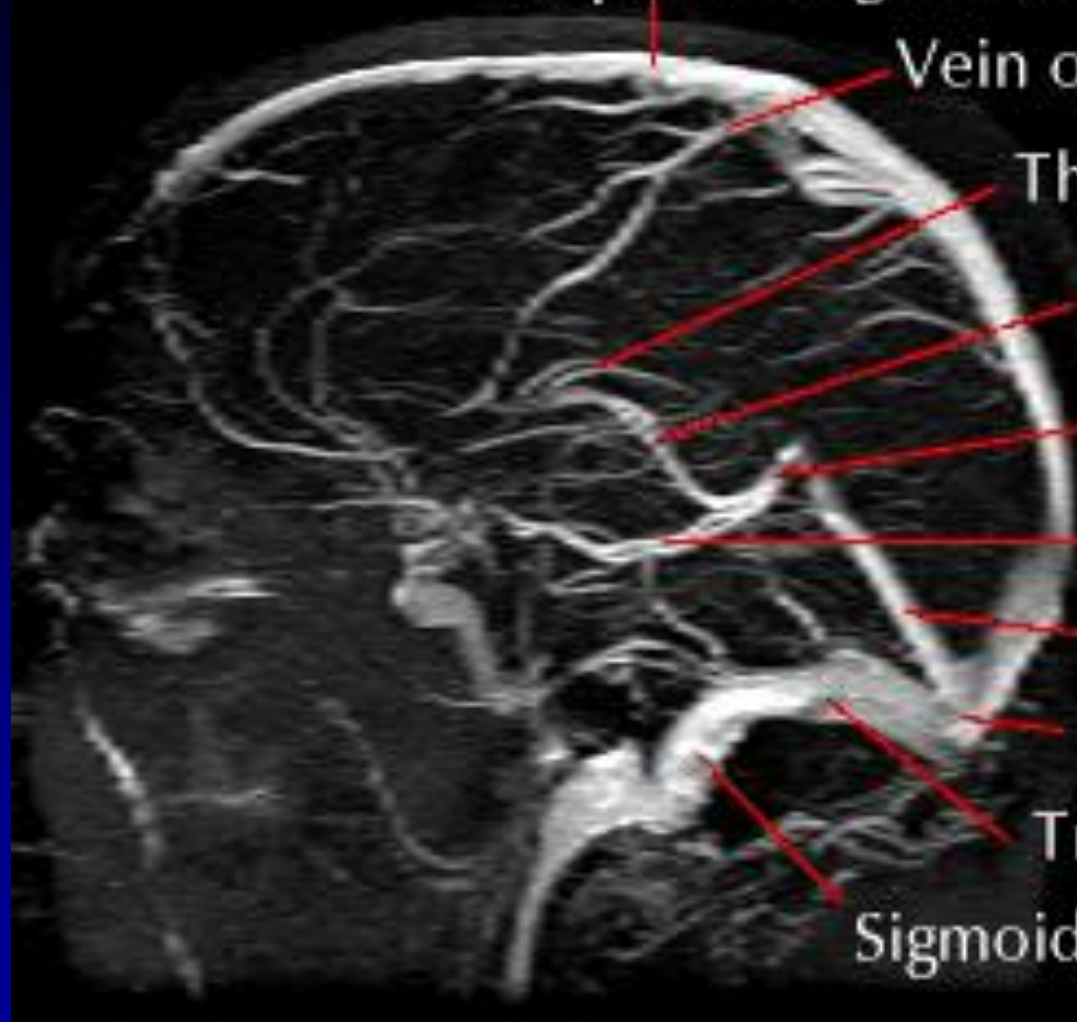
Basal Vein of Rosenthal

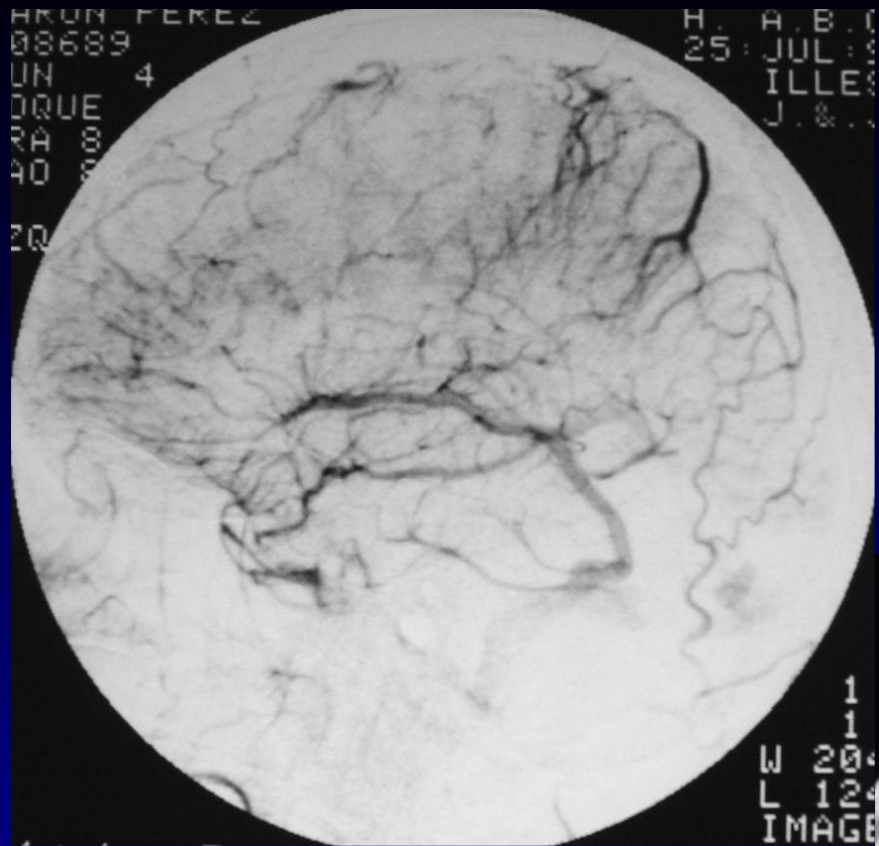
Straight Sinus

Torcular Herophili

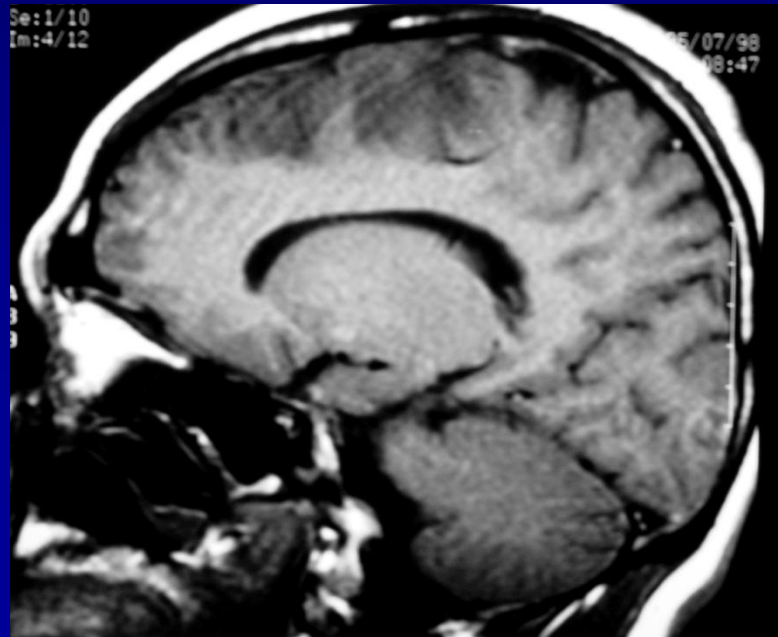
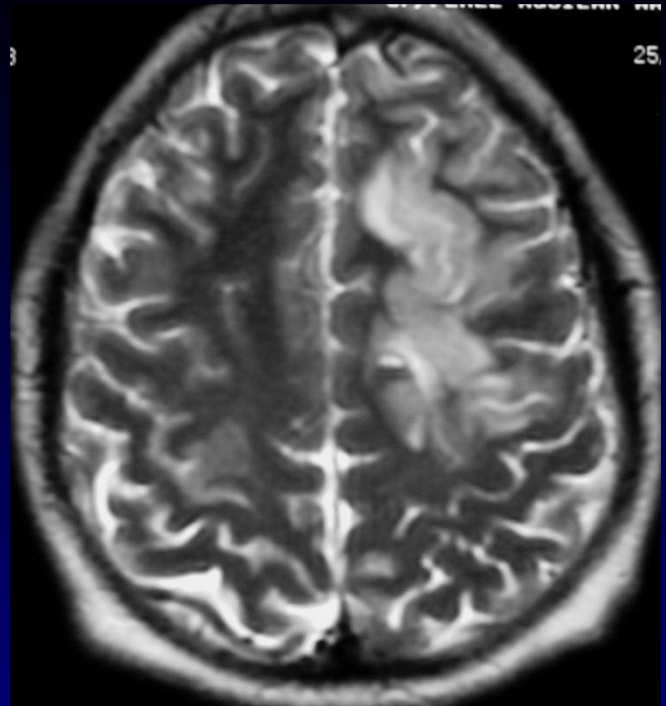
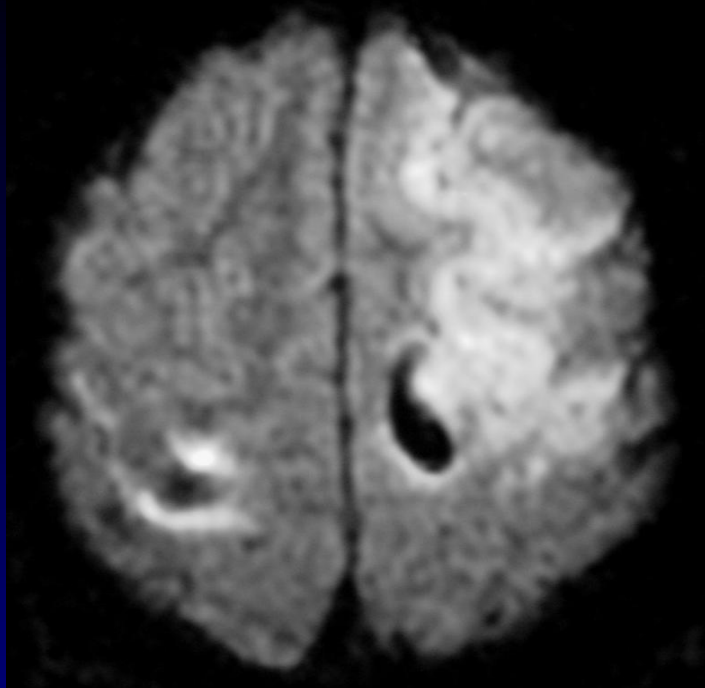
Transverse Sinus

Sigmoid Sinus





# SSS THROMBOSIS



**VENOUS INFARCT**

# CEREBRO VASCULAR EVENT

- HEMORRHAGIC

HYPERTENSION

ANEURYSM

VASCULAR MALFORMATION

TRAUMA

COAGULOPATHY

AMYLOIDOSIS



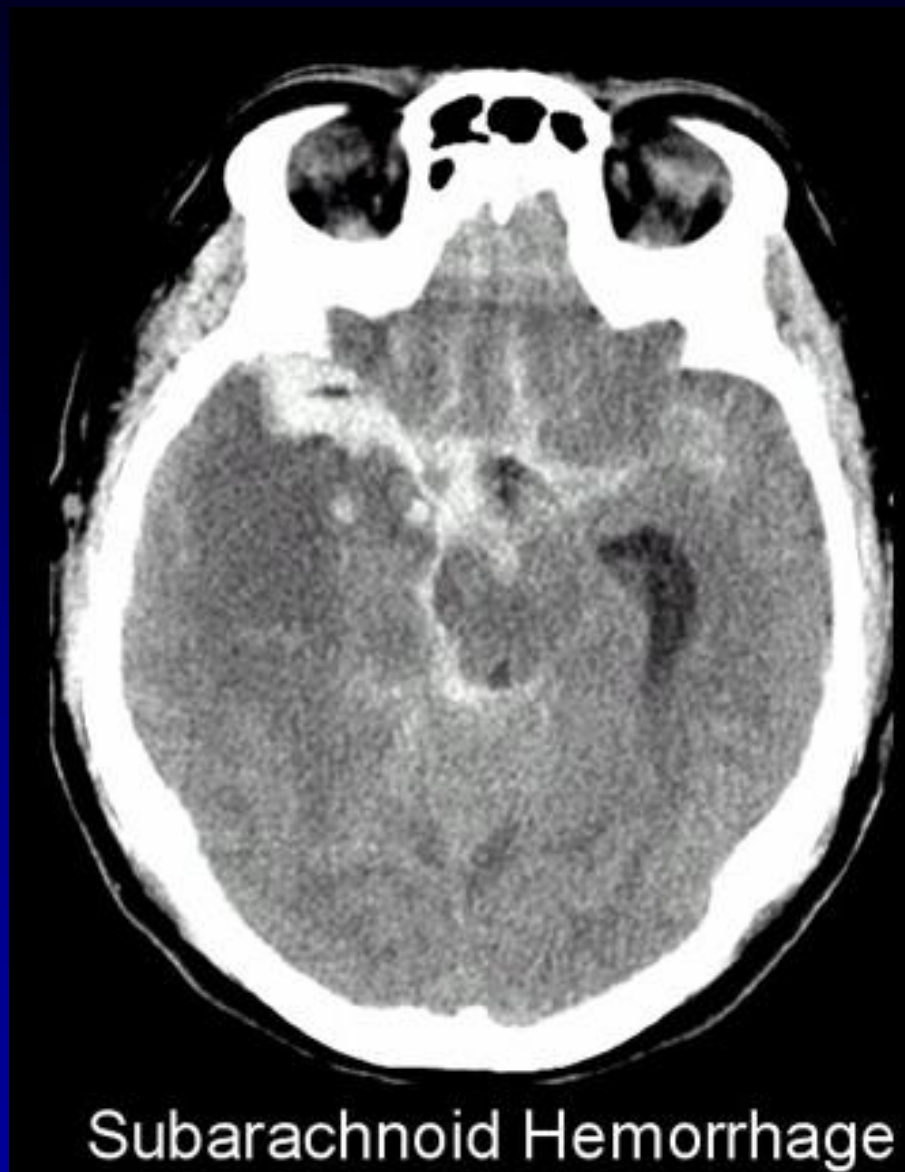
Intracerebral Hemorrhage

**HYPERTENSION**

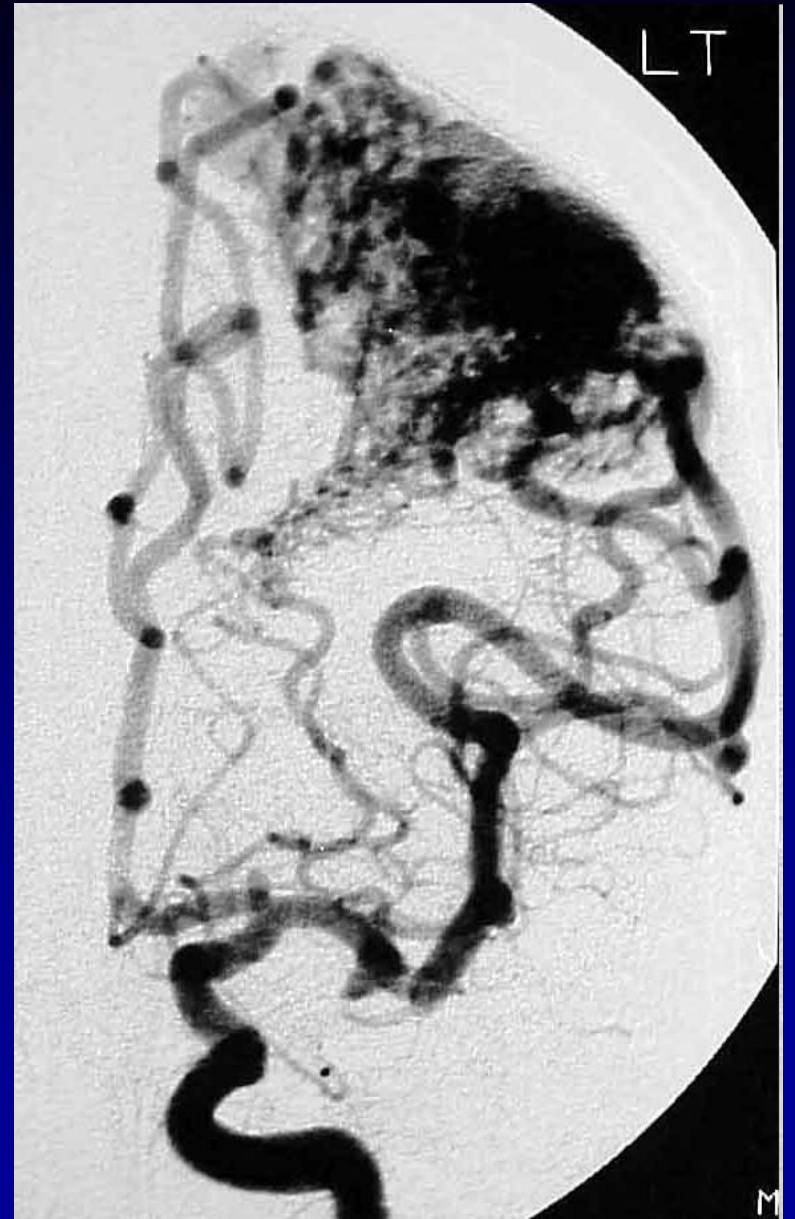
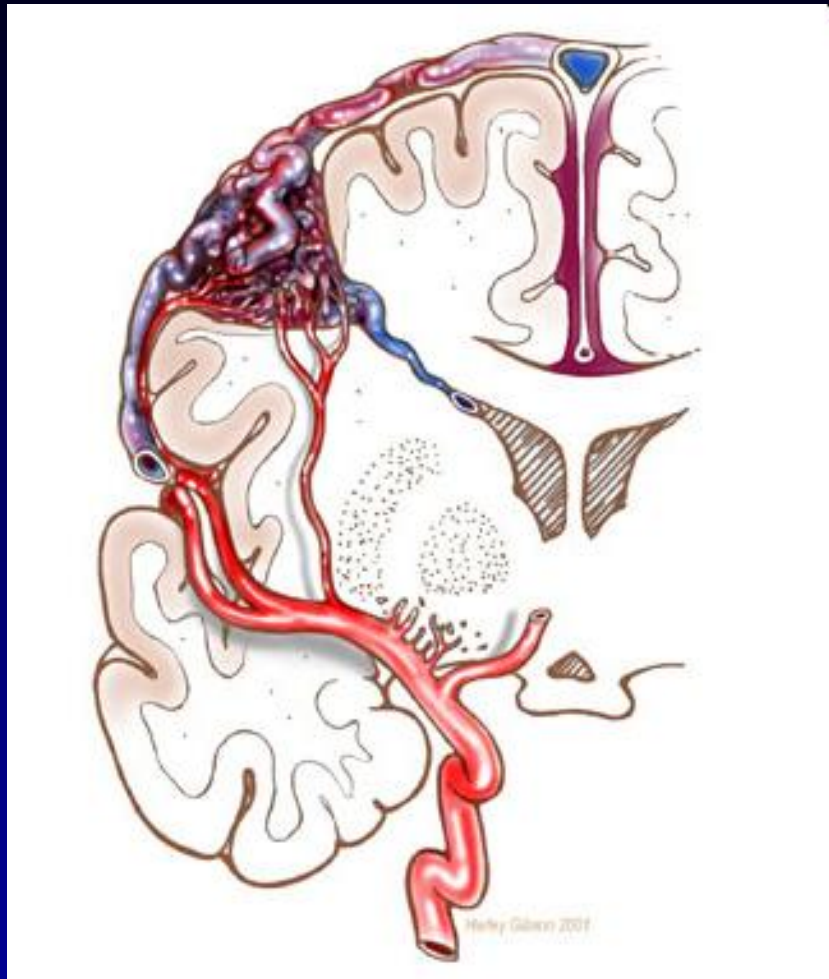




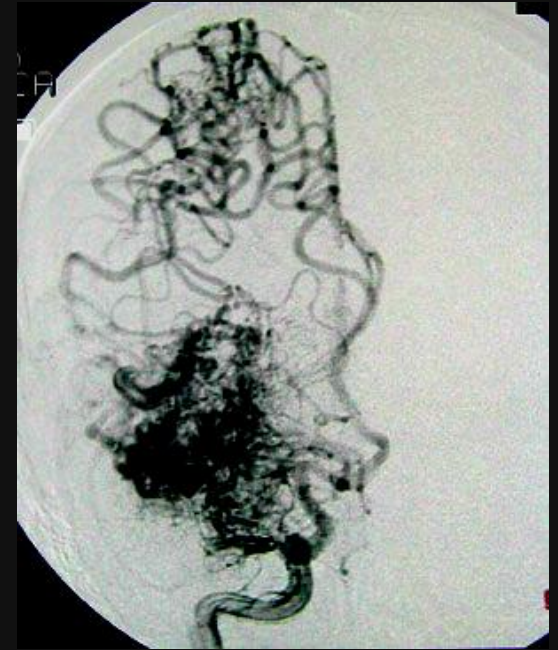
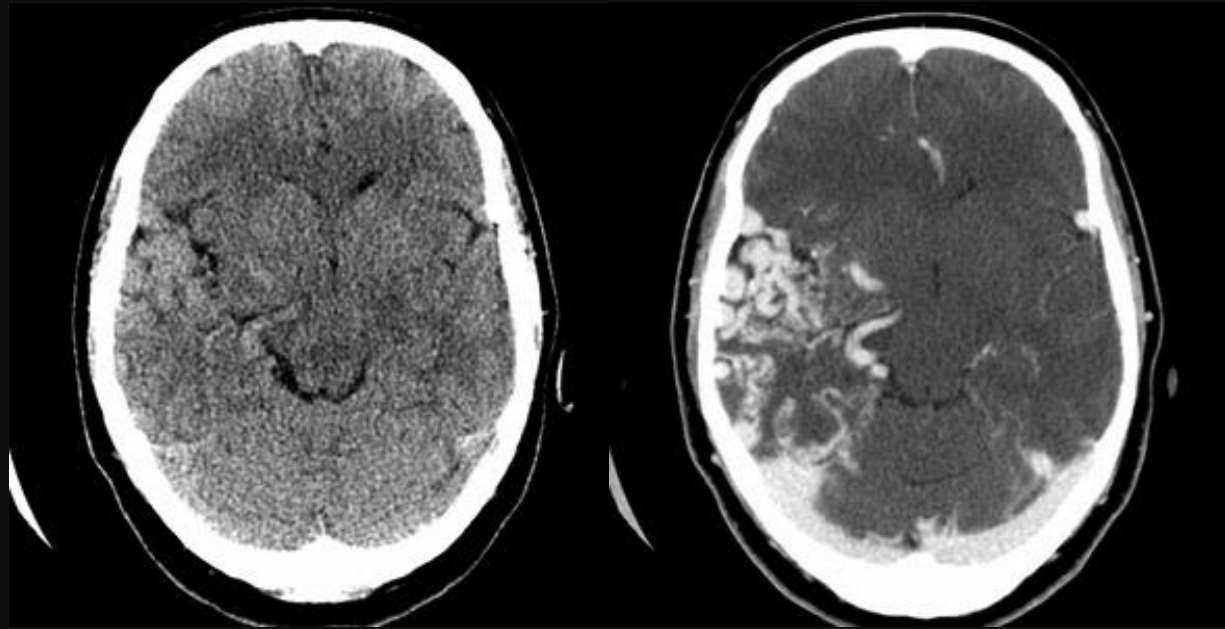
**ANEURYSM**



**Subarachnoid Hemorrhage**

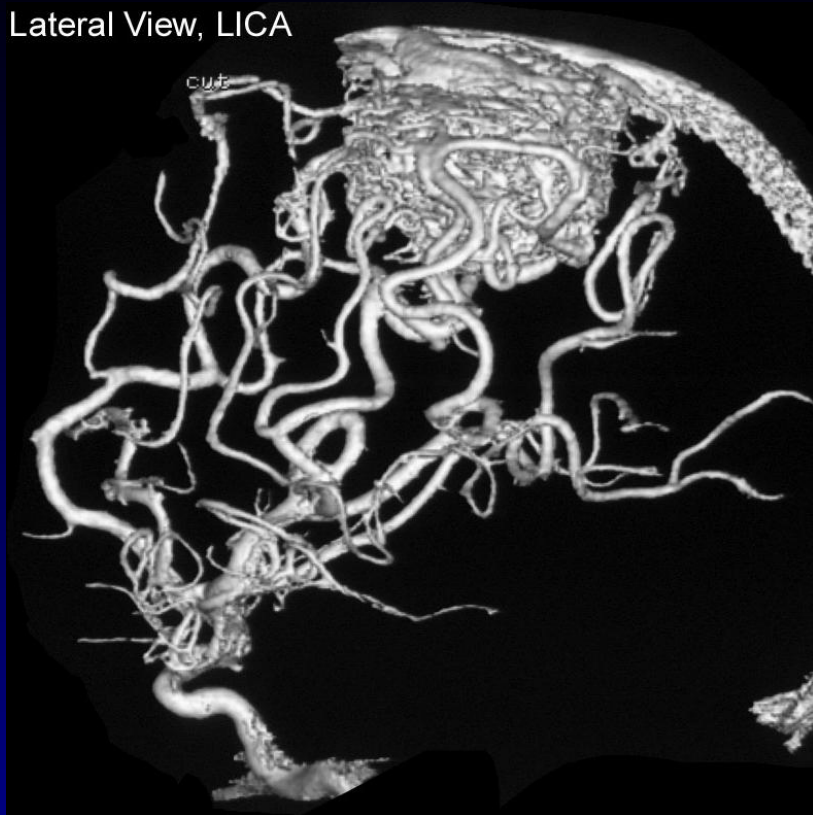


# Cerebral Arterio Venous Malformation (AVM)





Lateral View, LICA



# CTA 3D RECONSTRUCTION

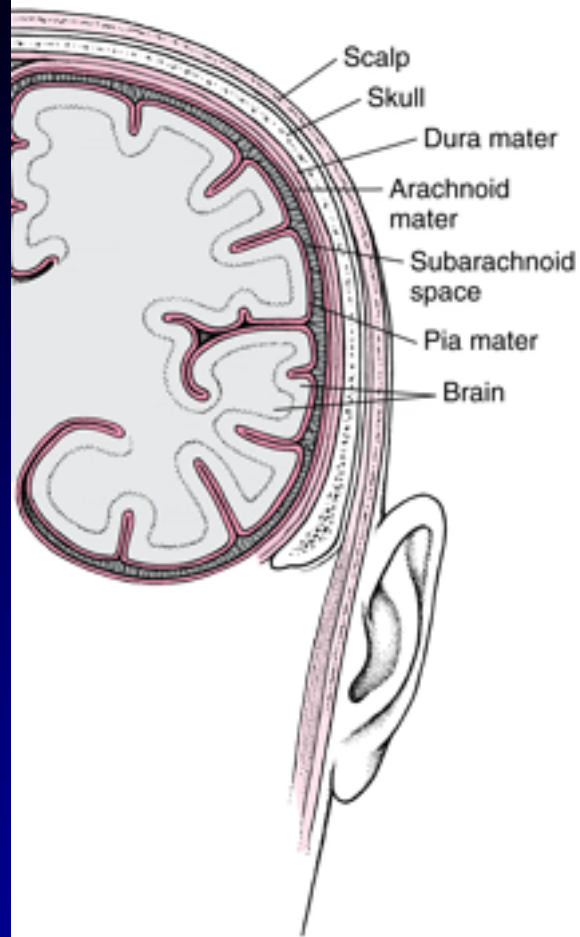


# TRAUMA

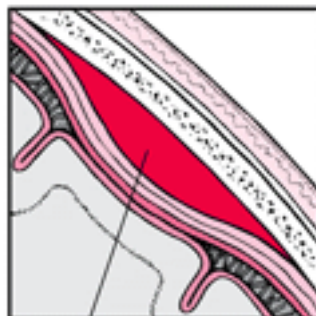
- **CONTUSION**
- **DIFFUSE AXONAL INJURY**
- **SUBDURAL HEMATOMA**
- **EPIDURAL HEMATOMA**
- **SUBARACHNOID HEMORRHAGE**



### Cross Section of the Brain

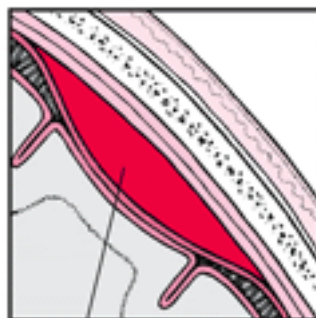


### Epidural Hematoma

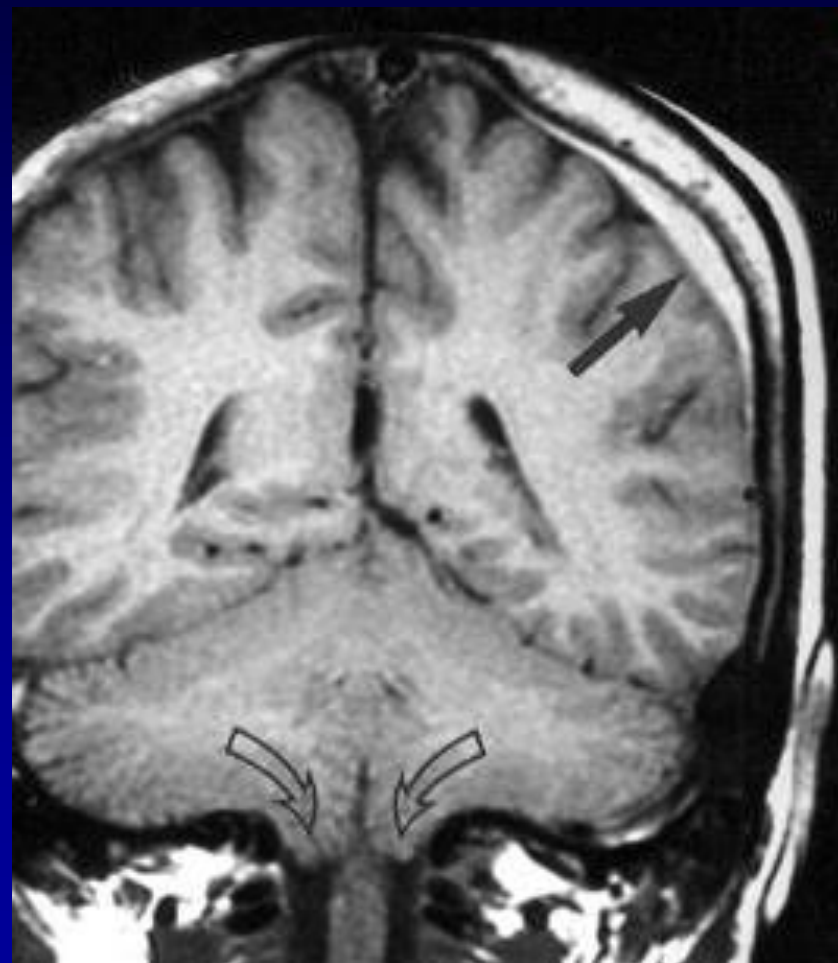


Bleeding between the dura mater and the skull

### Subdural Hematoma

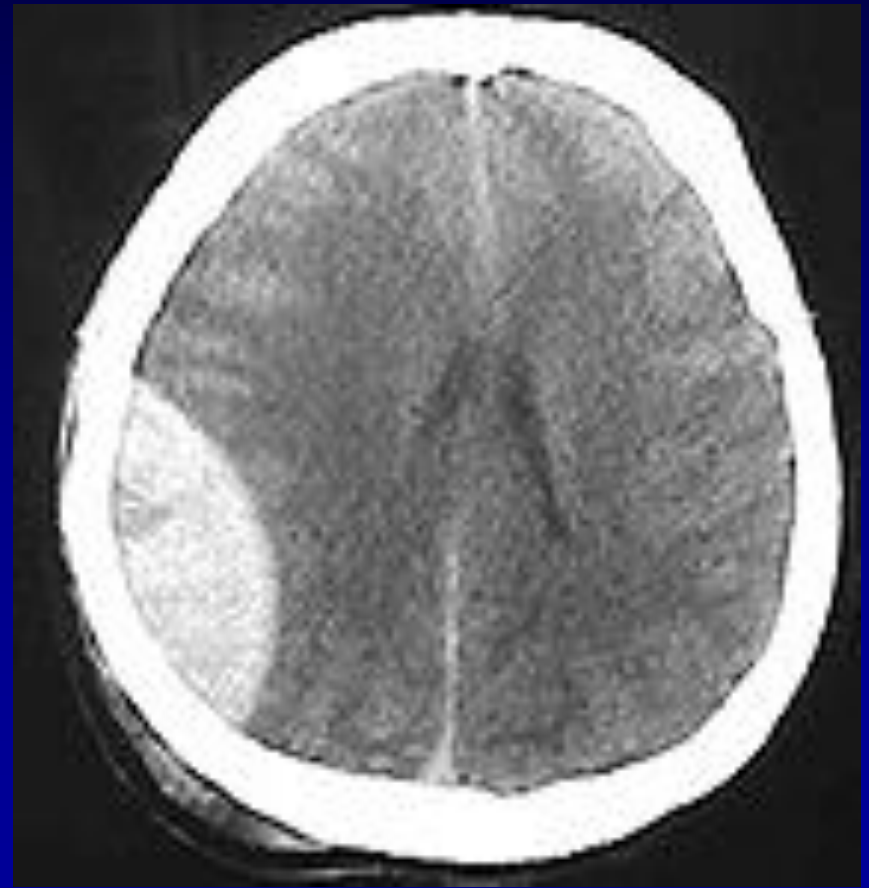


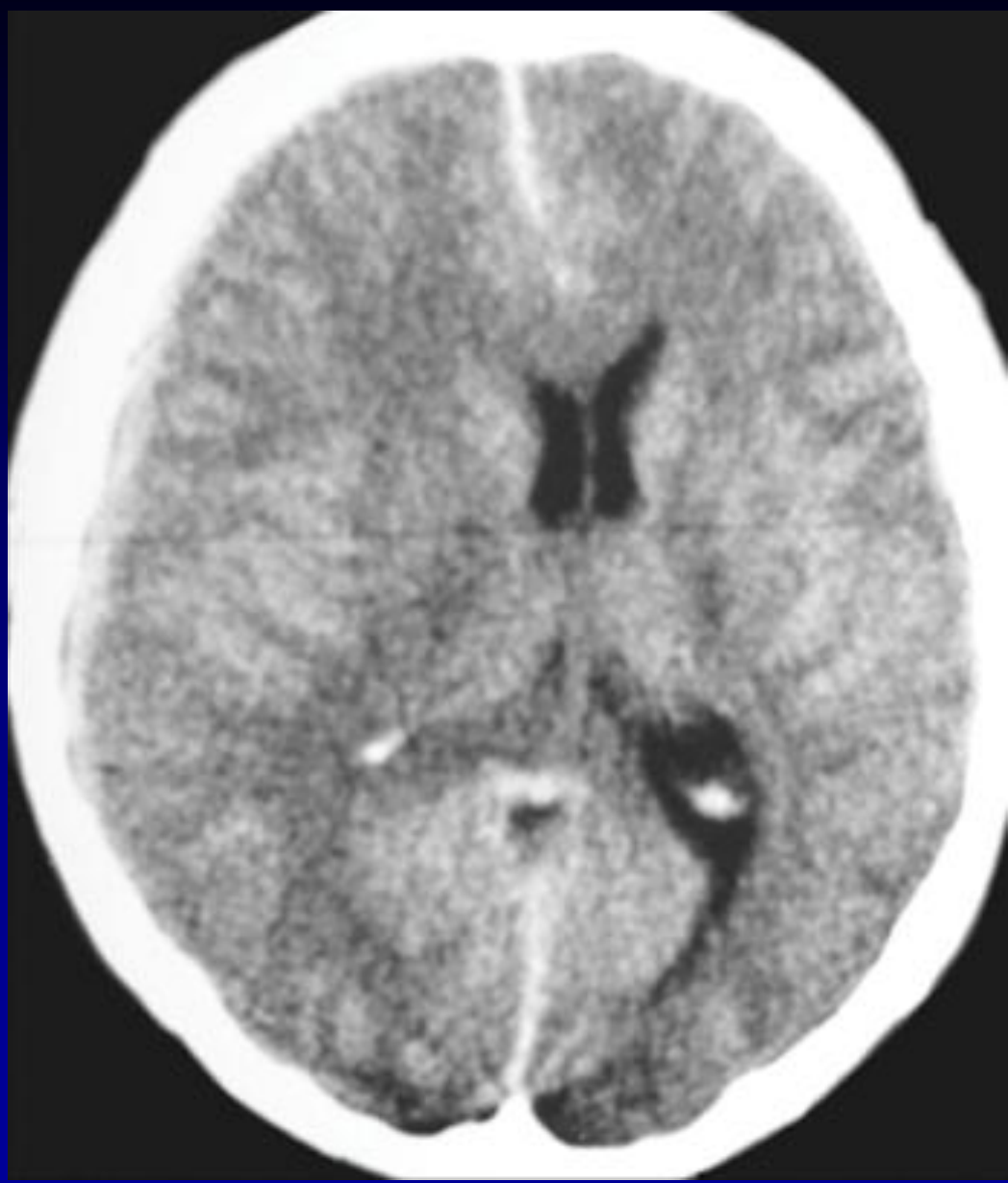
Bleeding between the arachnoid mater and the dura mater



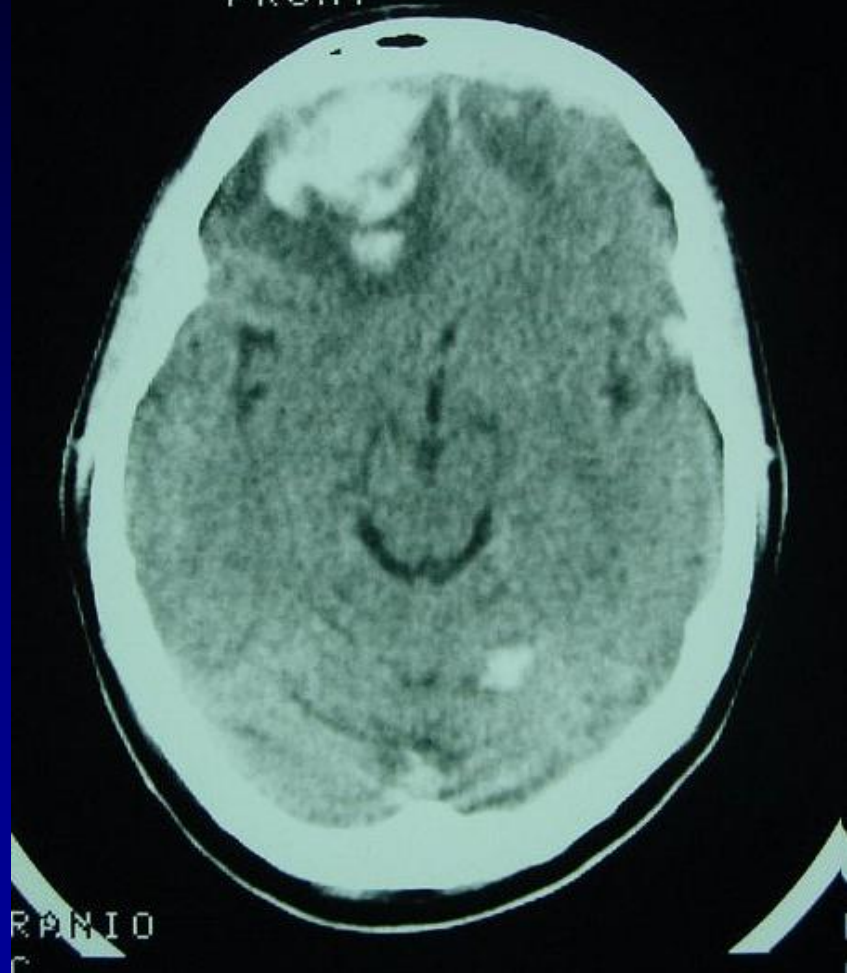


**EPIDURAL HEMATOMA**





FRONT



RANIO  
C



RANIO



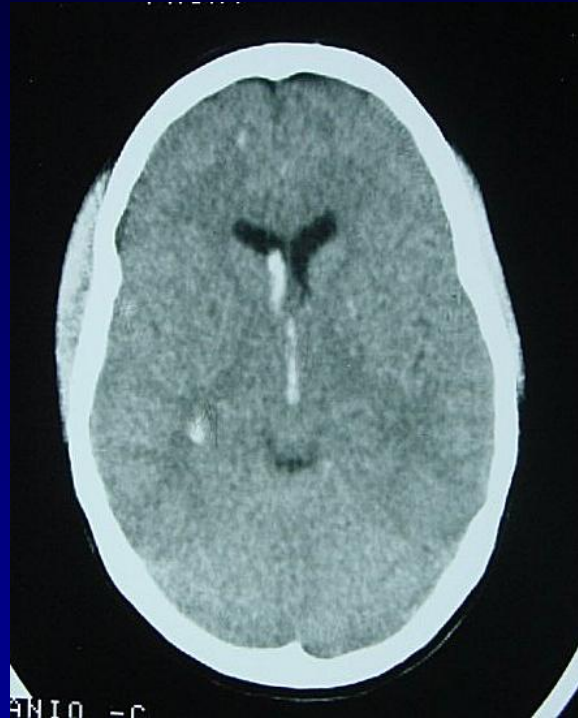
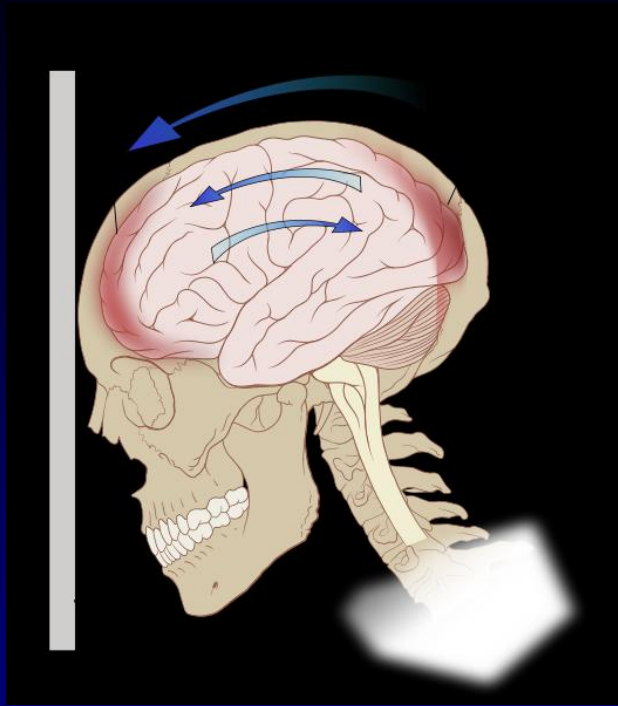


**SUBACUTE SUBDURAL  
HEMATOMA**



**CHRONIC SUBDURAL  
HEMATOMA**





# DIFFUSE AXONAL INJURY

# SEIZURE

- **CONGENITAL MALFORMATION**
- **MESIAL SCLEROSIS**
- **CVA**
- **POSTTRAUMATIC**

igna 1.5T SYS#FOR.IC0

6241  
2/7  
16/24  
S22.9

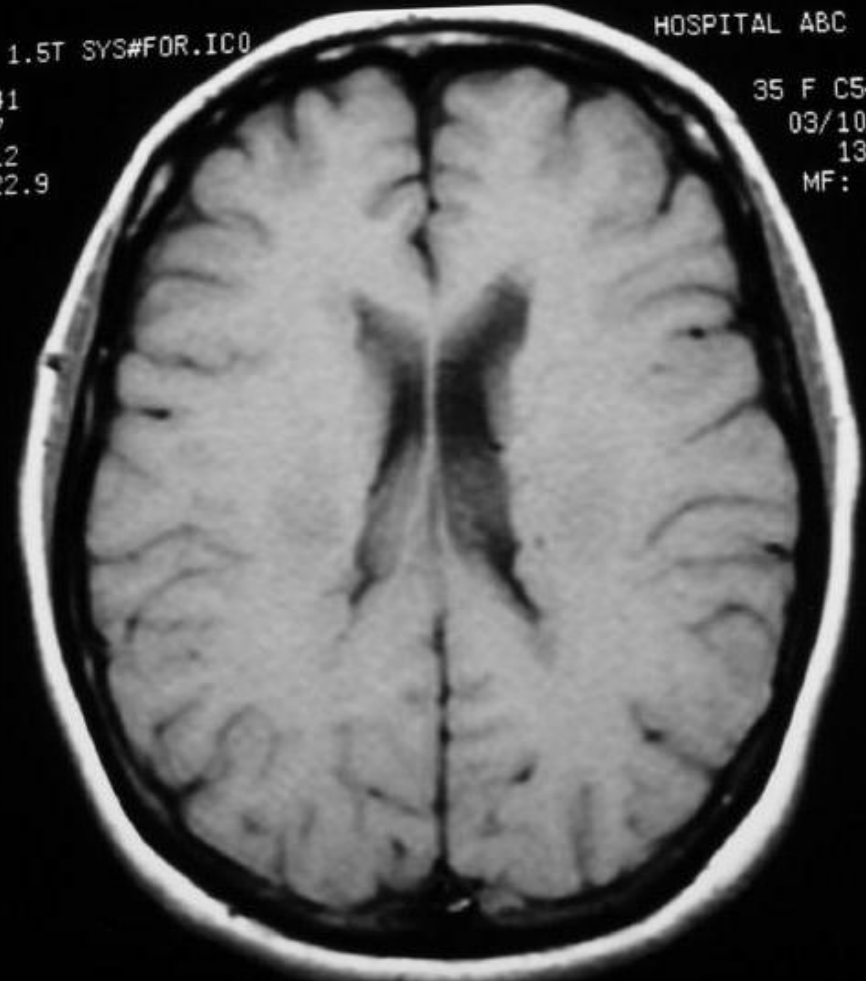
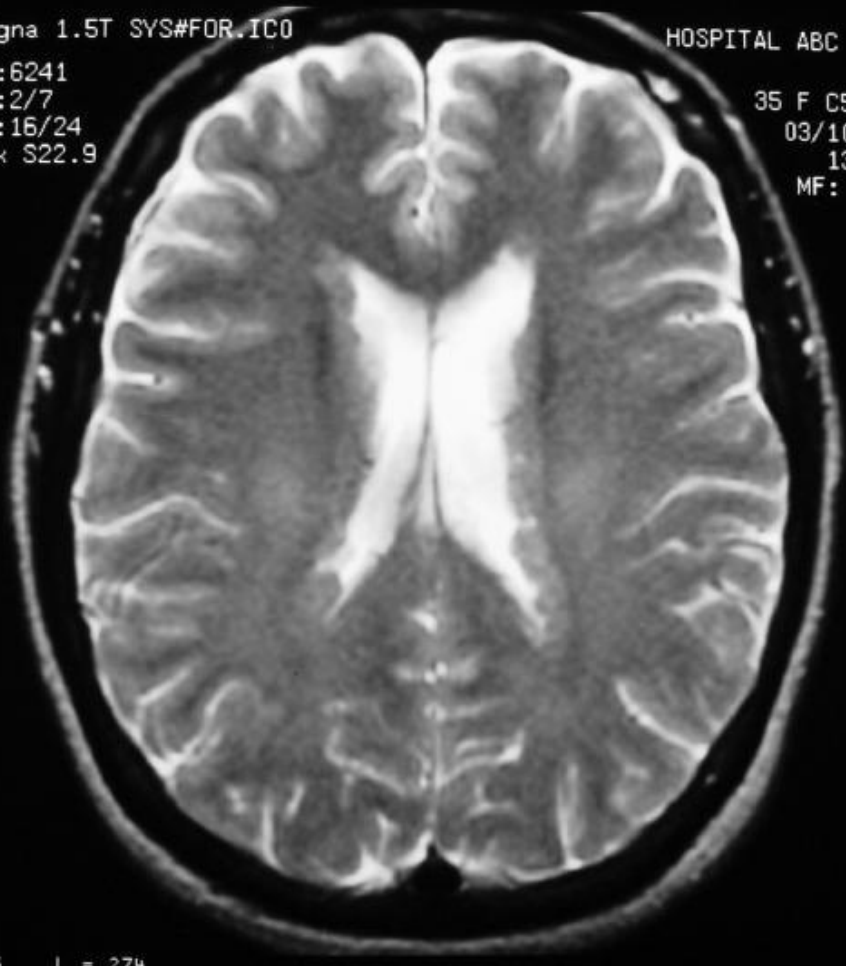
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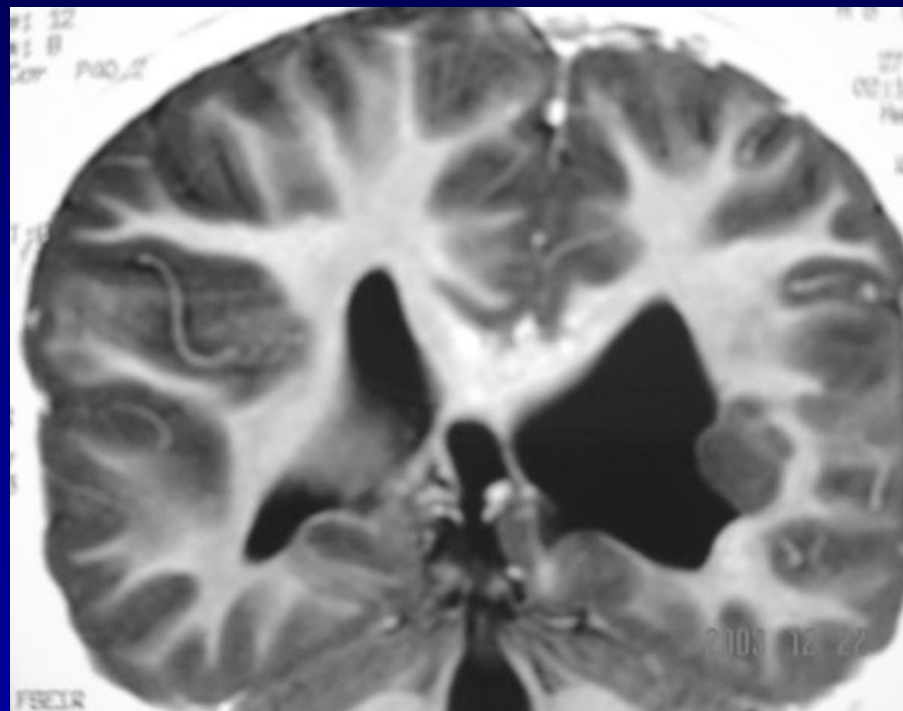
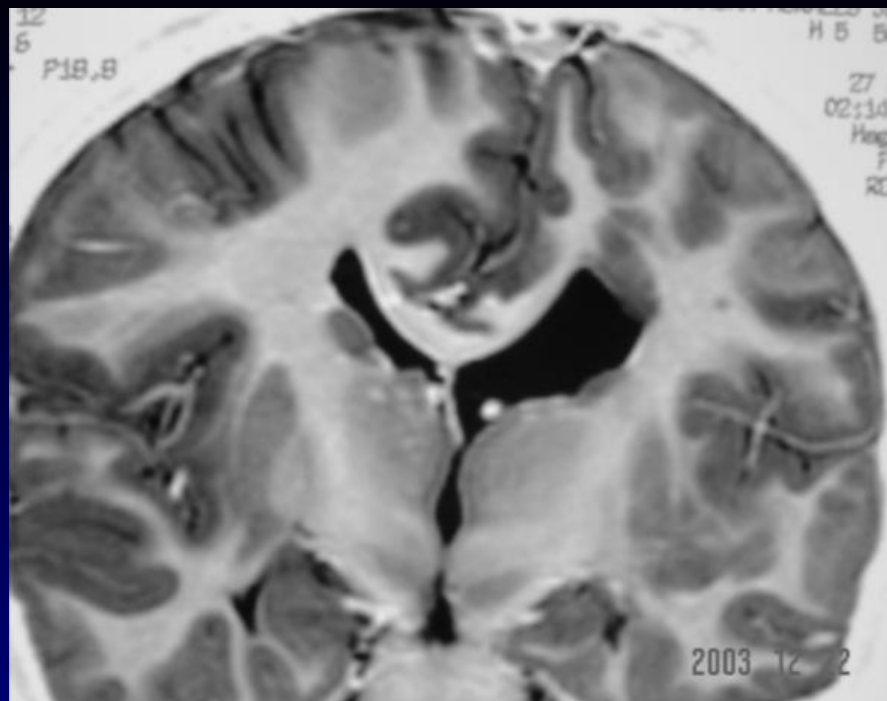
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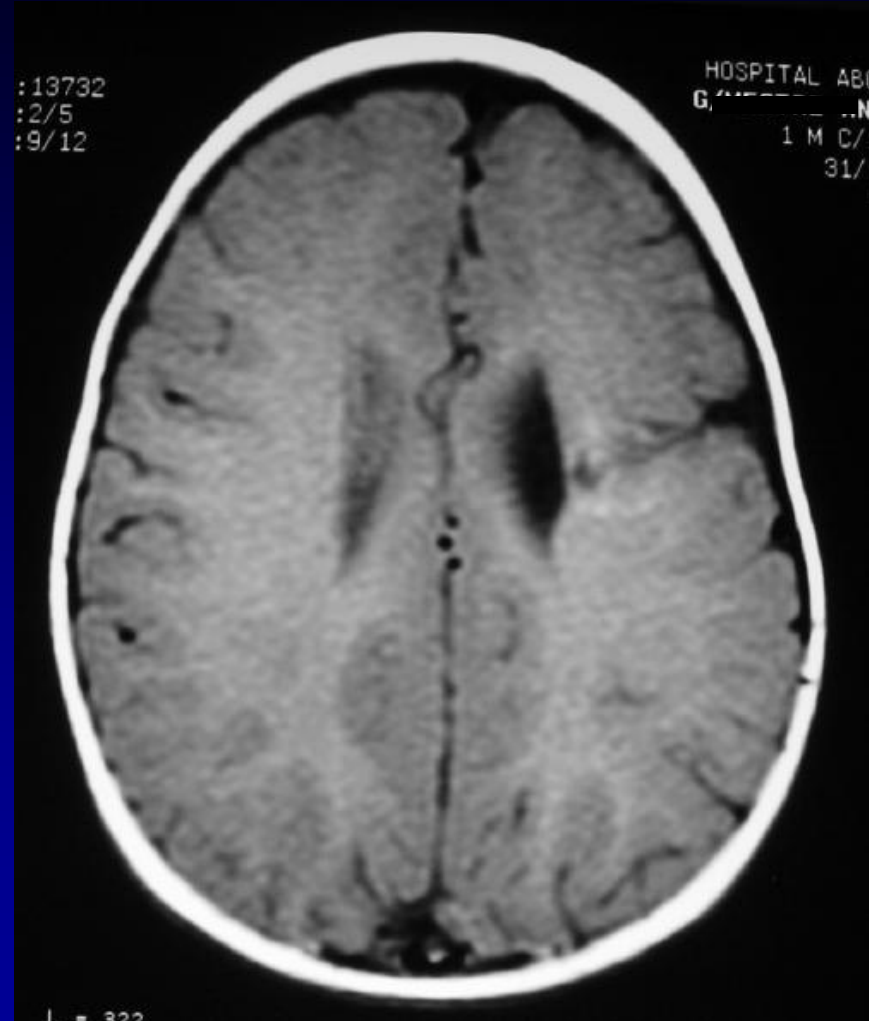
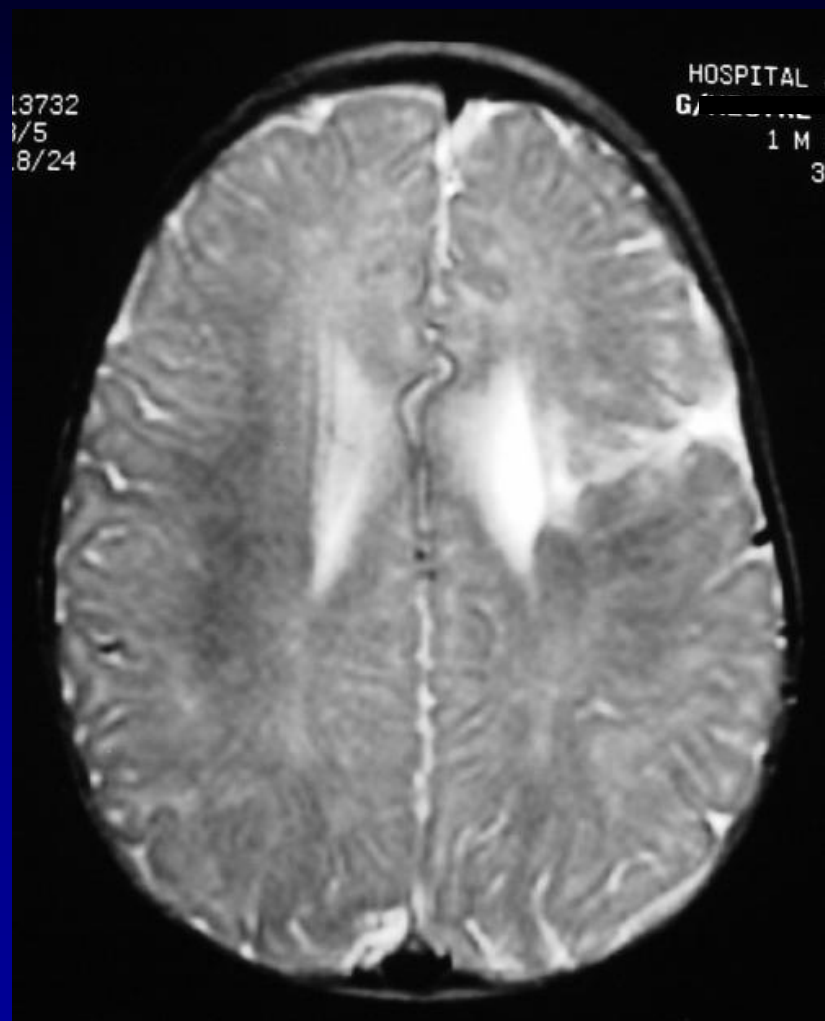
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35 F C54487  
03/10/94  
13:20  
MF: 1.3

HOSPITAL ABC

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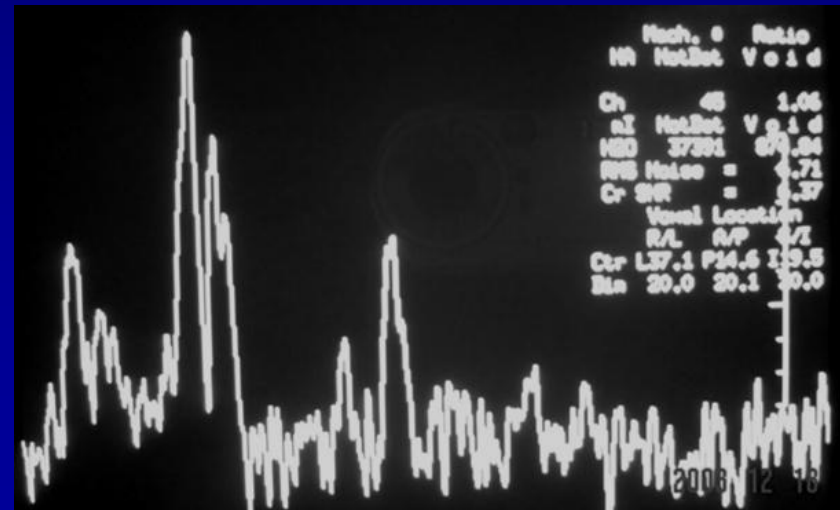
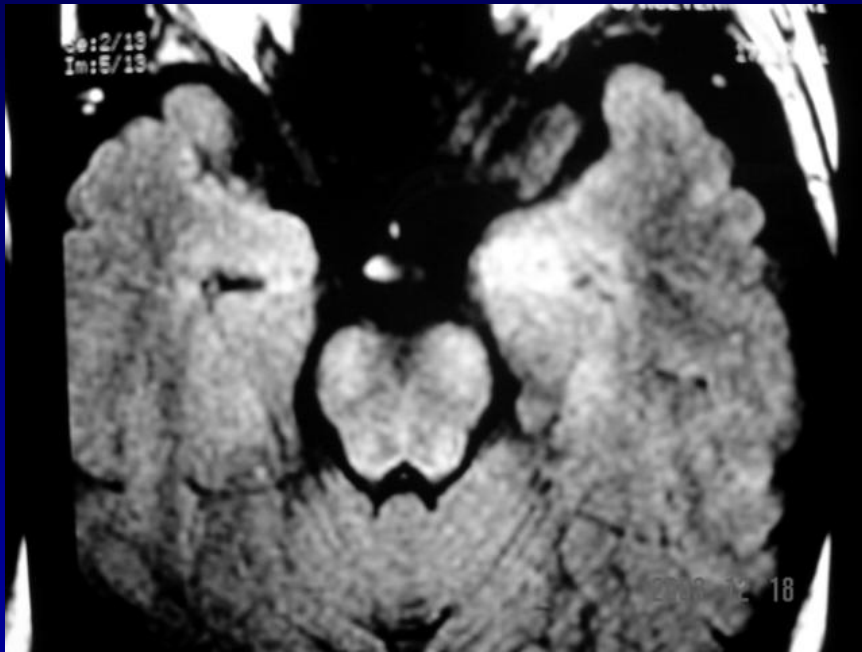
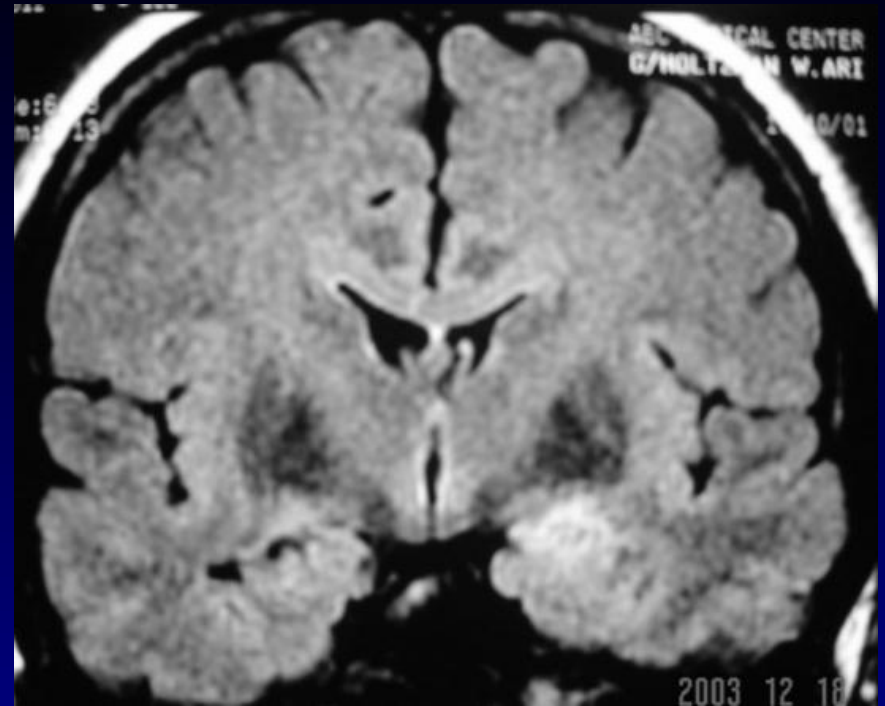






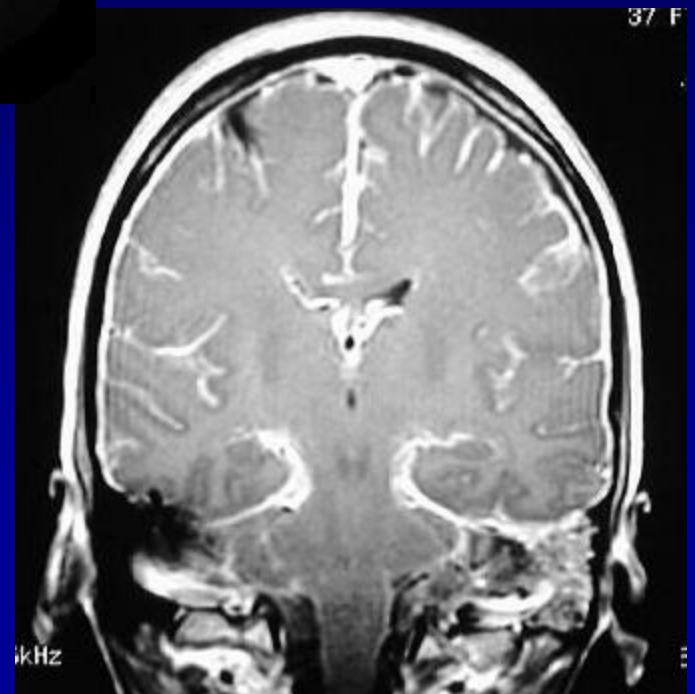
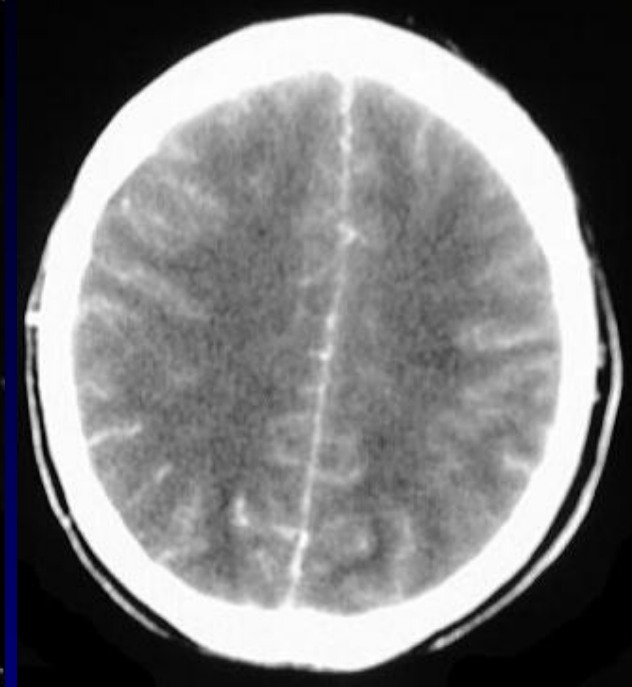
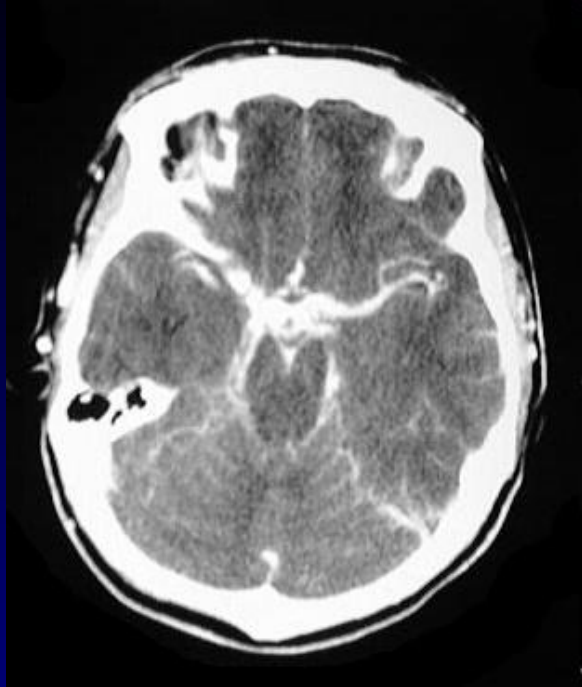


# MESIAL SCLEROSIS

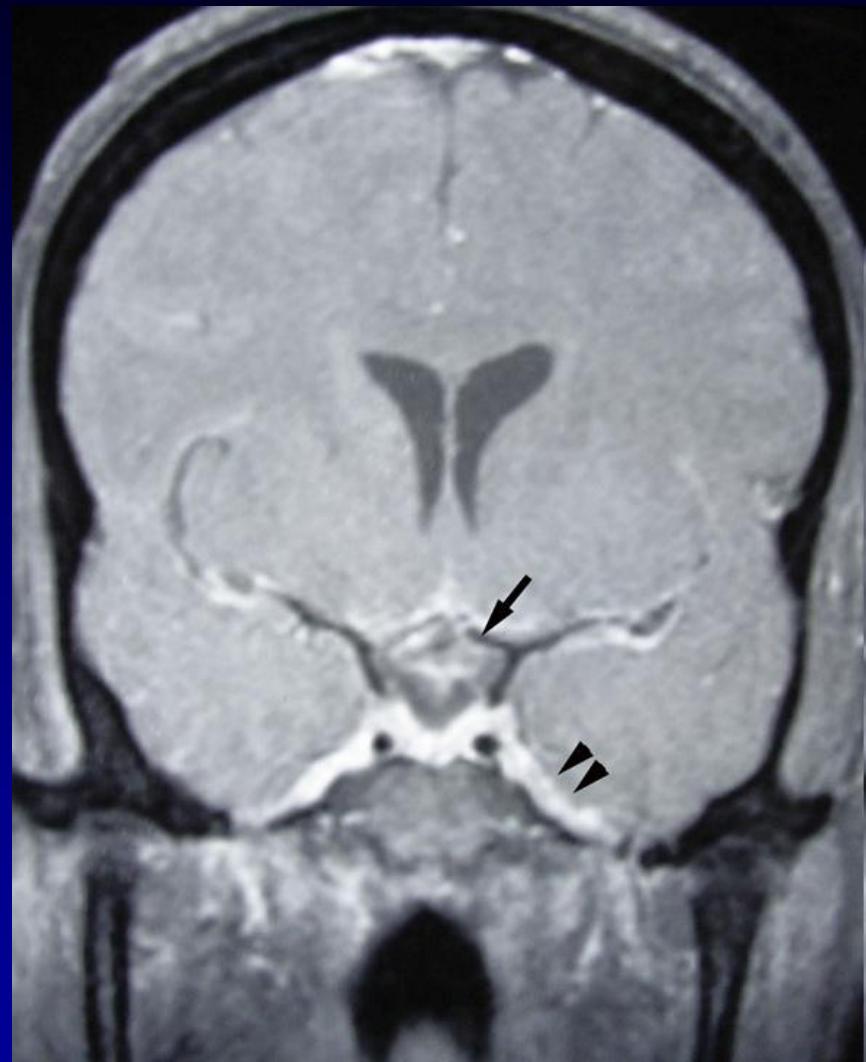
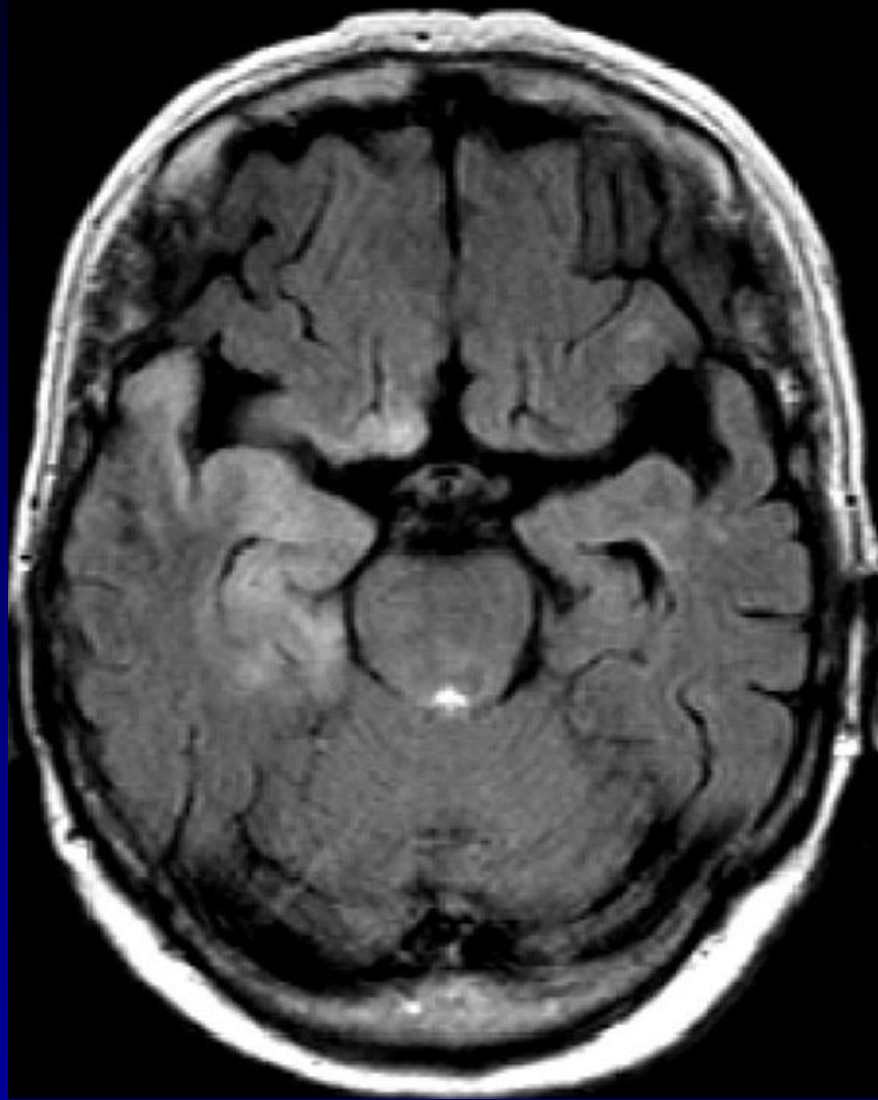


# INFLAMMATORY

- **MENINGO ENCEPHALITIS**
- **ABCESS**
- **TOXOPLASMOSIS**



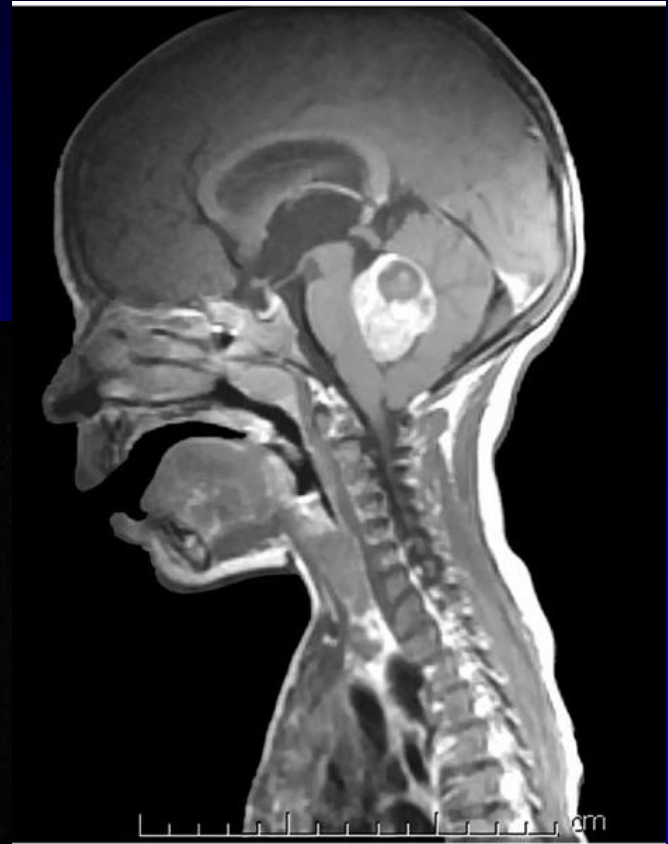
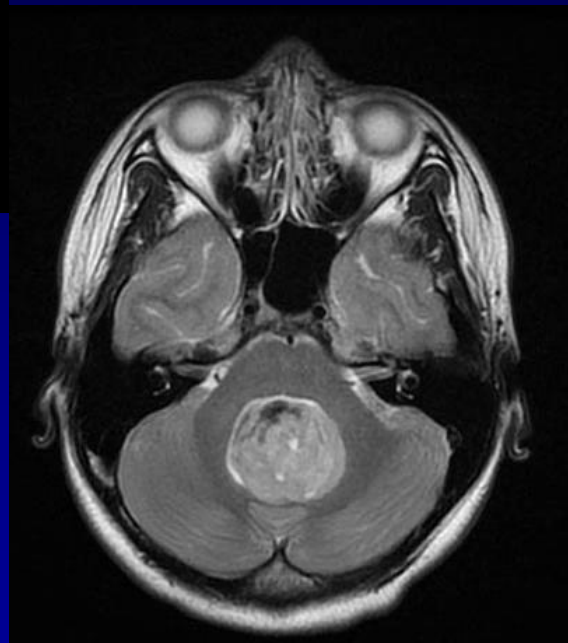
# MENINGITIS



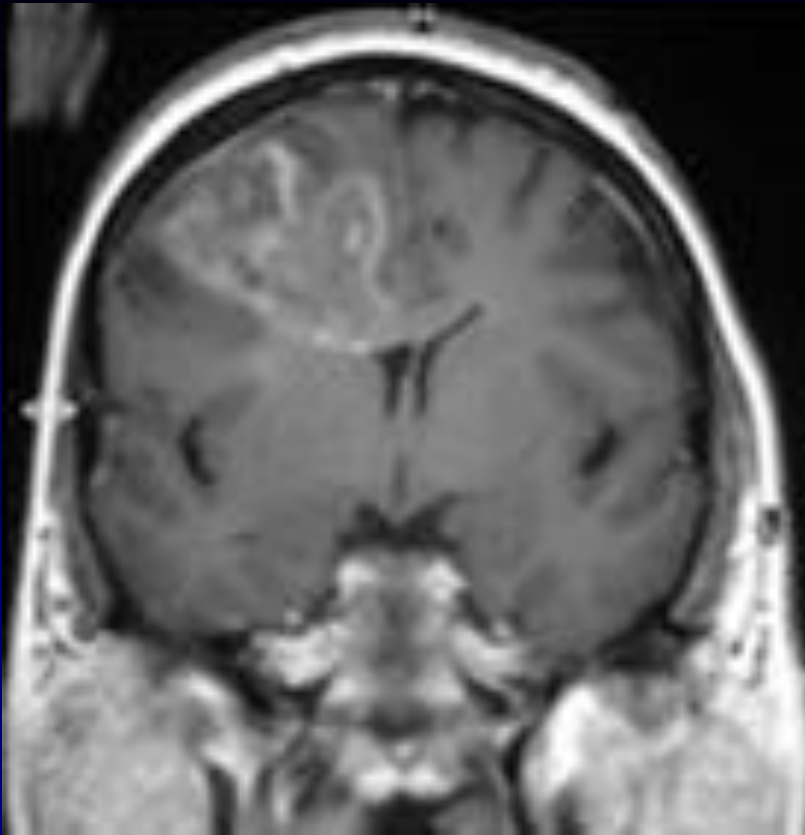
# NEOPLASIA

- **GLIOMAS**
- **LYMPHOMA**
- **MEDULOBLASTOMA**
- **PINEAL TUMOR**
- **PITUITARY ADENOMA**
- **EXTRAAXIAL TUMORS**
- **MENINGIOMA**
- **SCHWANNOMA**



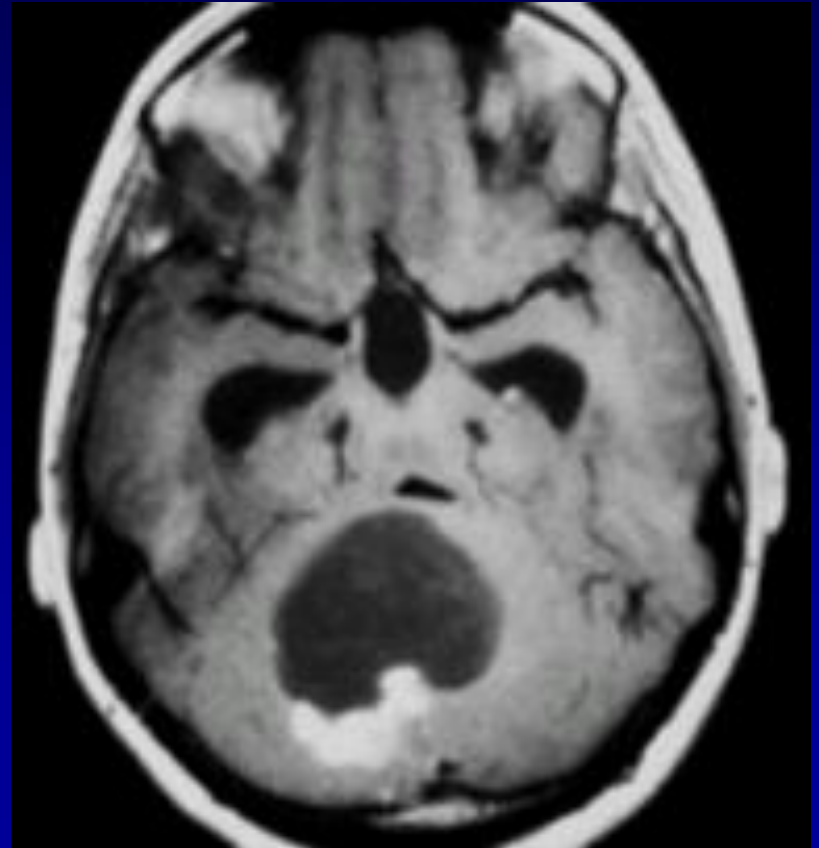


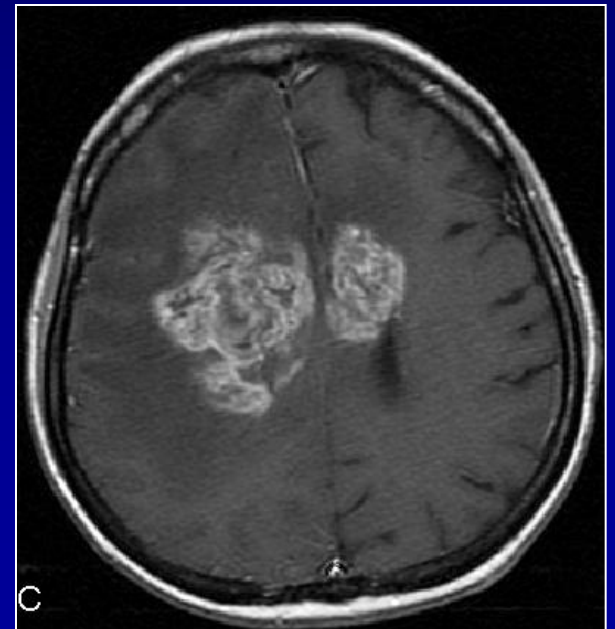
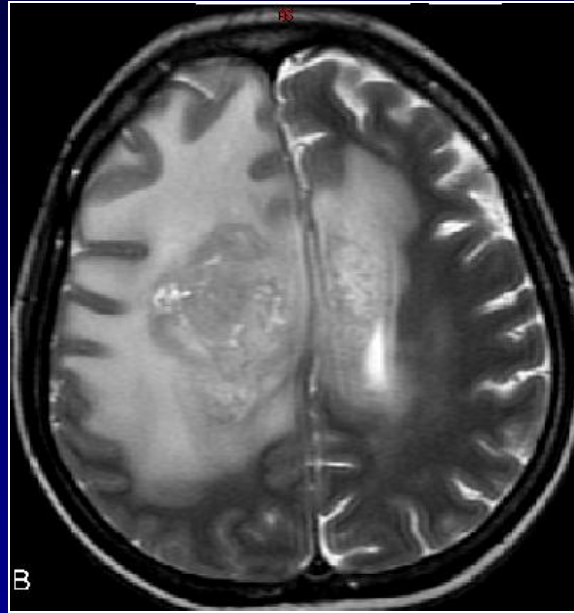
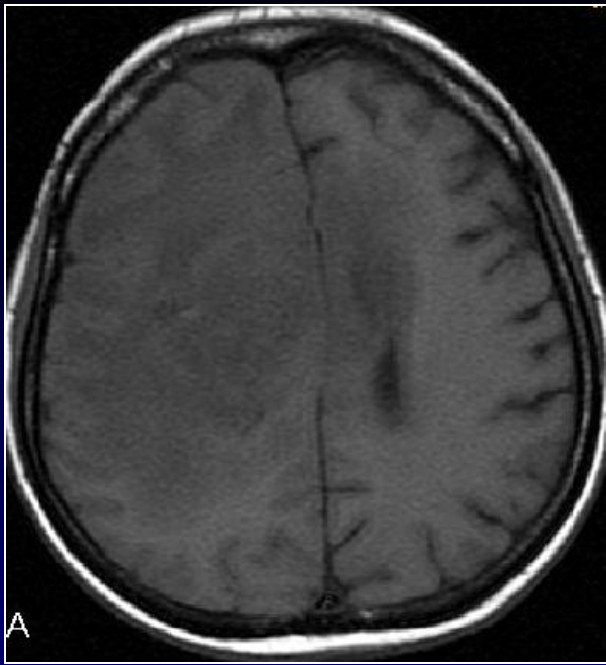
# MEDULLOBLASTOMA



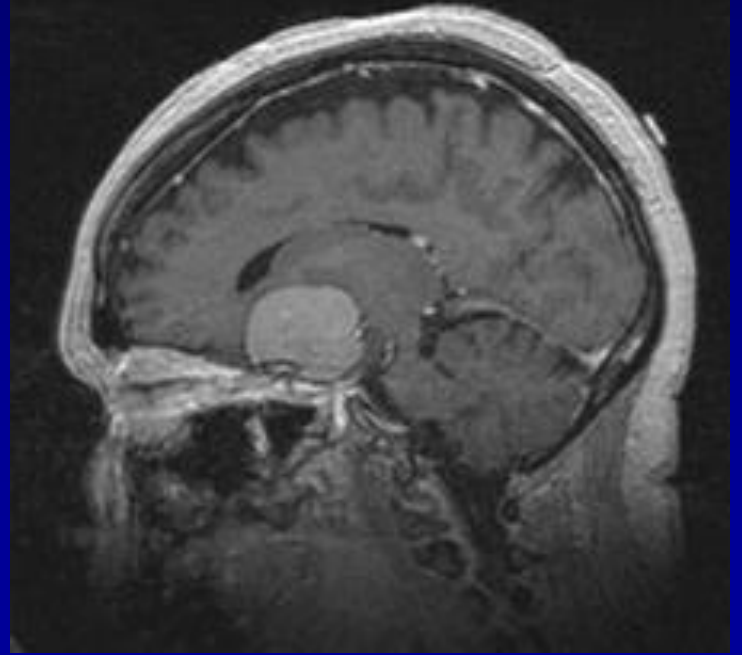
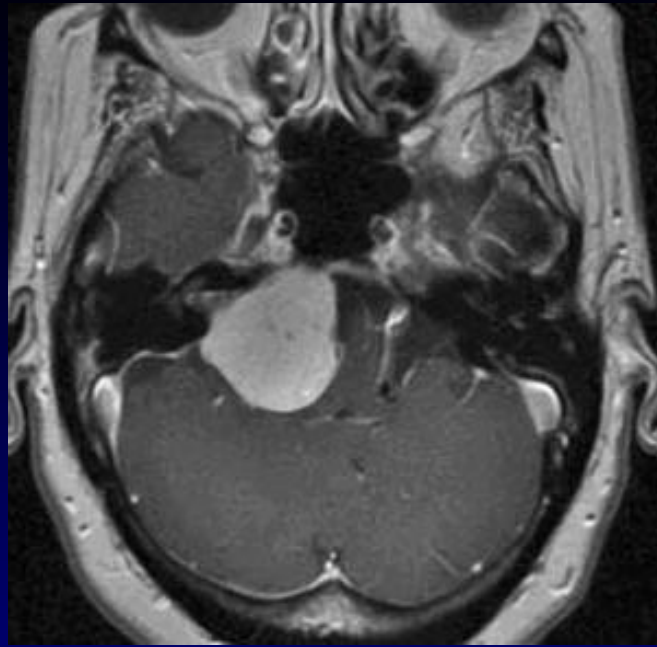
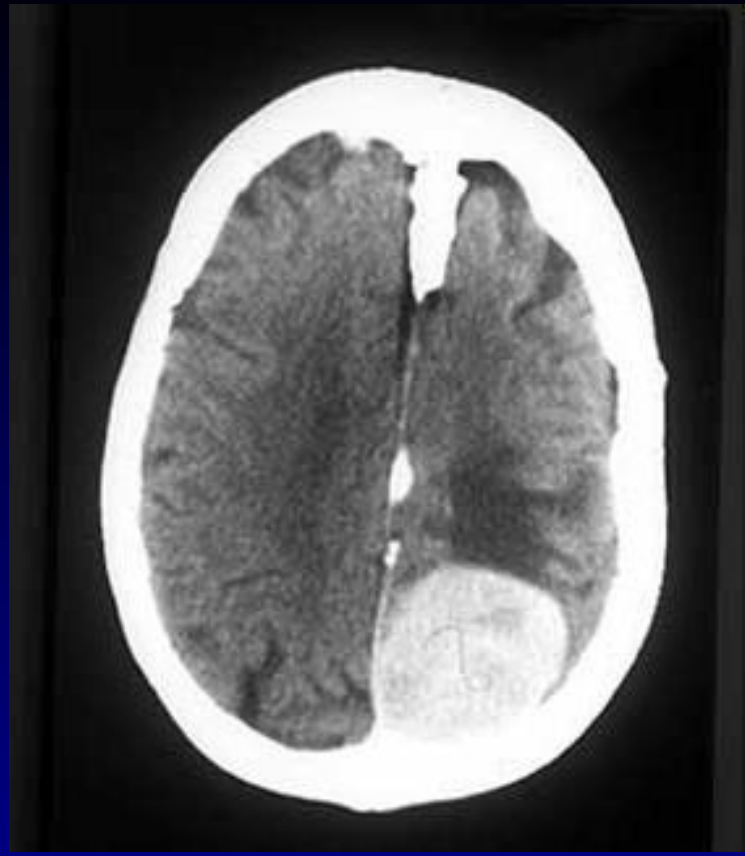
**LYMPHOMA**

**ASTROCITOMA**





**HIGH GRADE GLIOMA  
(GRADE III)**

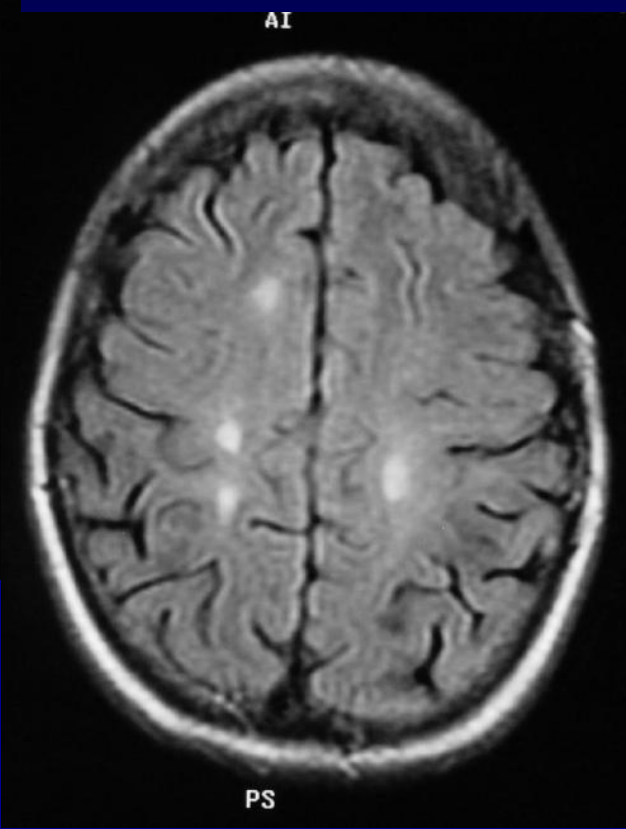
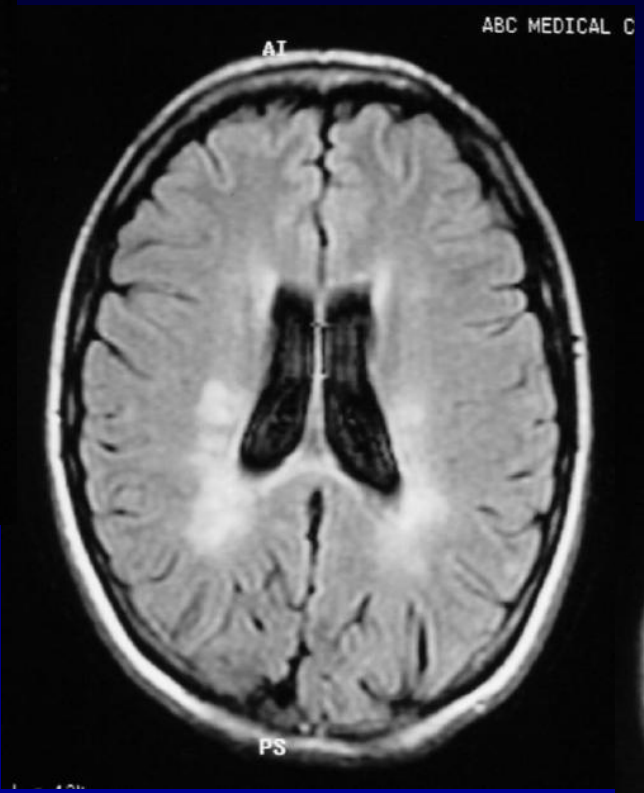
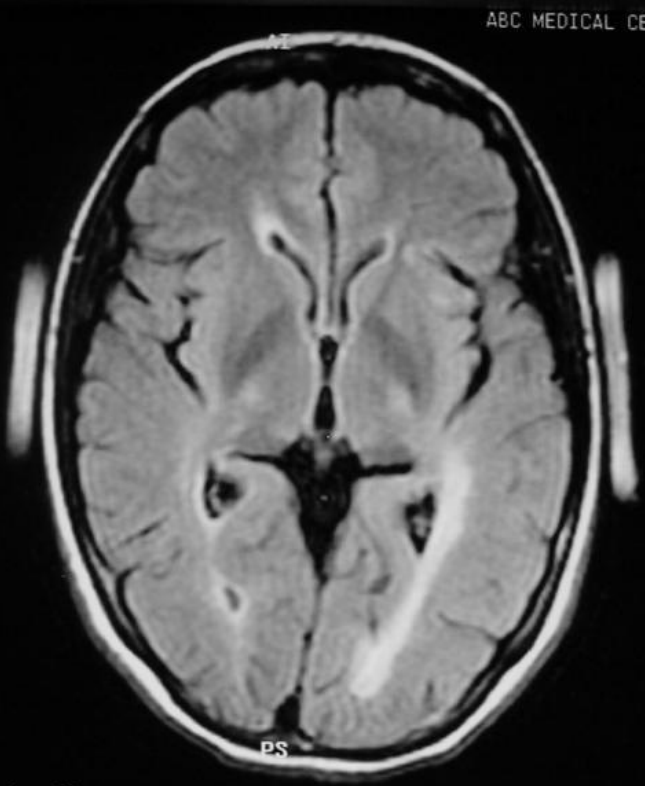


**MENINGIOMA**

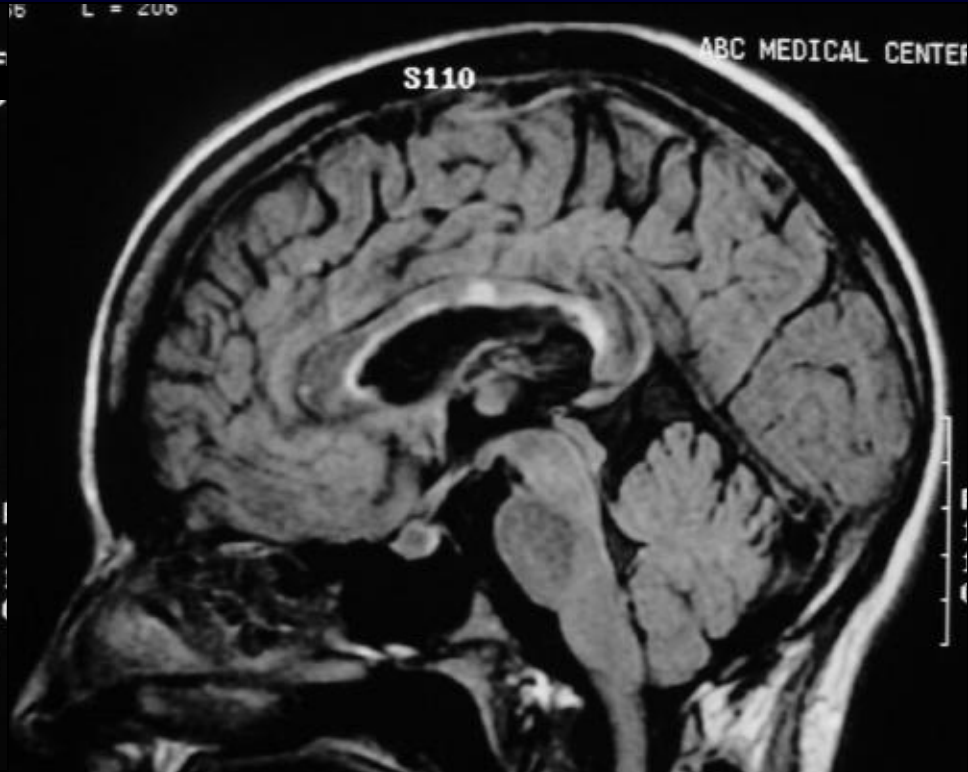
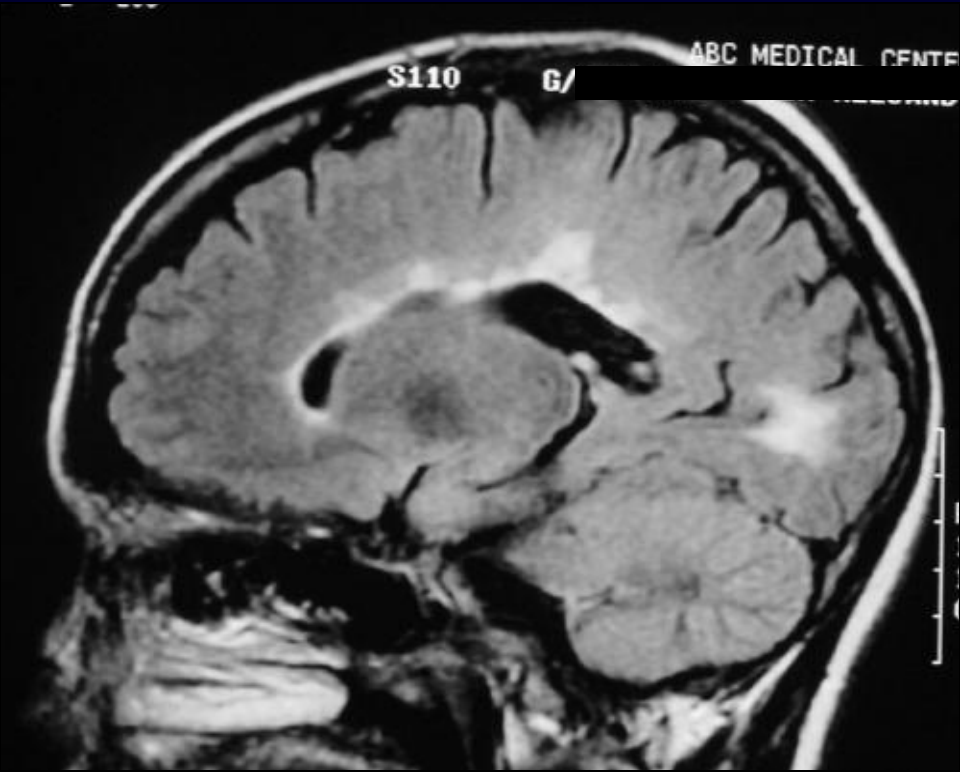
# DEMYELINATING DISEASE

- **MULTIPLE SCLEROSIS**
- **ADEM**

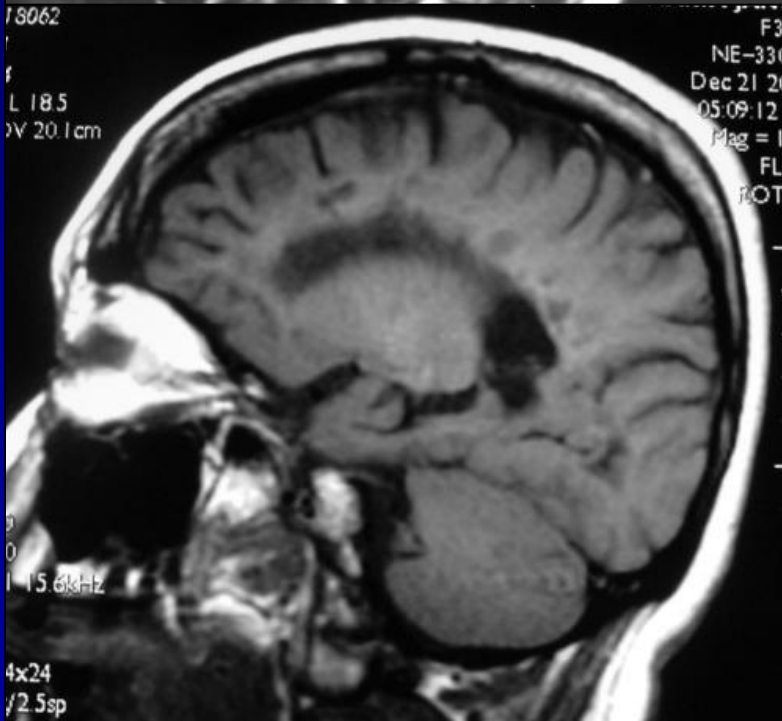
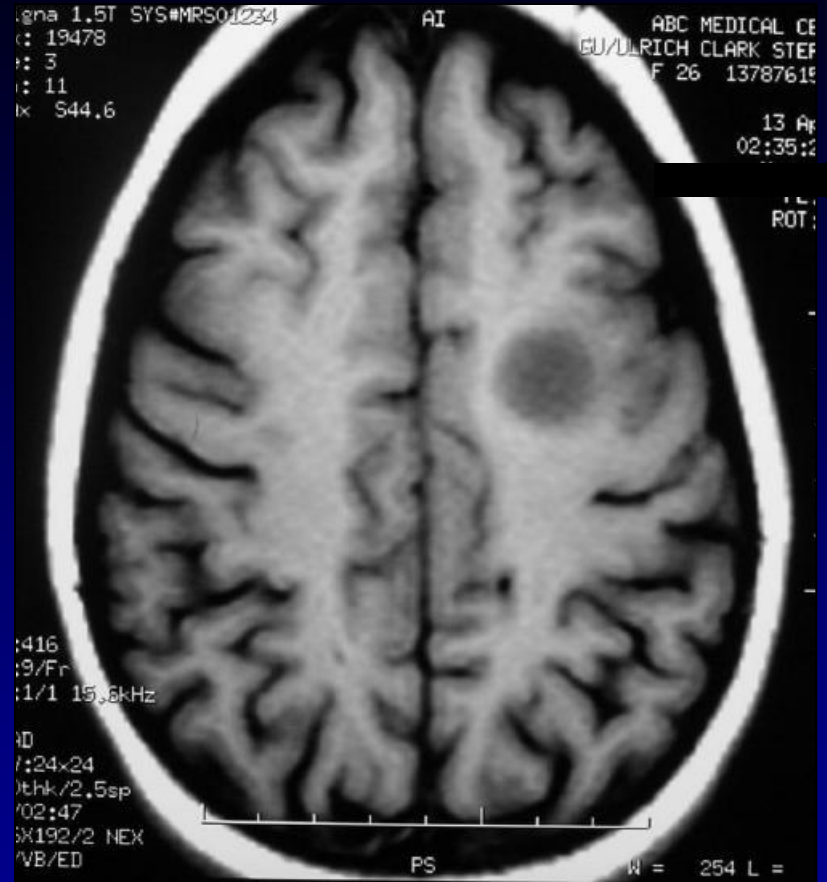
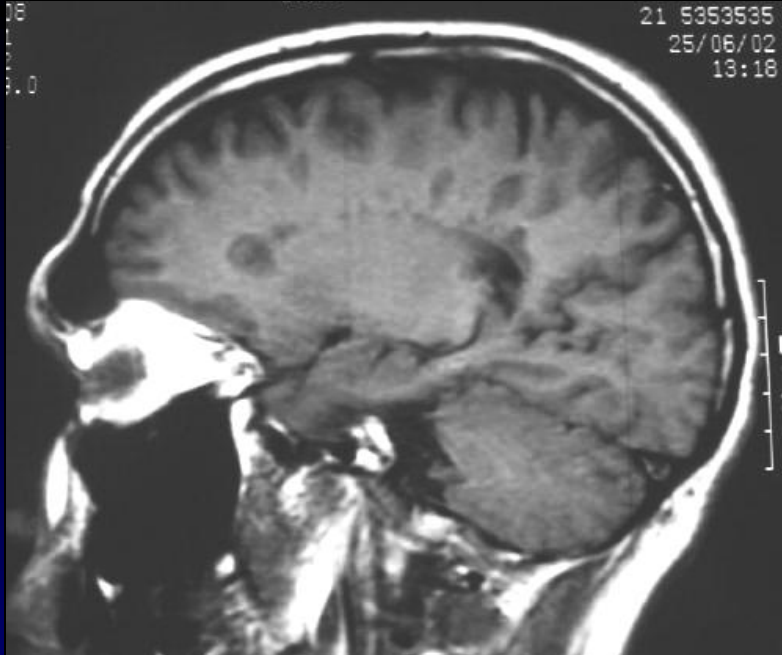




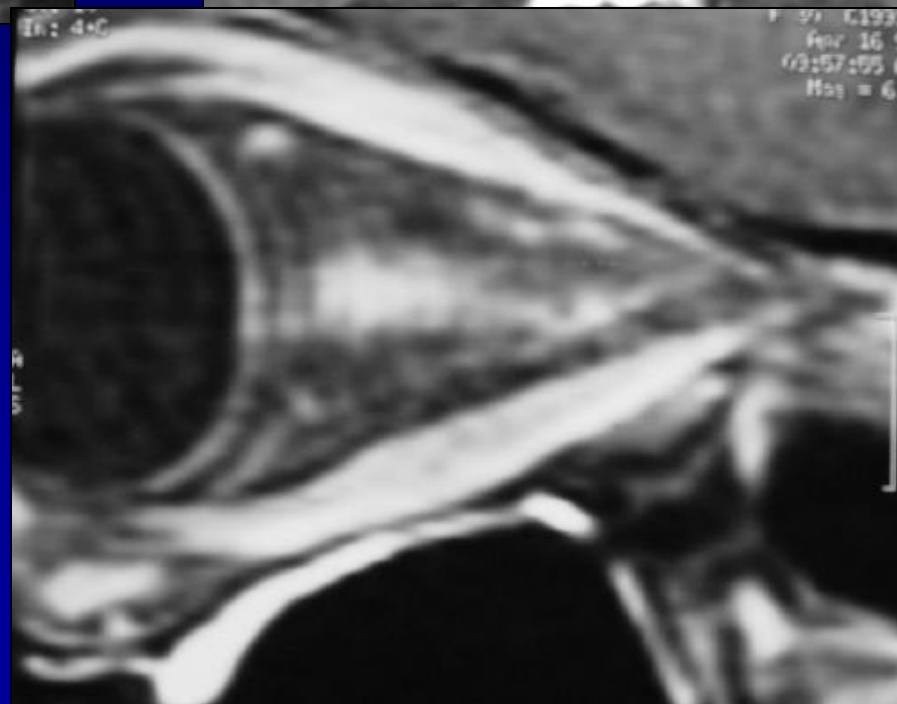
# MULTIPLE SCLEROSIS



# MULTIPLE SCLEROSIS

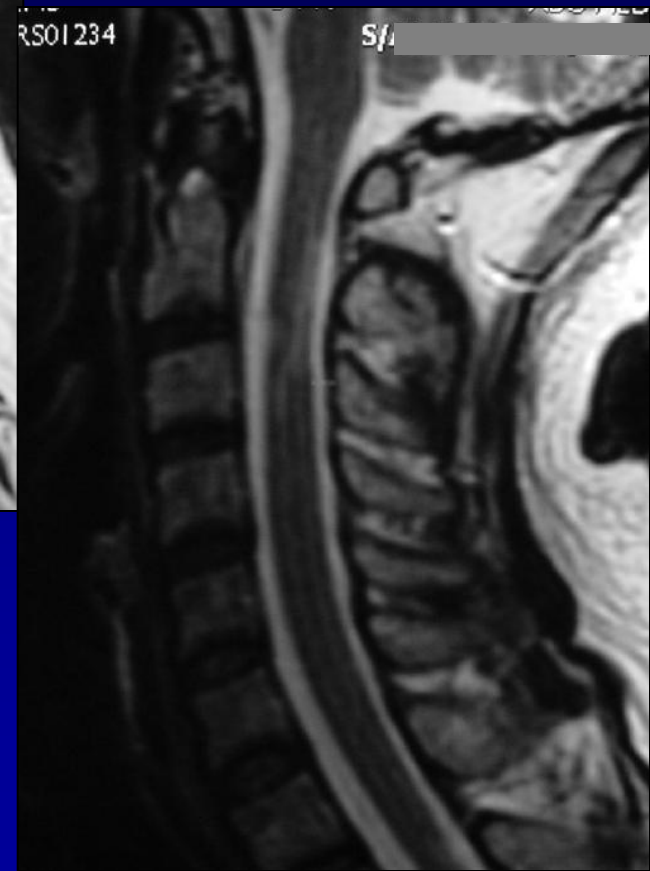
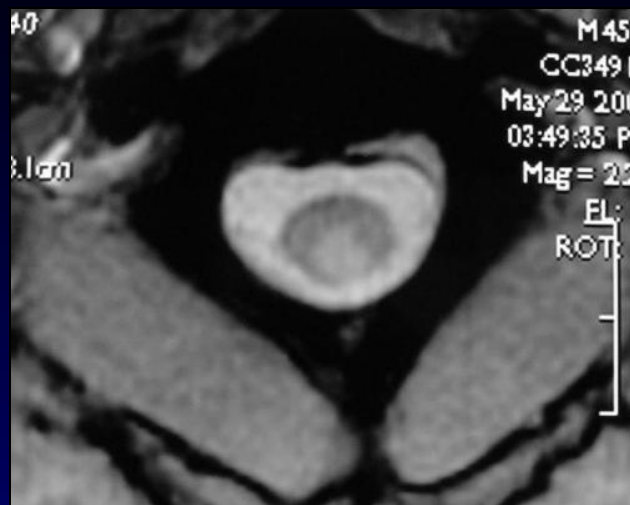


**MS**



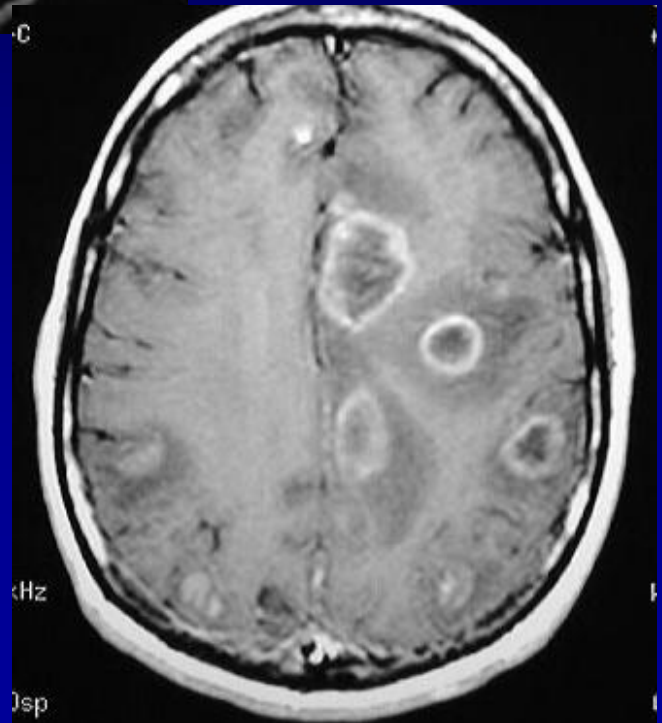
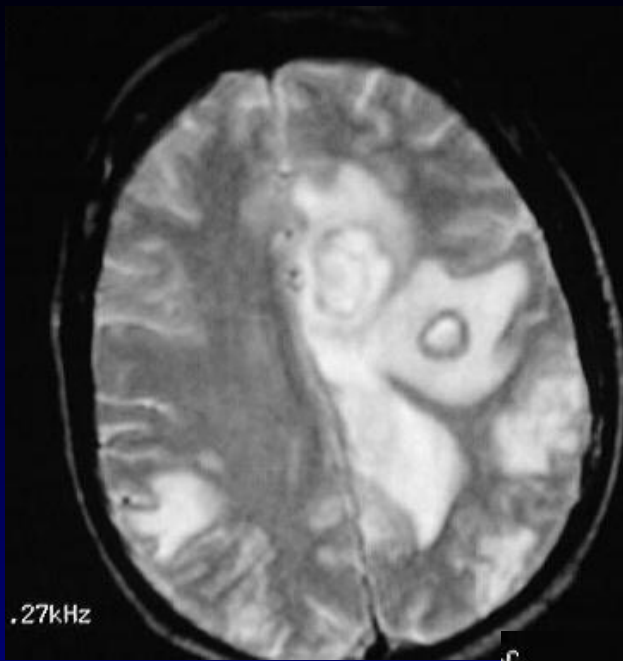
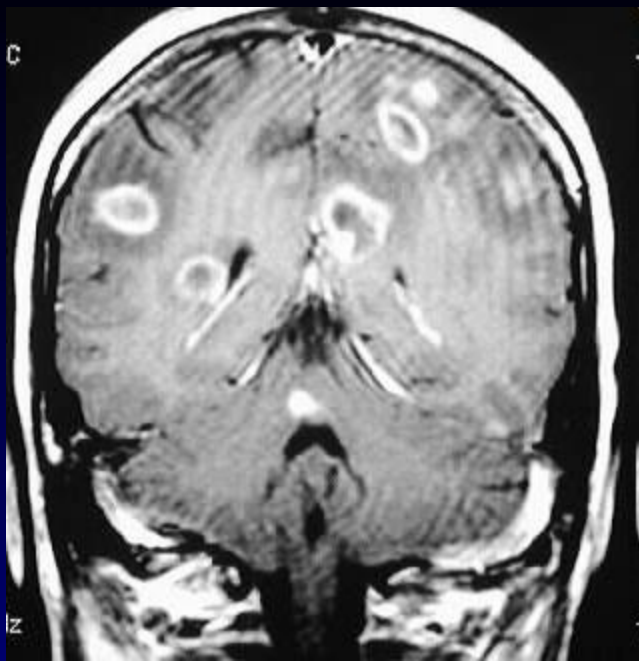
# OPTIC NEURITIS





# MULTIPLE SCLEROSIS





# TOXOPLASMOSIS

## Differential Diagnosis for ring-enhancing lesions:

### **MAGICAL DR**

M - Metastasis, MS

A - Abscess

G - Glioblastoma, Granuloma

I - Infarct (esp. Basal ganglia)

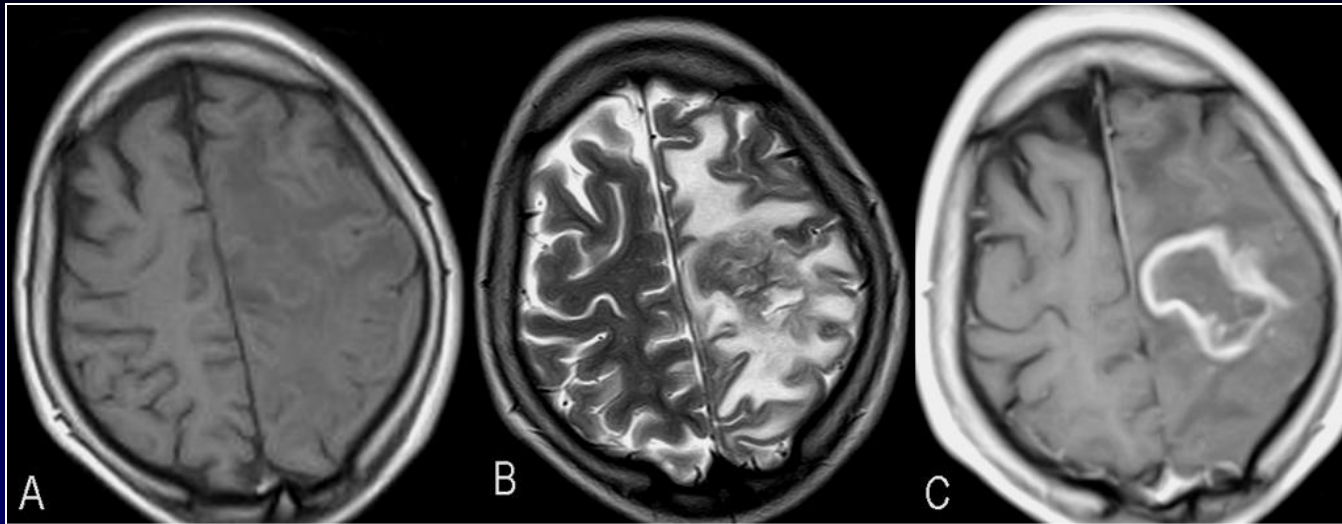
C - Contusion (rare)

A - AIDS (Toxo, etc.)

L - Lymphoma (in aids)

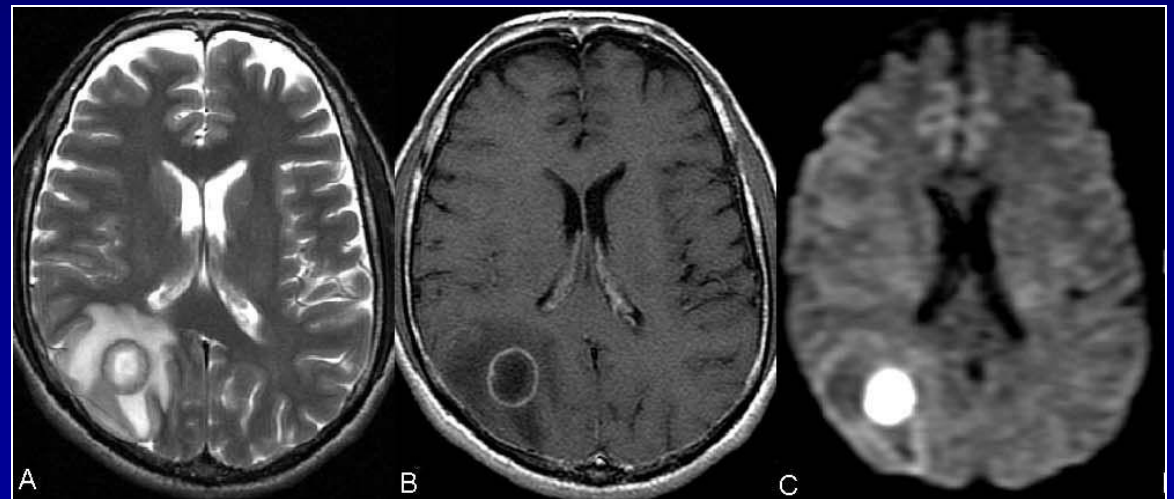
D - Demyelination (active)

R - Resolving hematoma, Radiation change (necrosis)



**LYMPHOMA**

**ABSCESS**





**RESOLVING HEMATOMA**

