

بِسْمِ اللّٰهِ الرَّحْمٰنِ الرَّحِیْمِ



RADIOLOGY REVIEW

Lecture 2

Cortical Related Lesions

Donot Forget

BY

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SOHAG UNIVERSITY

**ALL REGARDS TO OUR PROF. MAMDOUH
MAHFOUZ , AS HIS LECTURES ARE THE MAIN
SOURCES OF THIS TOPIC.**

Ahmad Mokhtar Abodahab

May 2016

Updated

Oct 2022



IT'S A LONG WAY..... SO I TRY

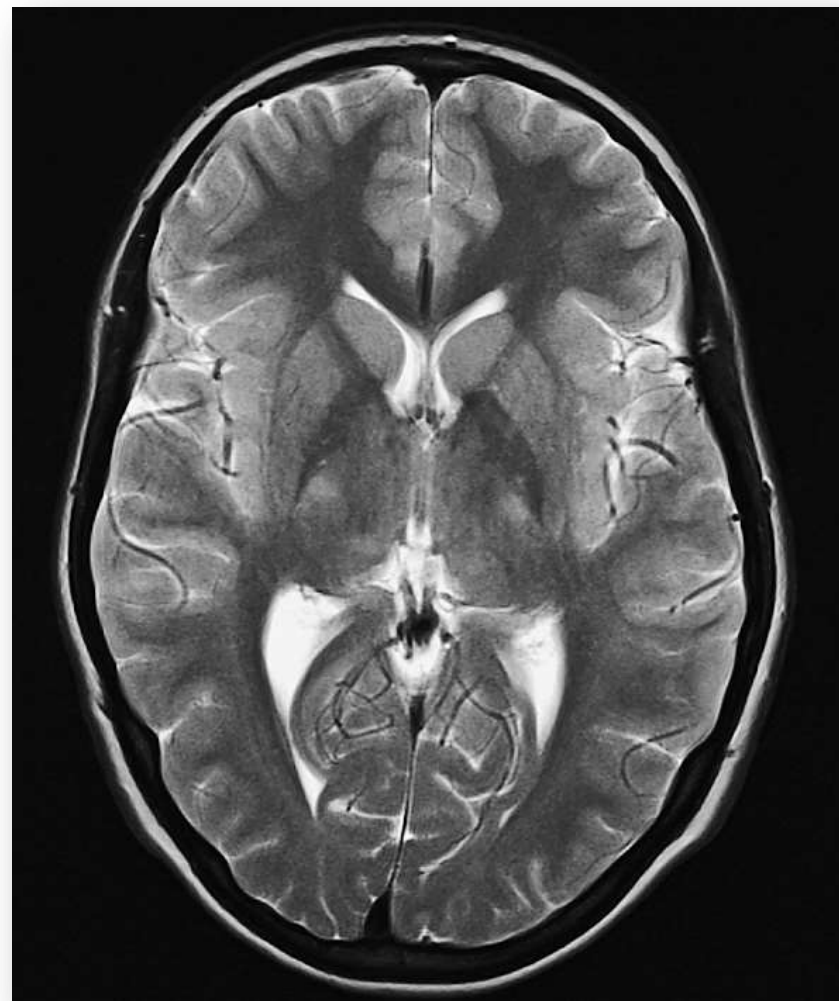
To make it simple.... & Straight

Brain Cortex

& Related Lesions

CT &

MRI



CT



T1



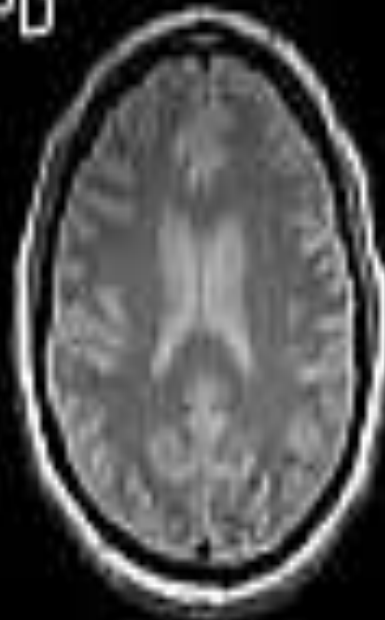
T2



FLAIR



PD



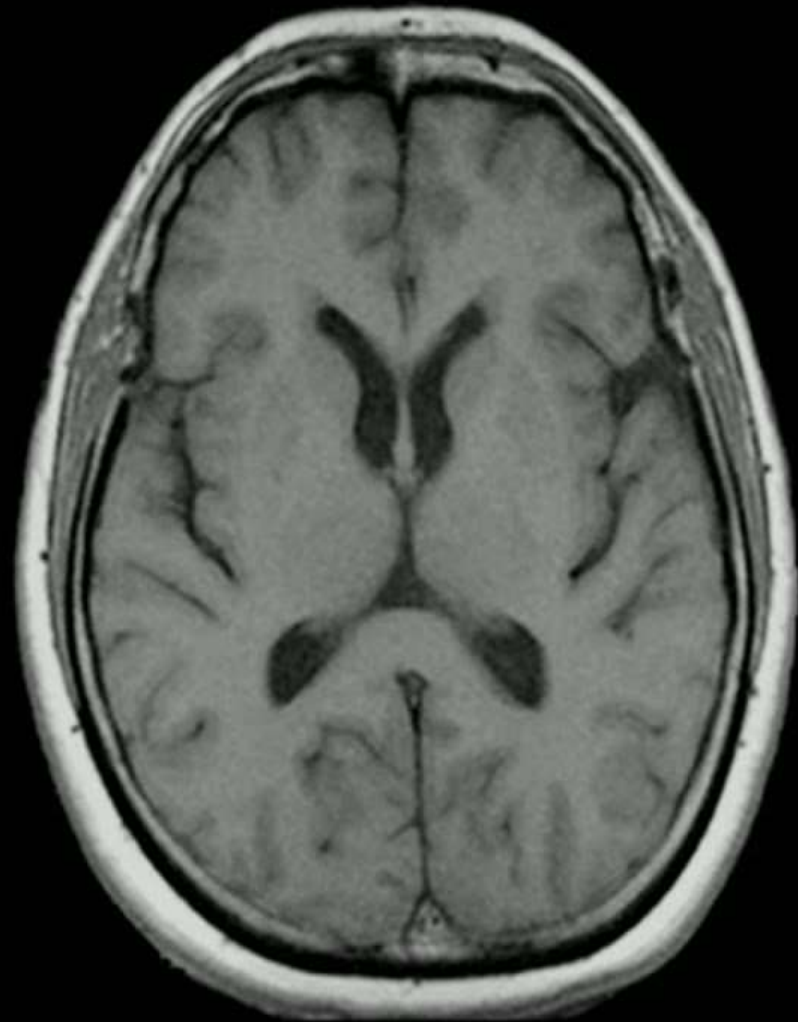
GRE



T1 Sequence

Recognition:-

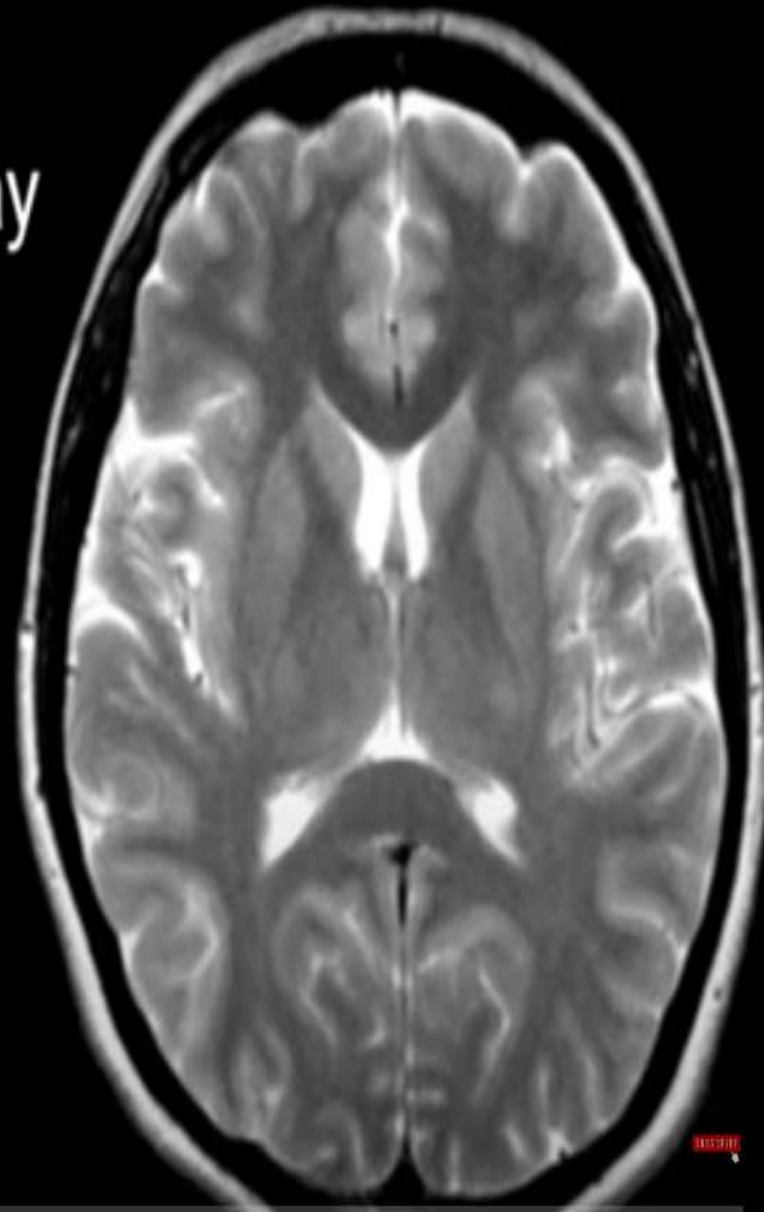
- | | |
|----------------|----------|
| • White matter | - Whiter |
| • Gray matter | - Gray |
| • Fluid | - Dark |
| • Fat | - Bright |
| • Air | - Dark |
| • Bone | - Dark |
| • Muscles | - Gray |
| • Moving blood | - Dark |



T2 Sequence

Recognition:-

- White matter - Dark than gray
- Gray matter - Gray
- Fluid - Bright
- Fat - Bright
- Air - Dark
- Bone - Dark
- Muscles - Gray
- Moving blood - Dark



FLAIR

Fluid Attenuation Inversion Recovery

RECOGNITION

- T2 + free flowing water (CSF) is dark
- Non free flowing water is bright
- Fat is dark

USEFUL FOR

- Same as T2
- Delineation of lesions near ventricles
- Edema
- Can improve grey-white differentiation

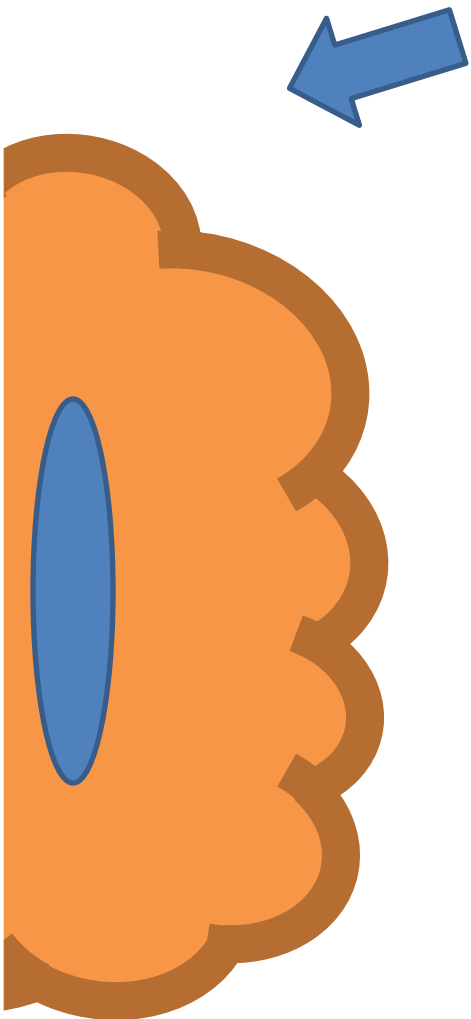


10

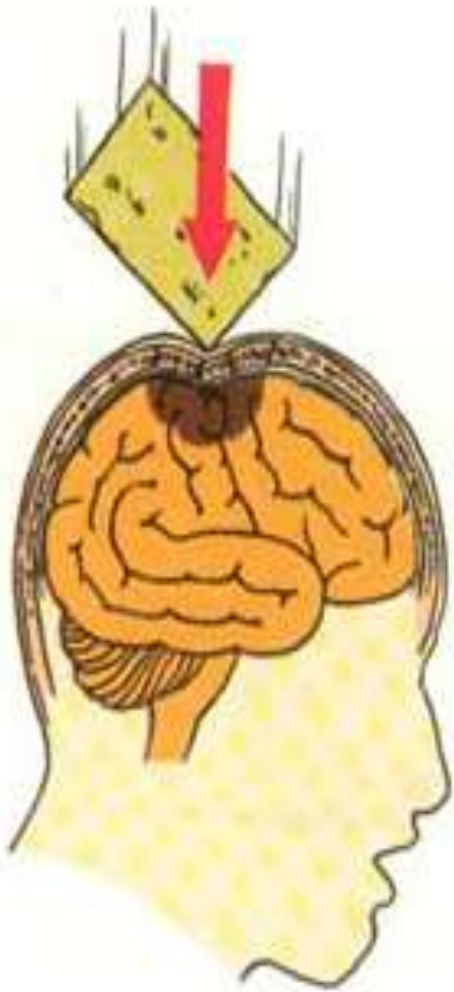
P

ADULT BRAIN
88-20

28

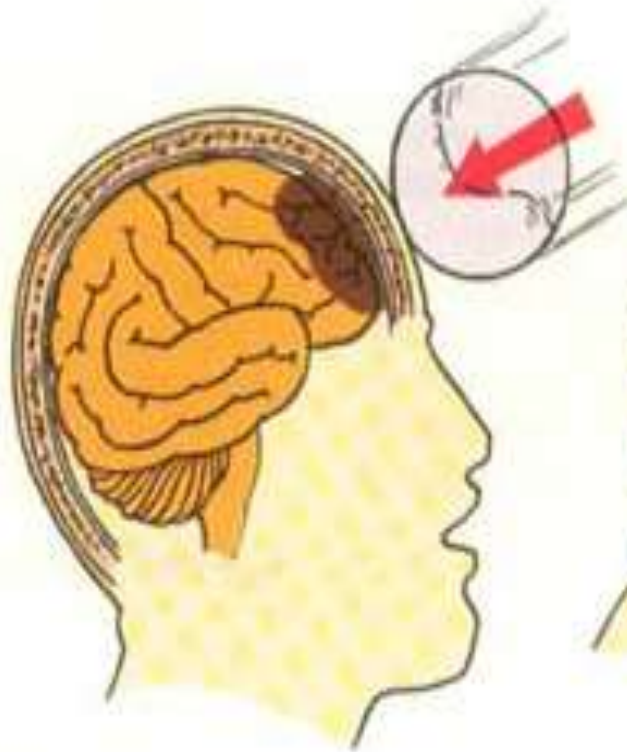


Lesions
Adjacent to cortex



A

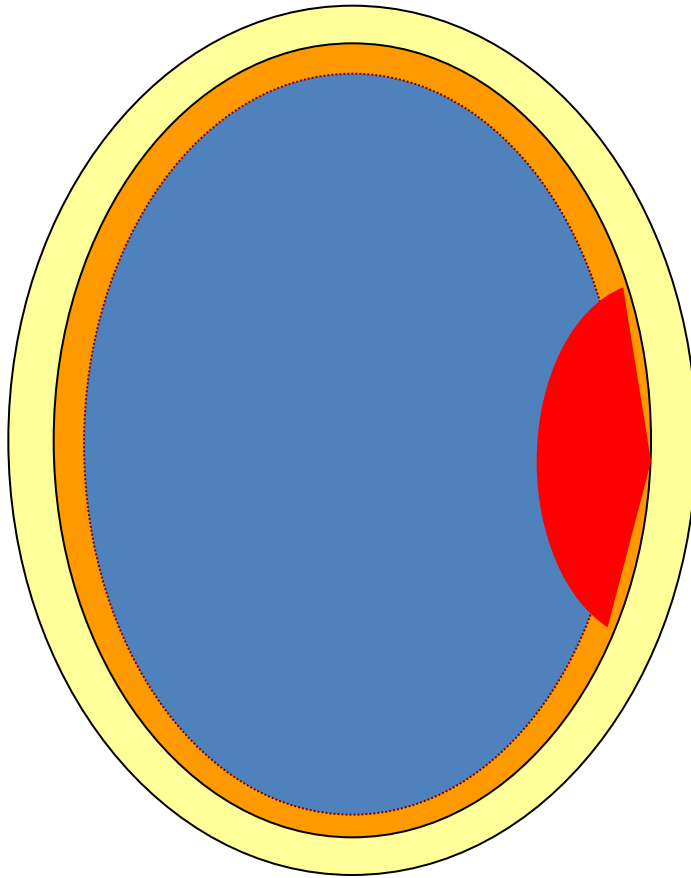
Figure 14-11



B



C



*Extra Dural
or
EpiDural*



**Extradural
Haematoma**

GE MEDICAL SYSTEMS
LightSpeed Ultra CT01_OC0
Ex: 4882/4615
Se: 2
Im: 16
OM S96.68 0
DFOV 25.0cm
STNDM

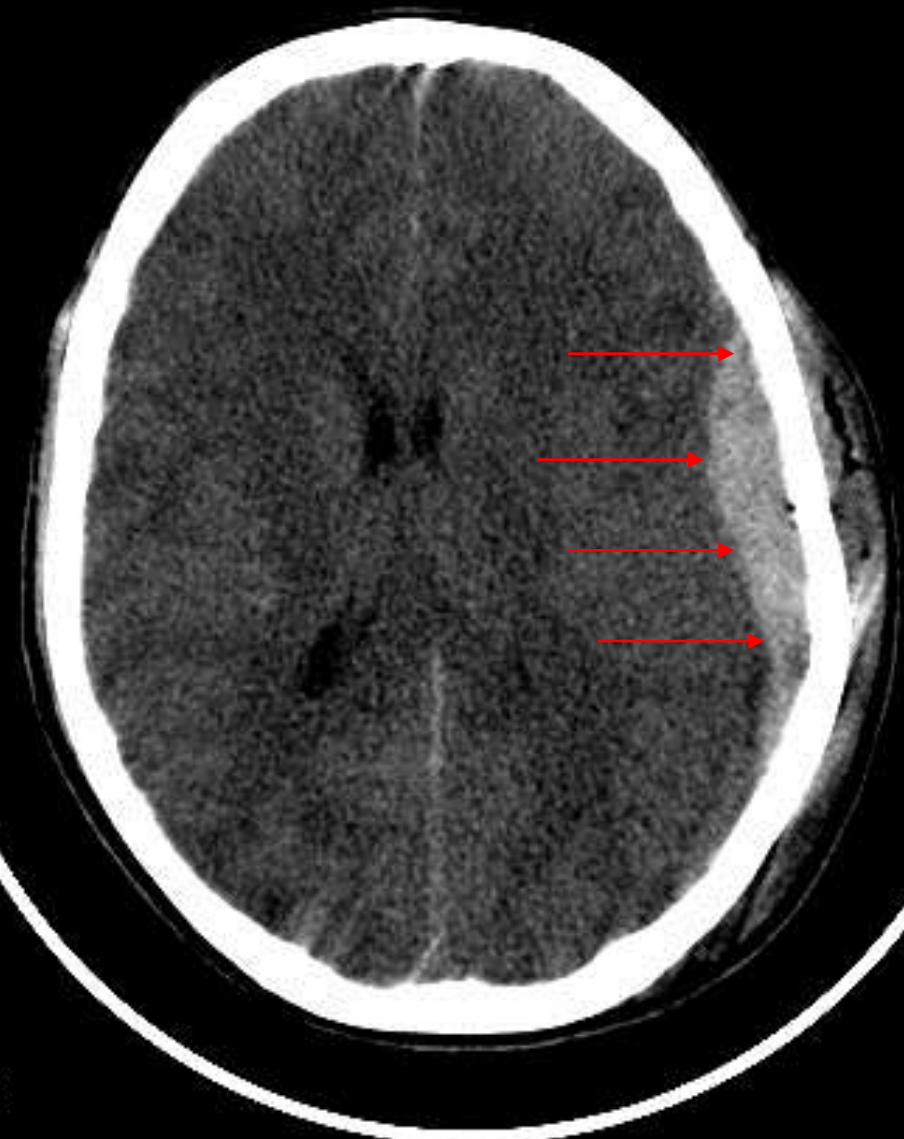
AS

SOHAG UNIVERSITY HOSPITAL
MEINA RAFAT HELMY
M17Y
TRAUMA
Nov 17 2007
03:45:37 PM
512 X 512

Mag = 1.00
FL:
ROT:

R
1
2
5

L
1
2
5



kV 140
mA 250

Head
5.000mm /4i 8 row
Tilt: S17.0
0.5s

WW: 84 WL: 52

PI

Se: 2/3
Im: 20/1
Ax: 1751.7 (COI)

512 x 512
FC27

R

L

120.0 kV
150.0 mA
5.0 mm/0.0:1
Tilt: 24.0
1.5 s
Lin:DCM / Lin:DCM / Id:ID
W:80 L:35

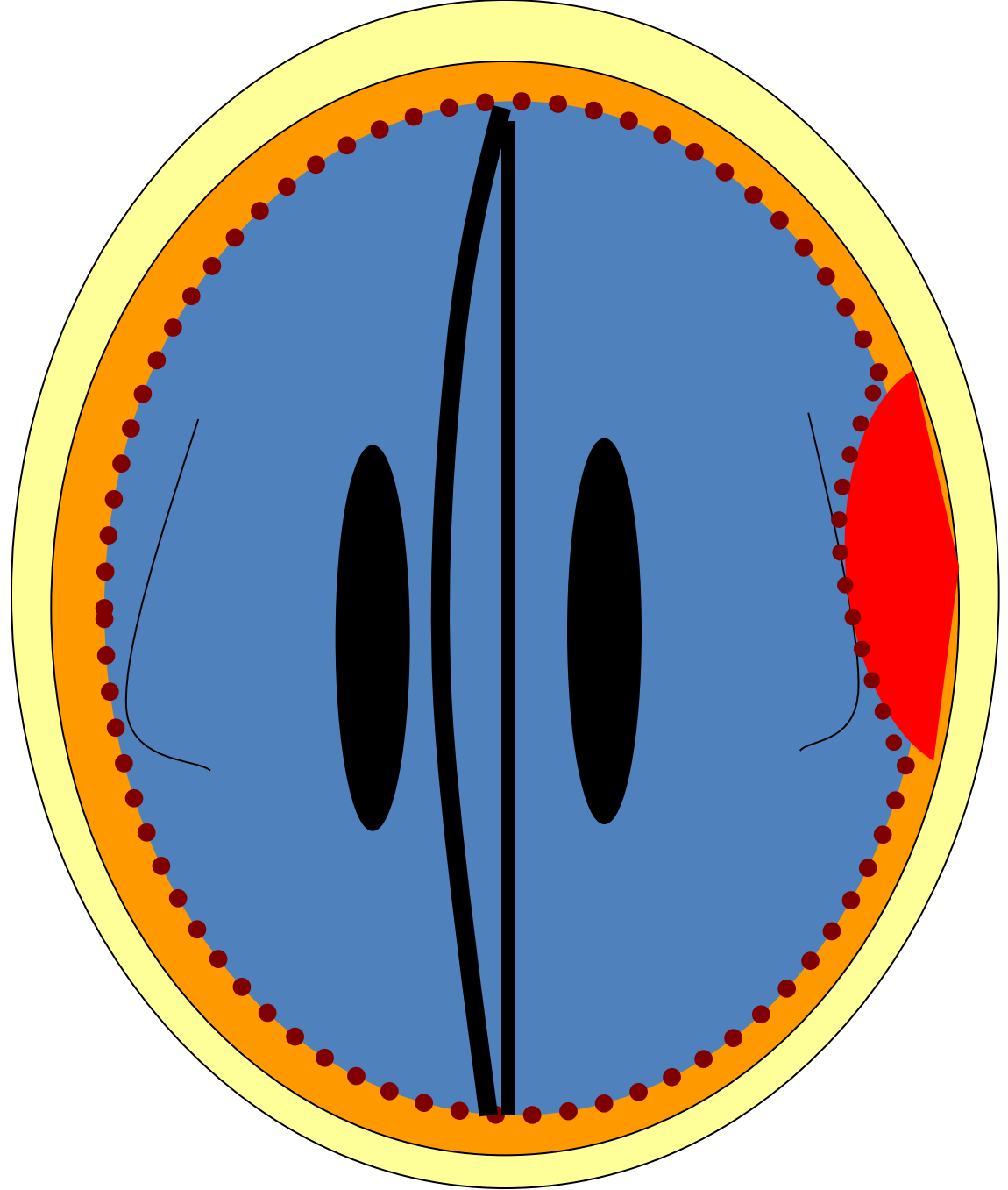
P₁



**Do You Notice
MASS EFFECT ?**

* **Mass effect :**

- **cortical sulci**
effacement
- **Ventricle**
compression
- **Medline Shift**



Se: 2/3
Im: 20/1
Ax: 1751.7 (COI)

512 x 512
FC27

R

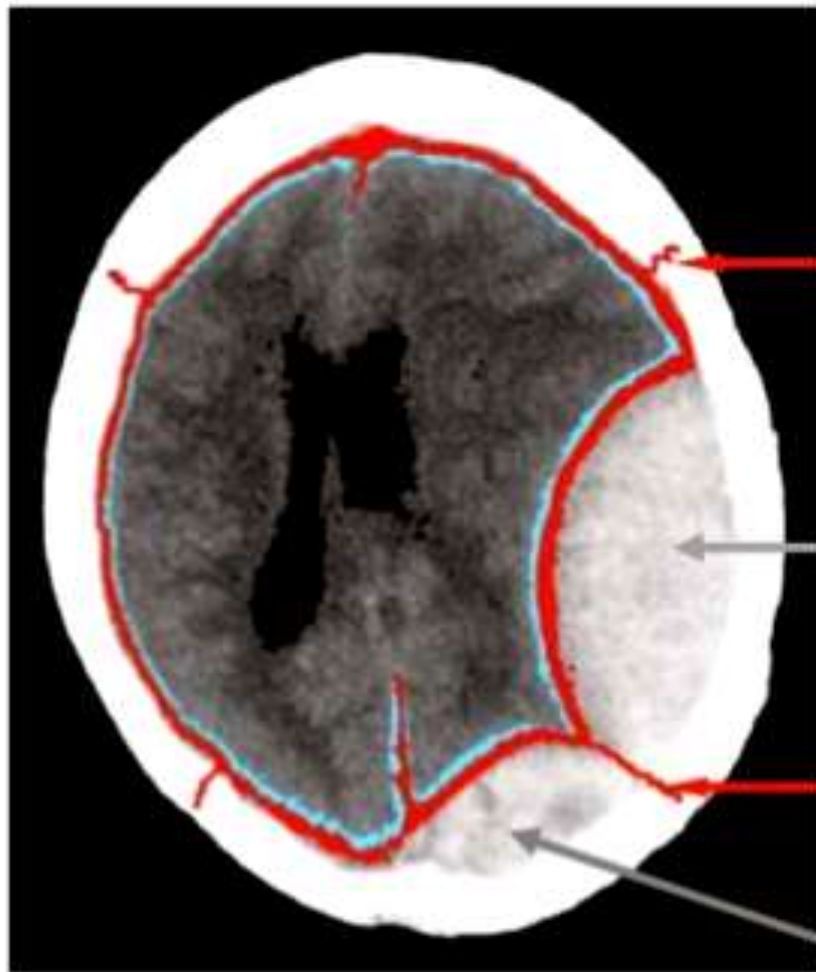
L

120.0 kV
150.0 mA
5.0 mm/0.0:1
Tilt: 24.0
1.5 s
Lin:DCM / Lin:DCM / Id:ID
W:80 L:35

P_i



Why Inner convex Border?



Dura inserted into coronal suture

Parietal EDH constrained between lambdoid and coronal sutures

Dura inserted into lambdoid suture

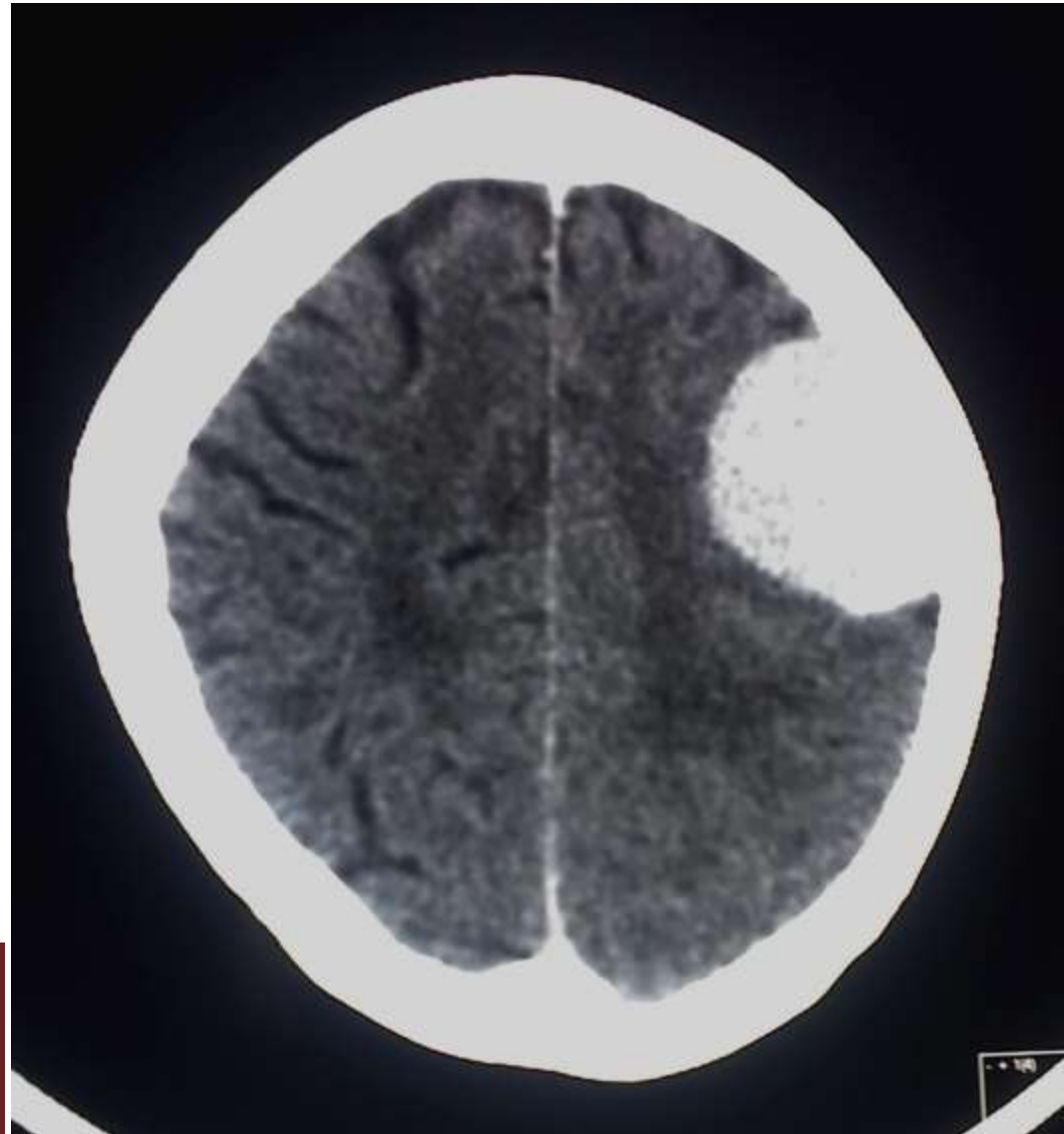
Occipital EDH constrained between lambdoid and insertion of sagittal sinus to skull

& THIS ?

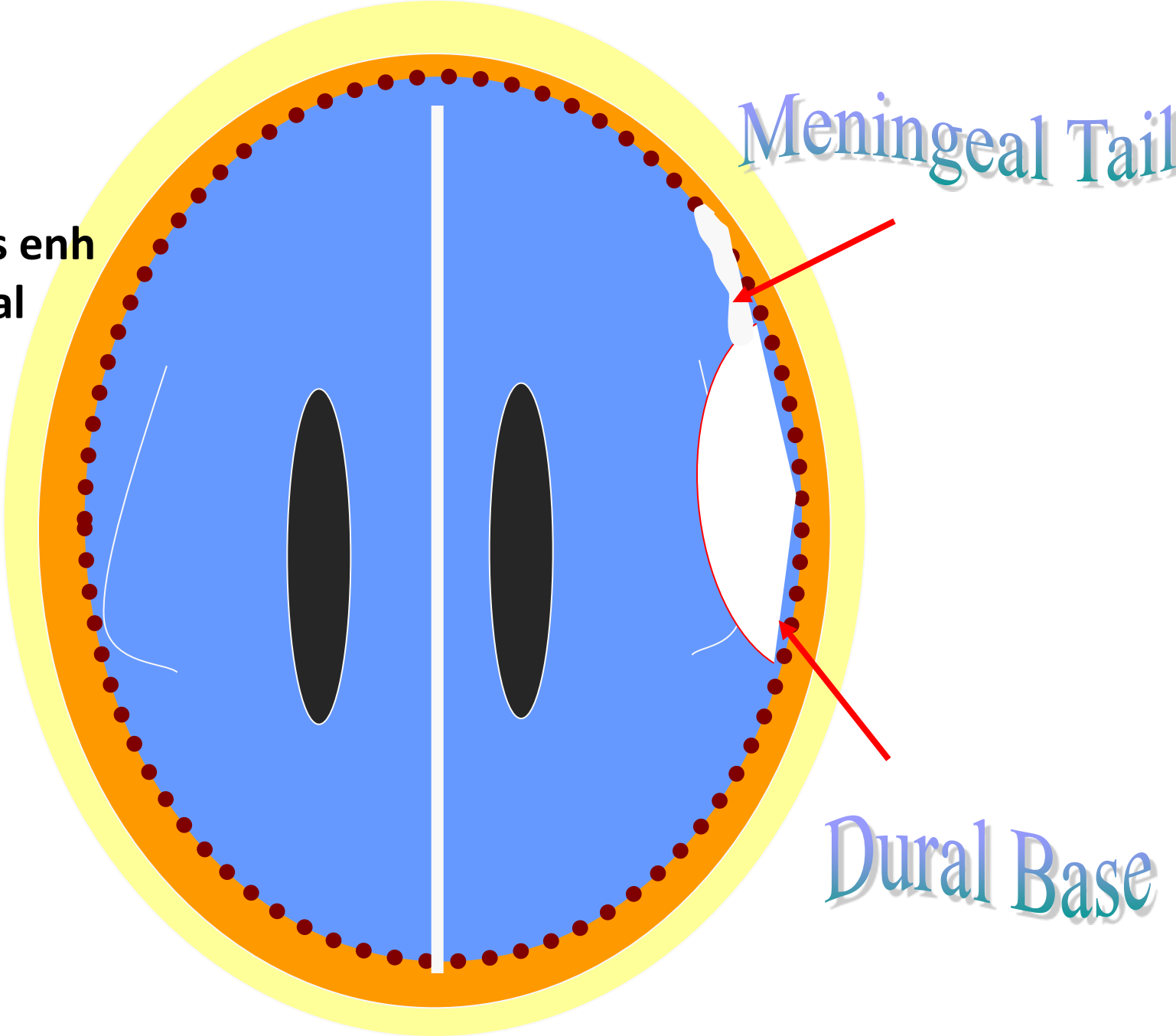
Enhanced CT

This is not EDH

Meningioma



- Dural Based
- Homogenous enh
- -/+Meningeal tail



Meningeal Tail

Dural Base

MENINGIOMA

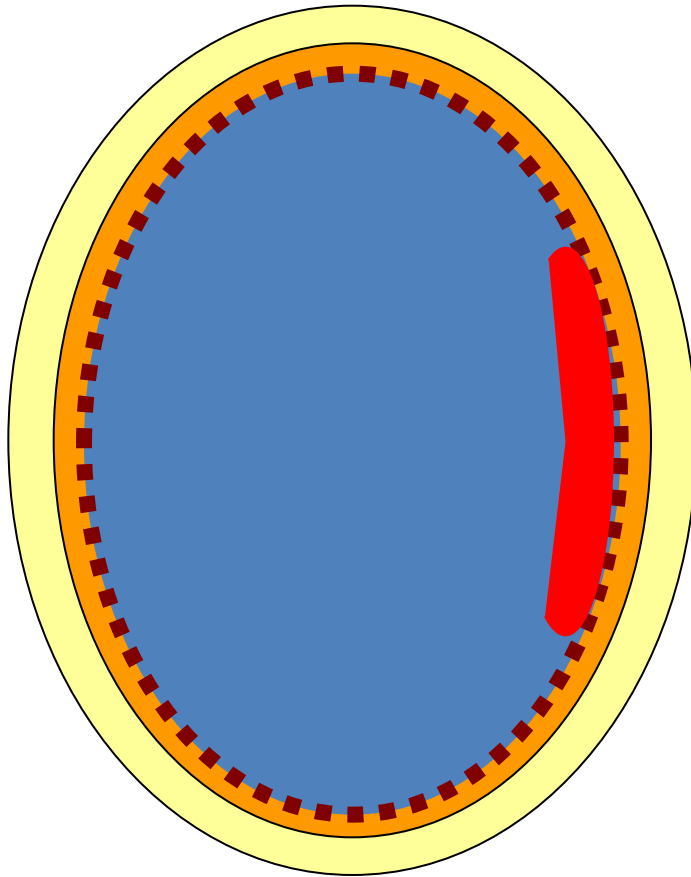
- Tumor of Meninges. = It is **Extra-Axial** Neoplasm.
- Commonest **homogenous enhancing** neoplasm of the brain.
- **Dural Base** = wide connection to dura

+/_

-**Calcification** 10:20%
-**Bone Sclerosis** = Bone irritation.
-**Edema** 40%
Rapidly grow → More edema

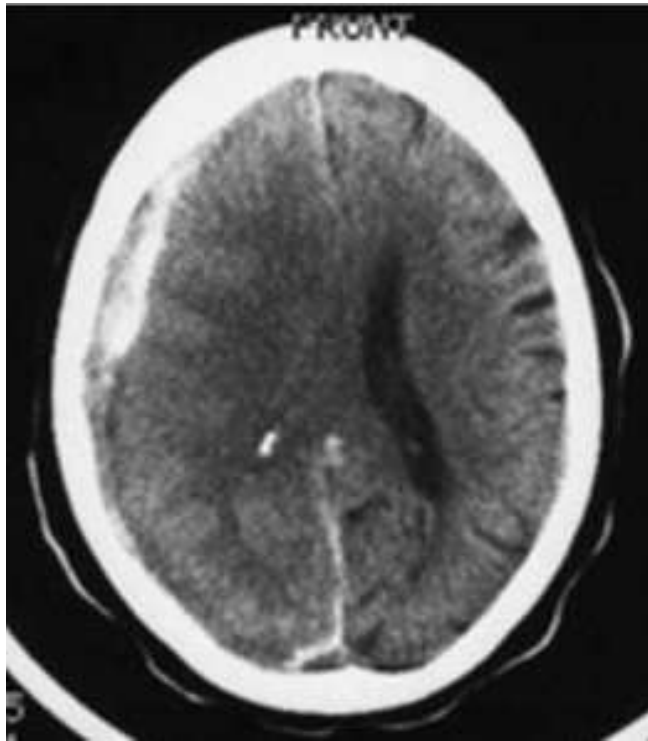
-**Meningeal Tail:**

Not Specific Sign
of Meningial irritation.

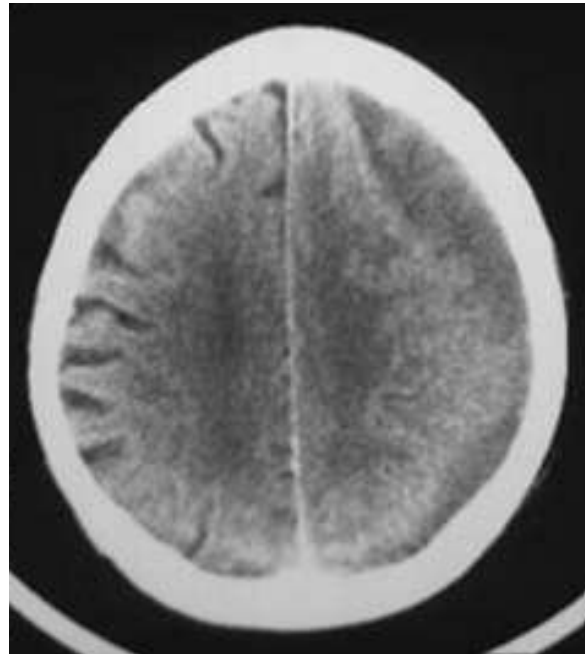


Sub Dural

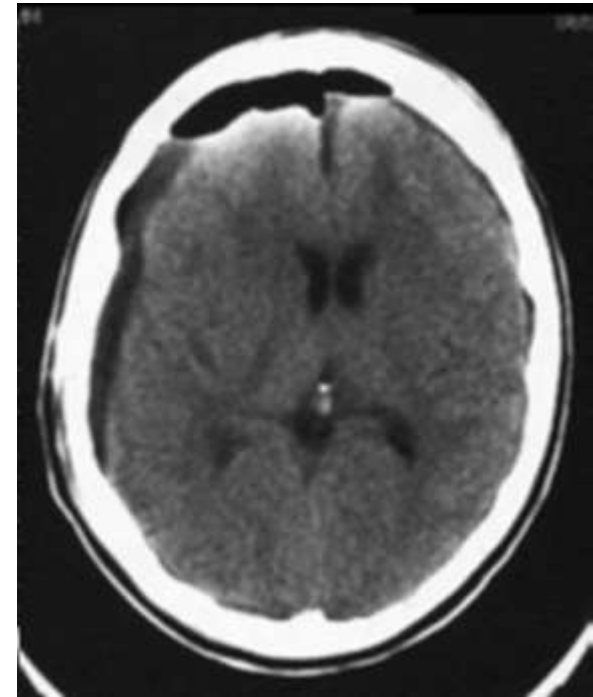
1- Acute



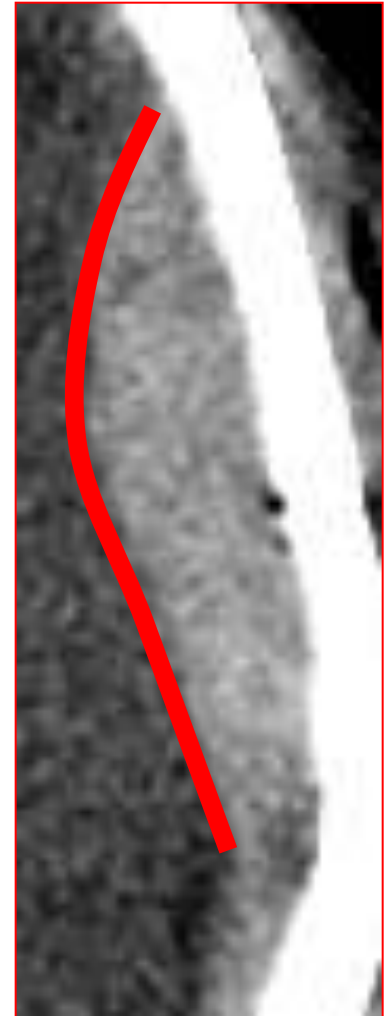
B- Sub acute



3-Chronic SDH.

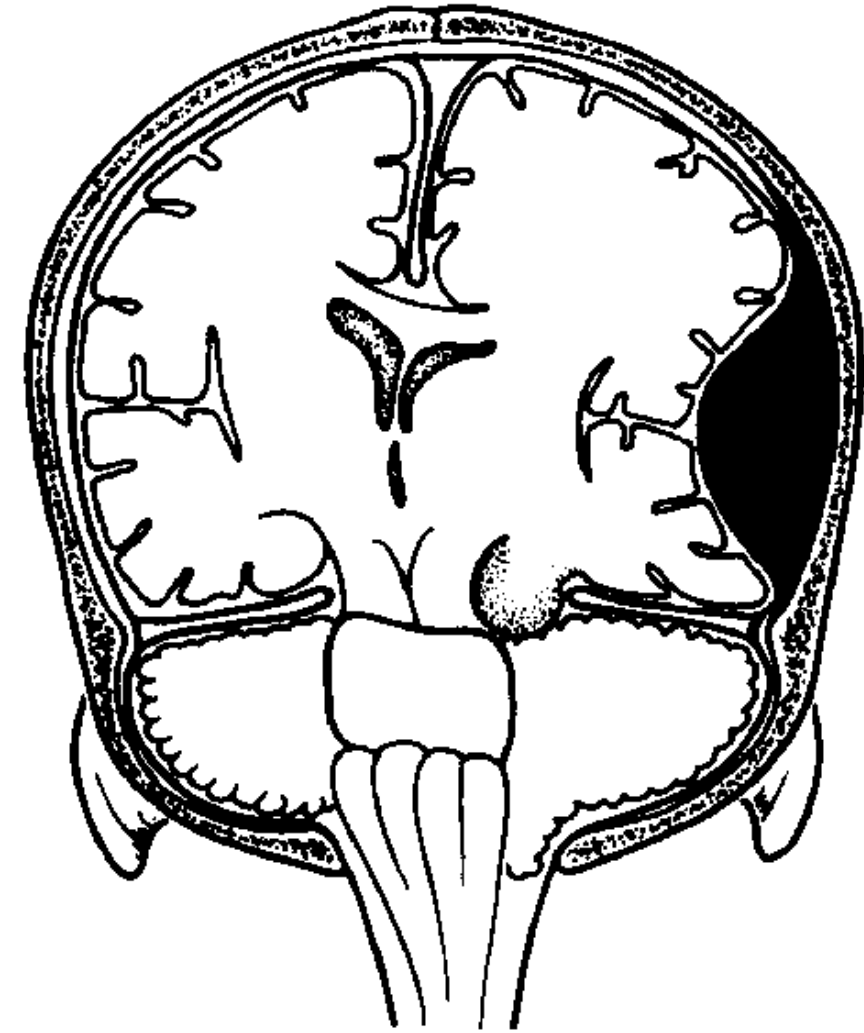


SUB OR EXTRA ?

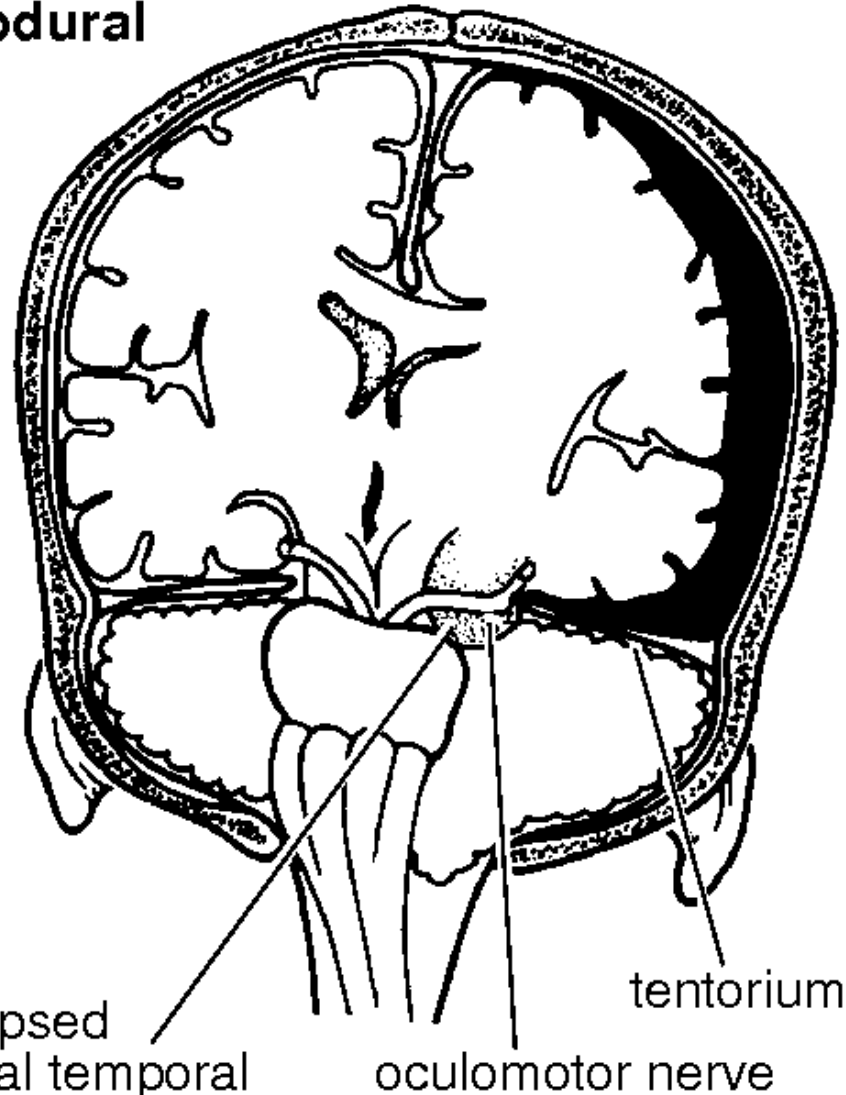


INTRACRANIAL HAEMORRHAGE

Extradural



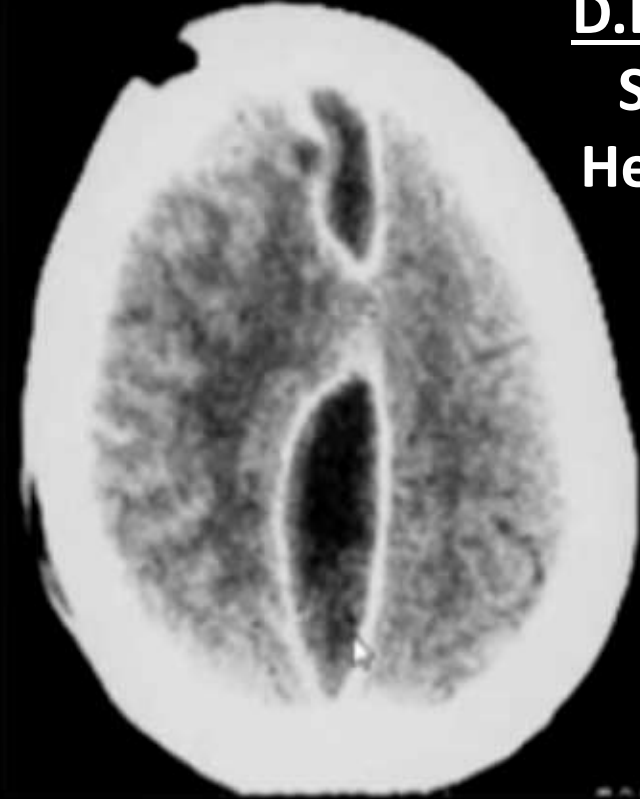
Subdural



prolapsed
medial temporal
lobe

tentorium
oculomotor nerve

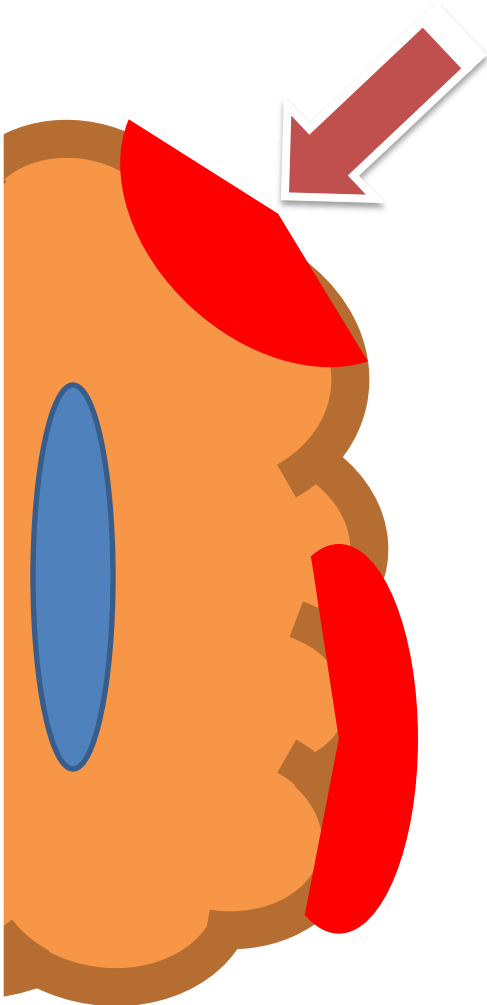
Para sagittal subdural empyema



D.D. Chronic
Subdural
Hematoma

* Key

Clinical Picture - Ring enhancement

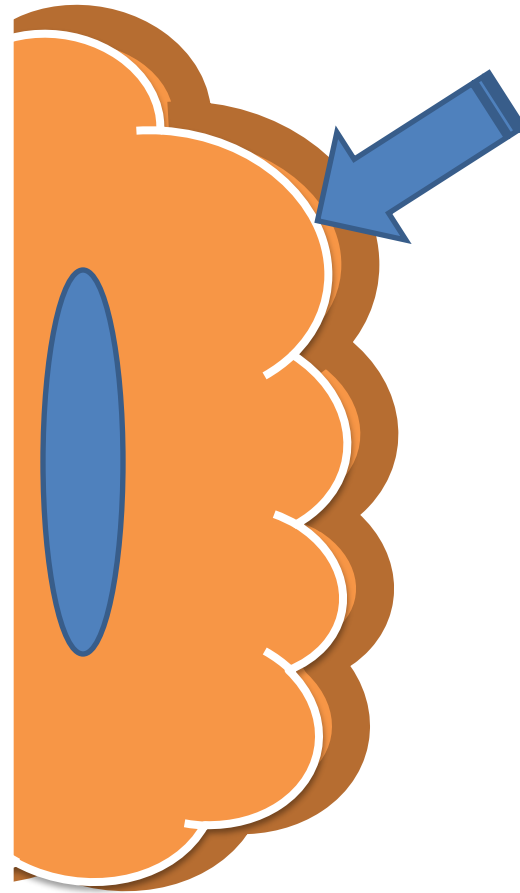


White Sulci

• Plain CT →
Subarachnoid Hage

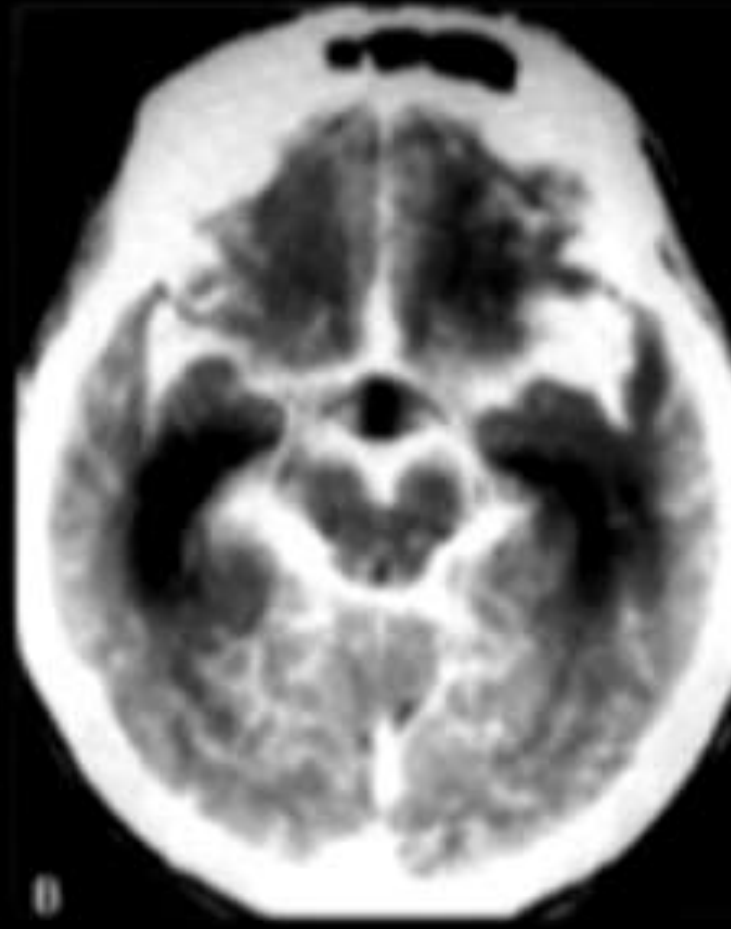
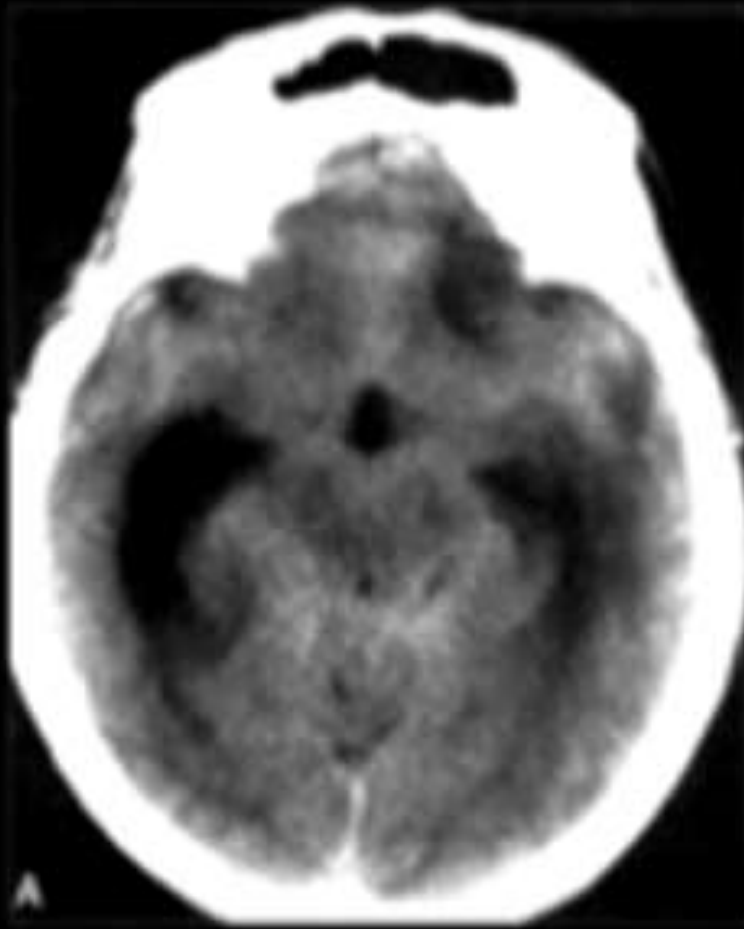
• CT + C →
Meningitis

Donot Forget History & CP





Subarachnoid Haemorrhage



***Don't Rash to Diagnose
This Case Subarachnoid
Hemorrhage Notice
it is post contrast Scan***

Cortical Lesions

&

Morphological changes

Wide

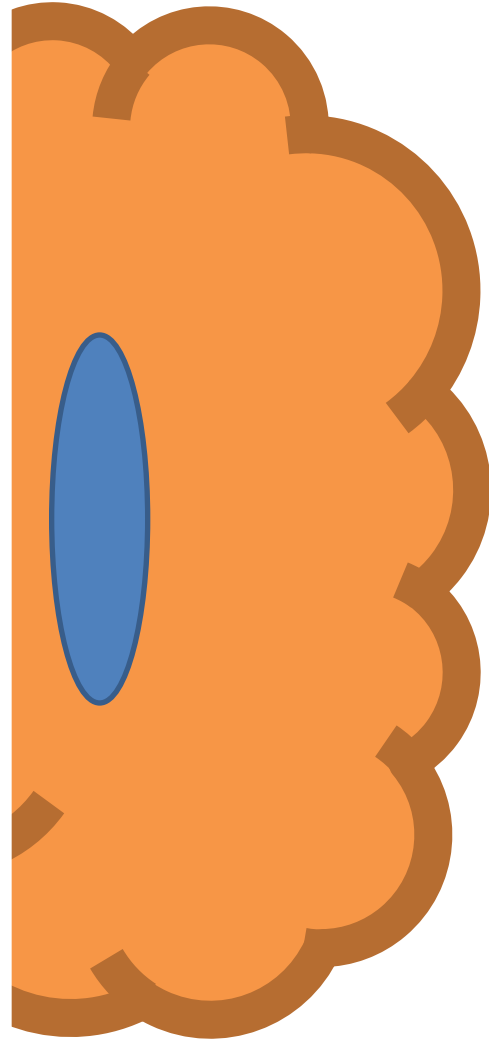
Smooth

Multiple

DOUBLICATED

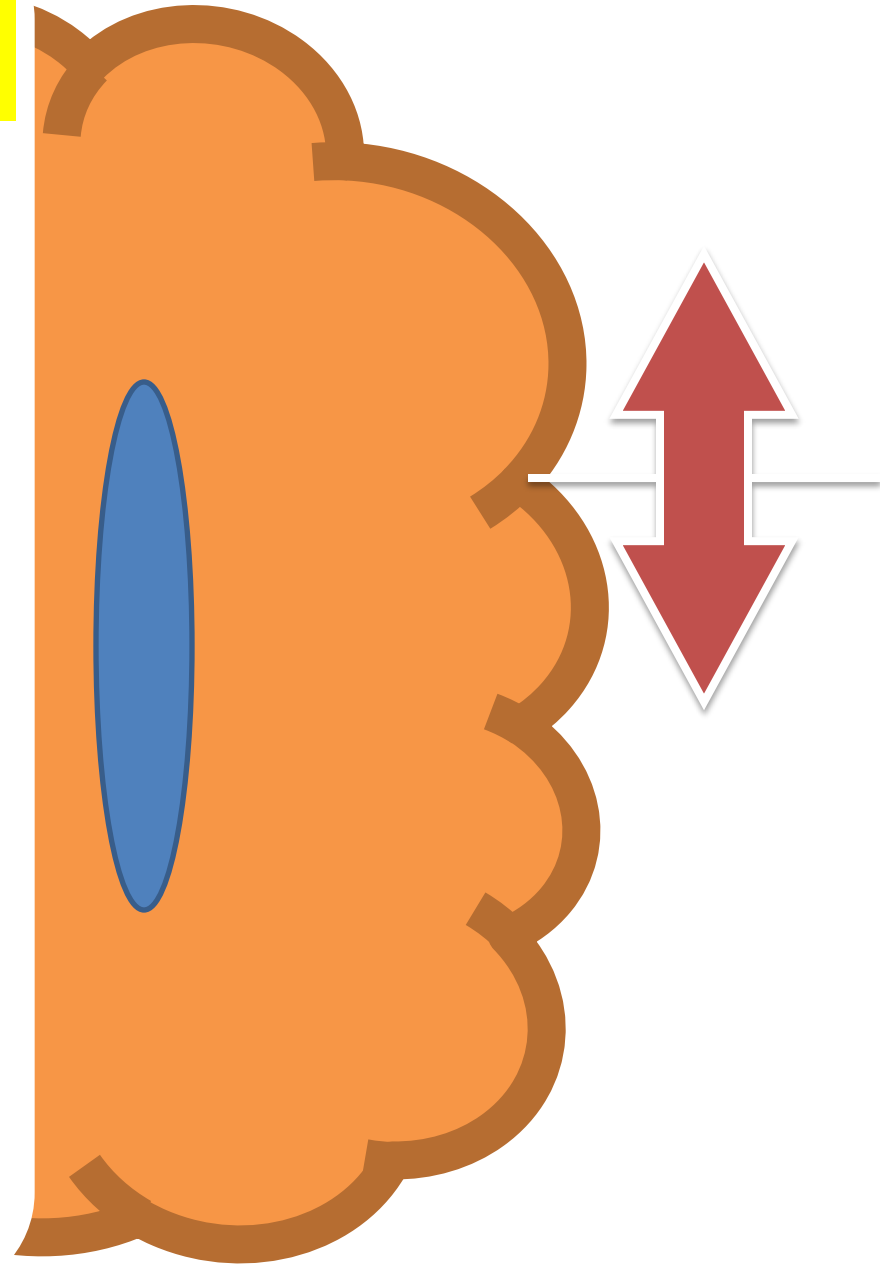
Island

Split

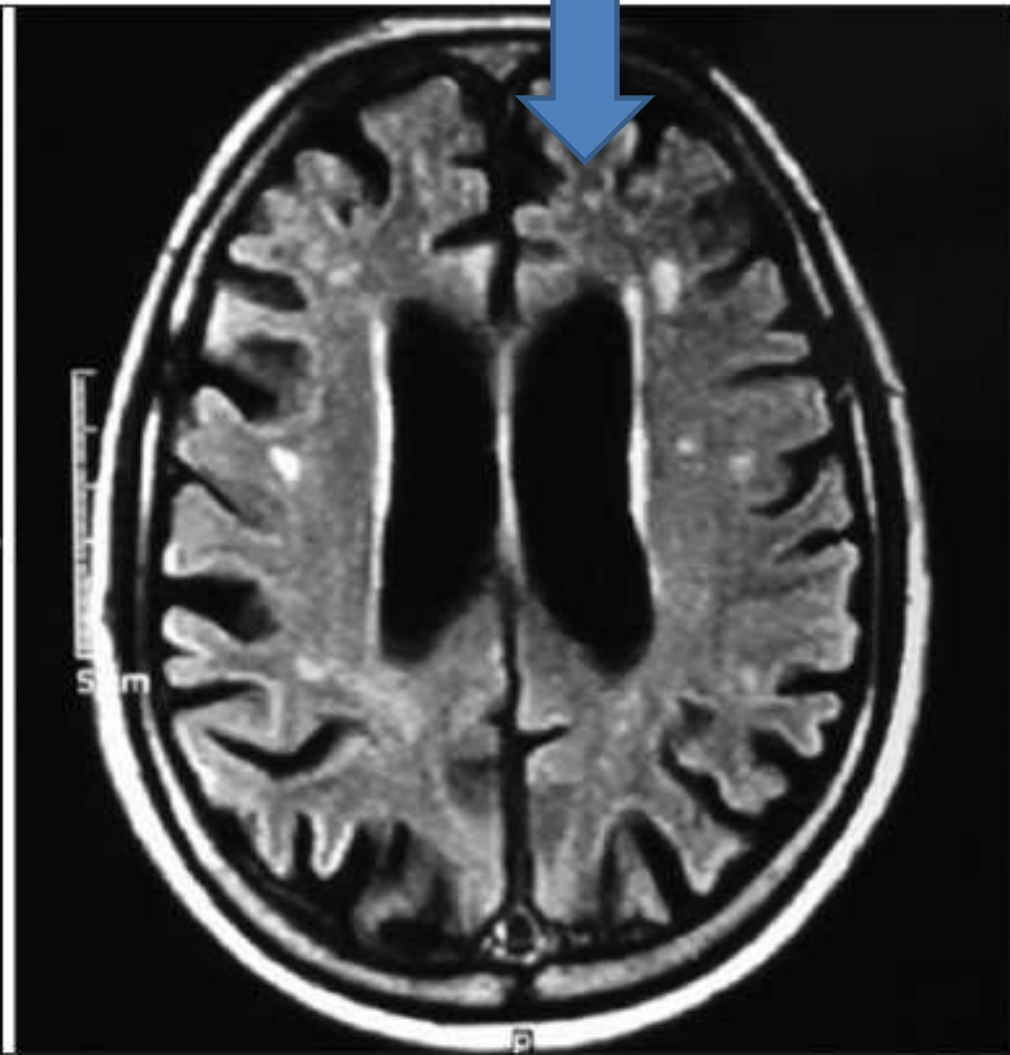
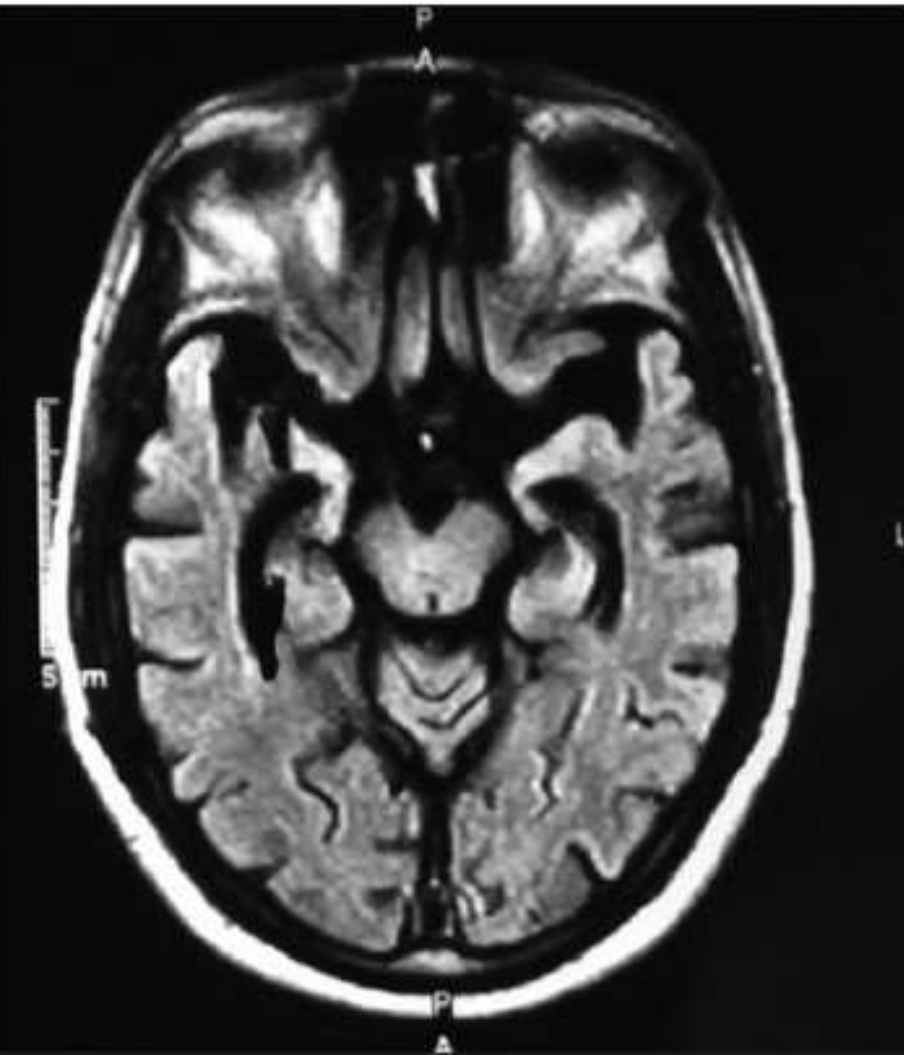


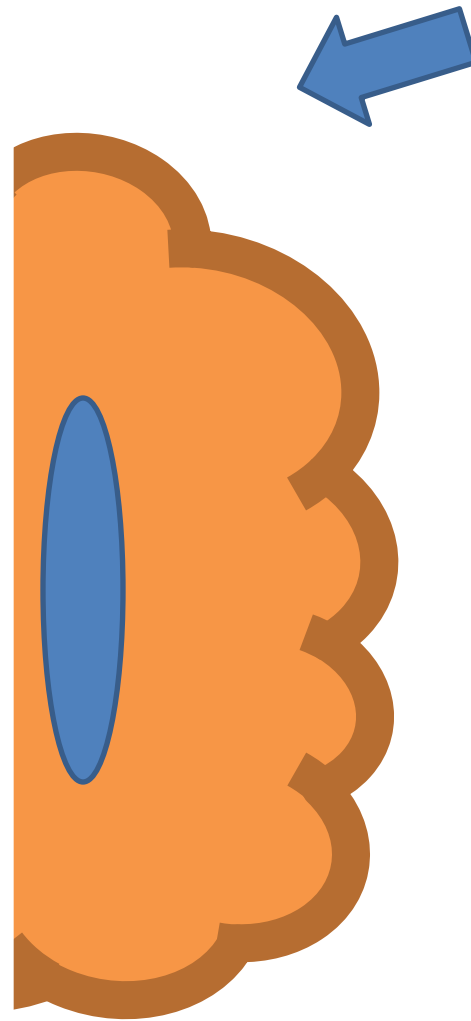
WIDENED CORTICAL SULCI

- *Senile*
- *Brain Atrophy*



Atrophic changes is associated with wide Ventricular systemi.e. Normotensive dilatation



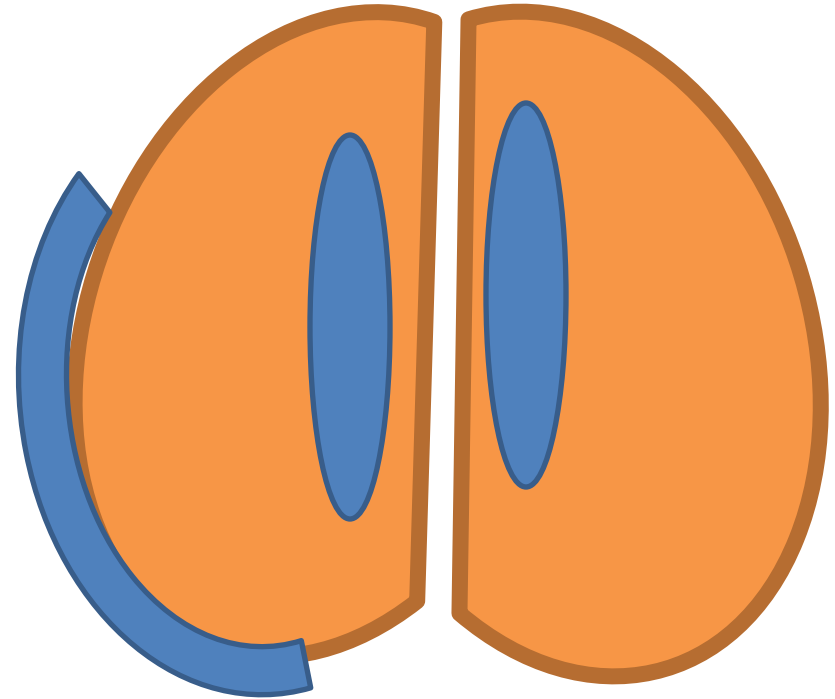


If Cortical Sulci → Smooth

SMOOTH BRAIN =

Lissencephaly

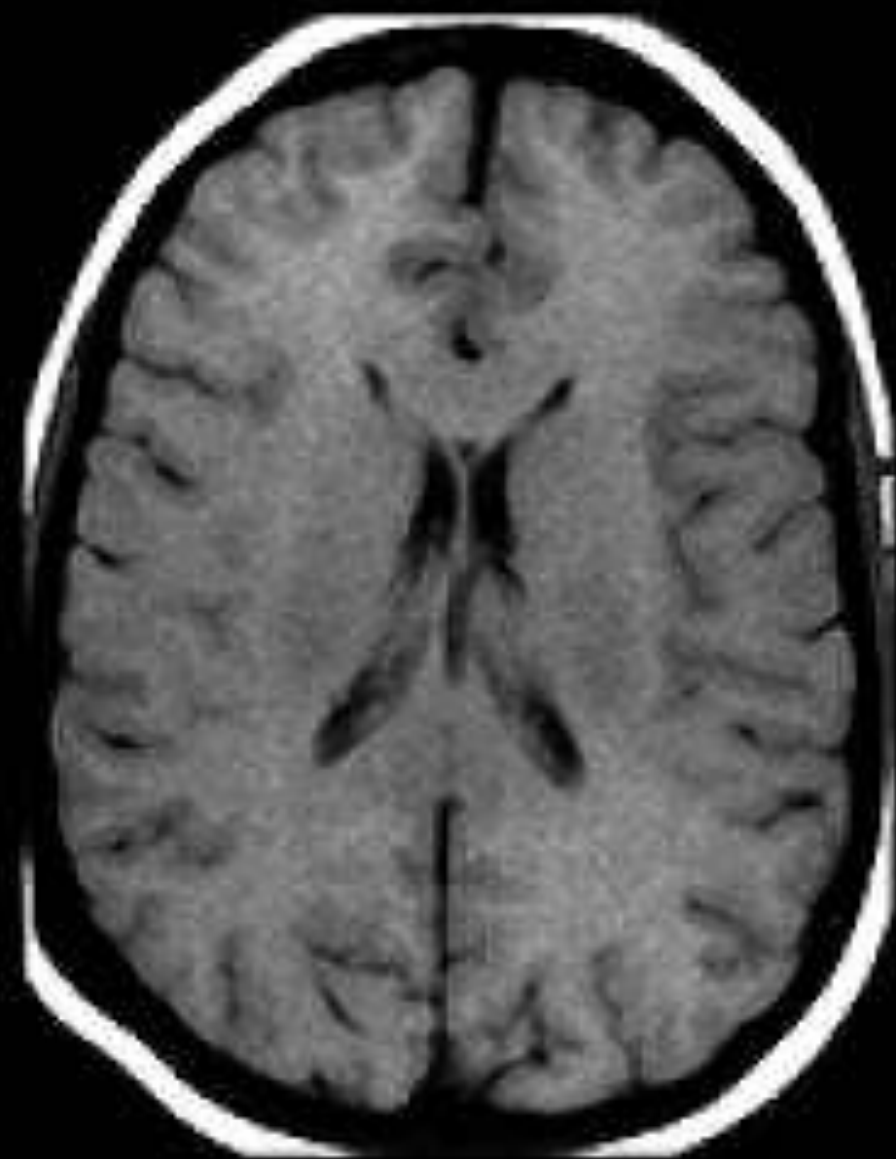
- Rare
- Neuronal Migration Disorder



ISS ENCEPHALY



Normal



Lissencephaly



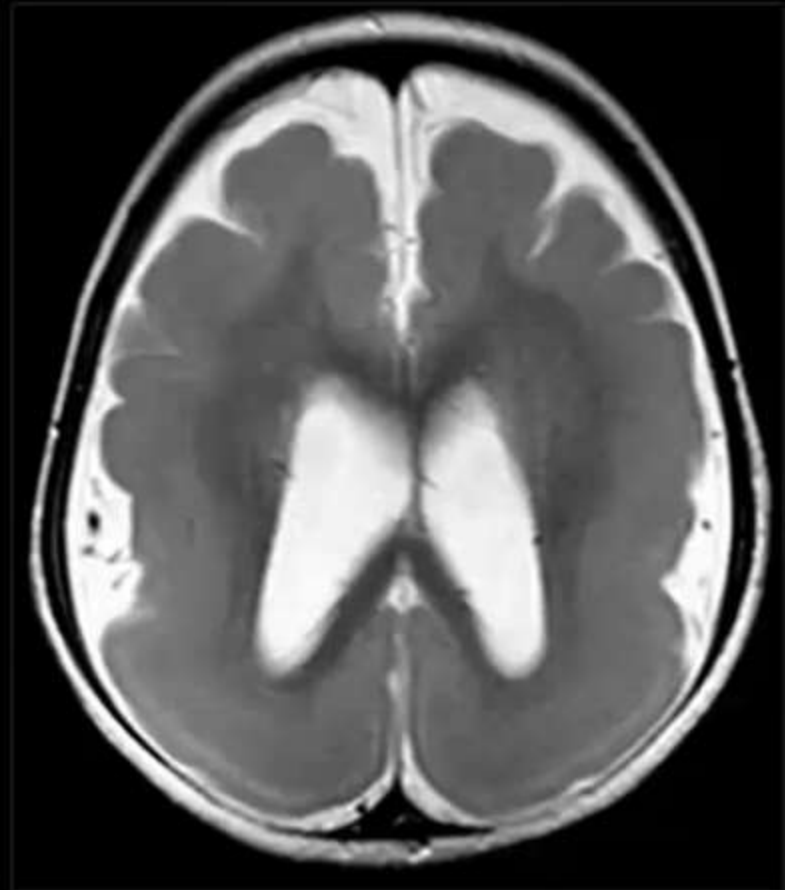
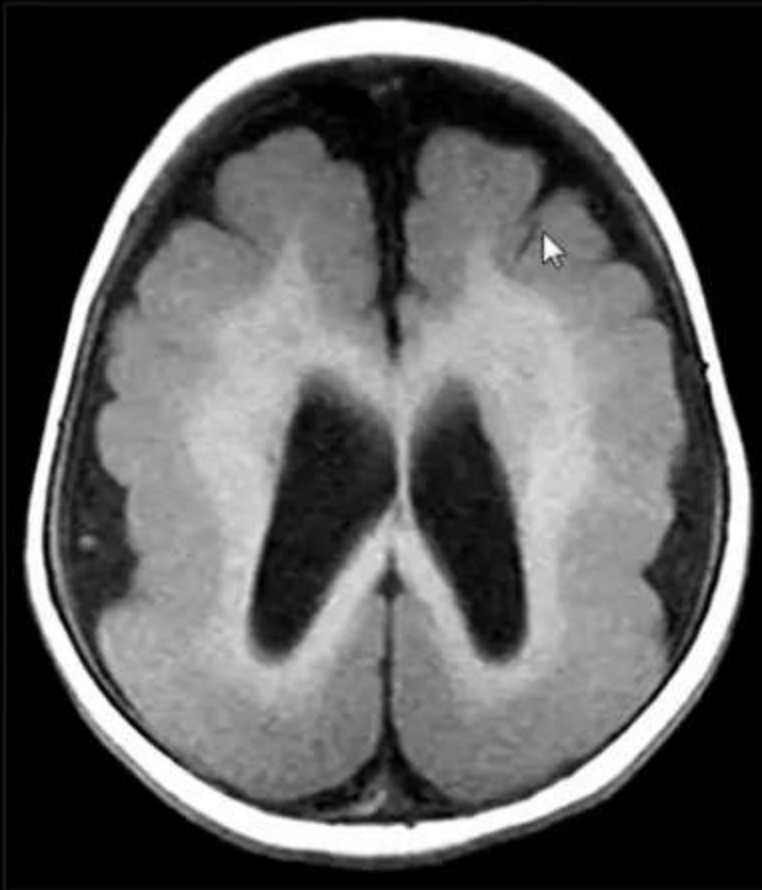
Lissencephaly

MRI

- ◆ Agyric brain with areas of pachygyria
- ◆ Hour glass configuration of the brain
- ◆ Primitive vertical Sylvian fissures
- ◆ Small temporal lobes



Lissencephaly



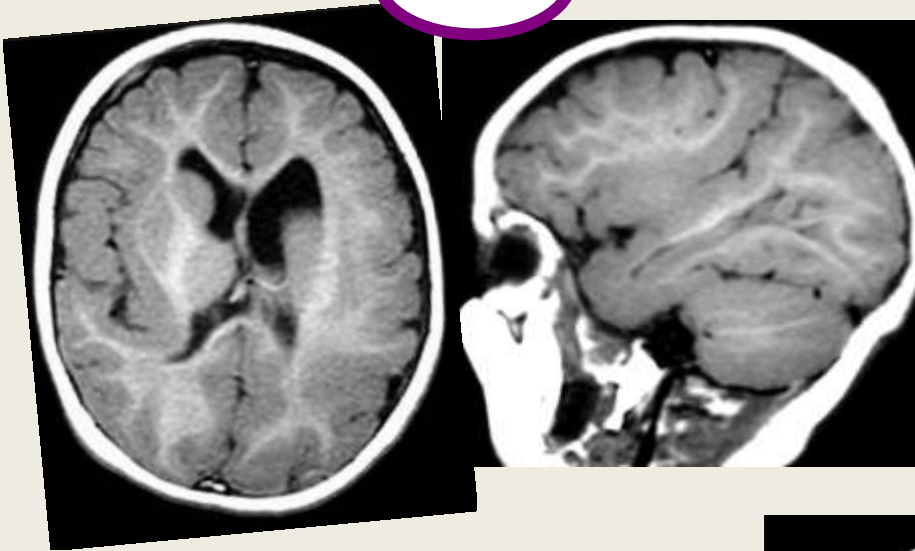
F 1 Y

Few gyrai may be noticed in few cases..... but always Thick

Fewer "thick" gyri

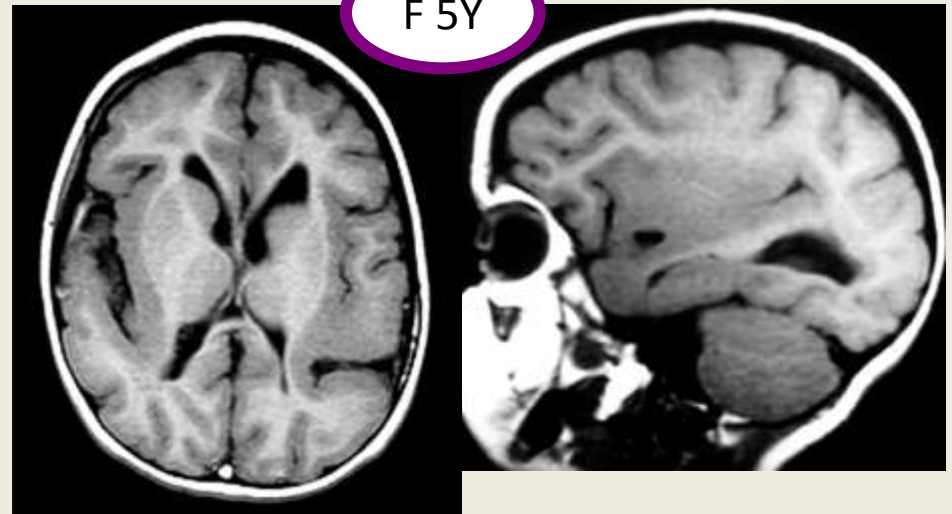
PACHY = Thick

F 1Y

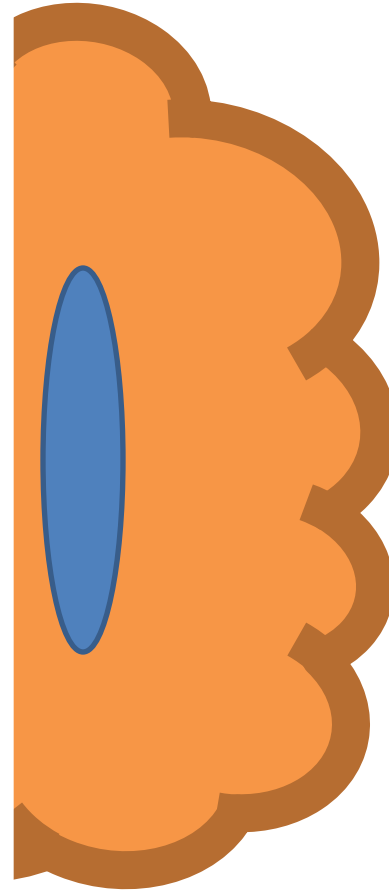
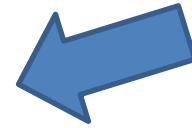


PACHYGYRIA

F 5Y



SULCI INCREASED IN NUMBER



***If Cortical Sulci →
increase in number & smaller***

Polymicrogyria PMG

- ◆ Thickened cortex with many small gyri
- ◆ Gyri may be so small to be identified on imaging
- ◆ Flat thick cortex similar to pachygyria or agyria
- ◆ 3D reformatted images are diagnostic



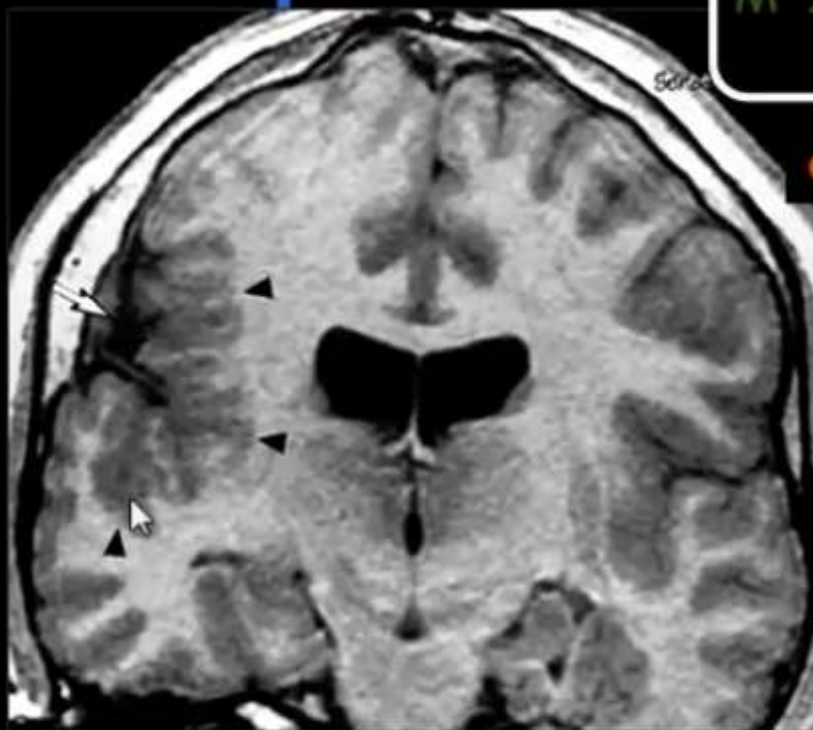
PMG

Locations

- Unilateral 40%
- Bilateral 60%
- **Perisylvian** 80%
- Frontal 70%
- Parietal 63%
- Temporal 38%
- Occipital 7%

M 27Y

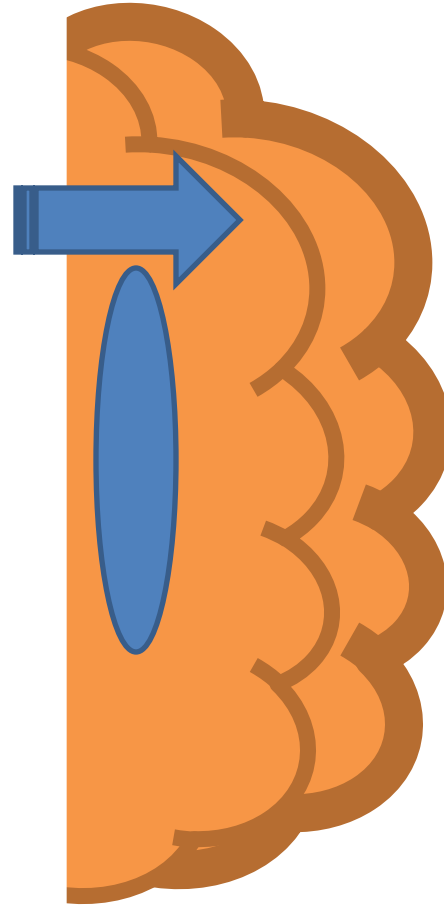
epilepsy



80 %
Peri
Sylvian

•if this cortex i s

DOUBLICATED



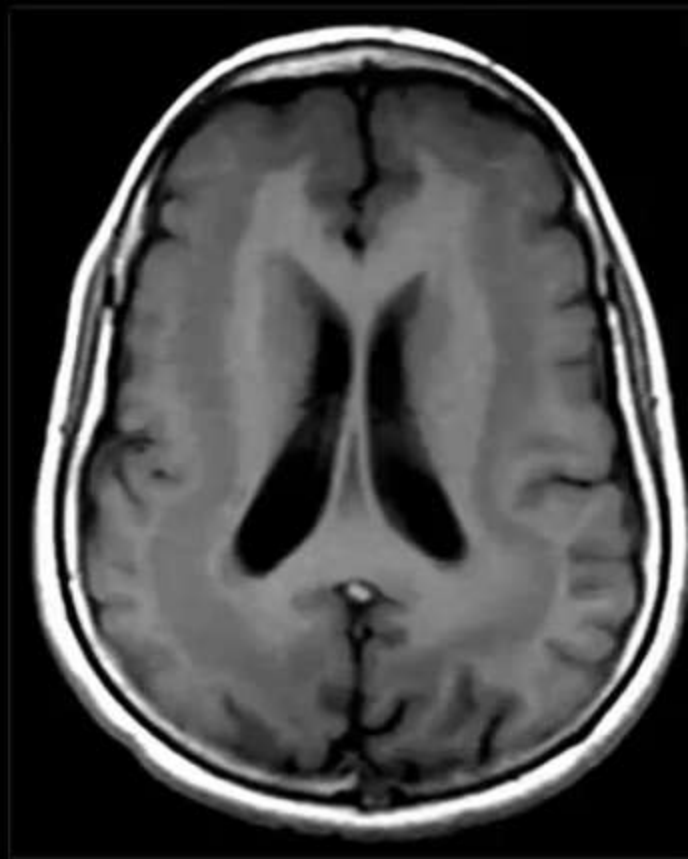
i.e.

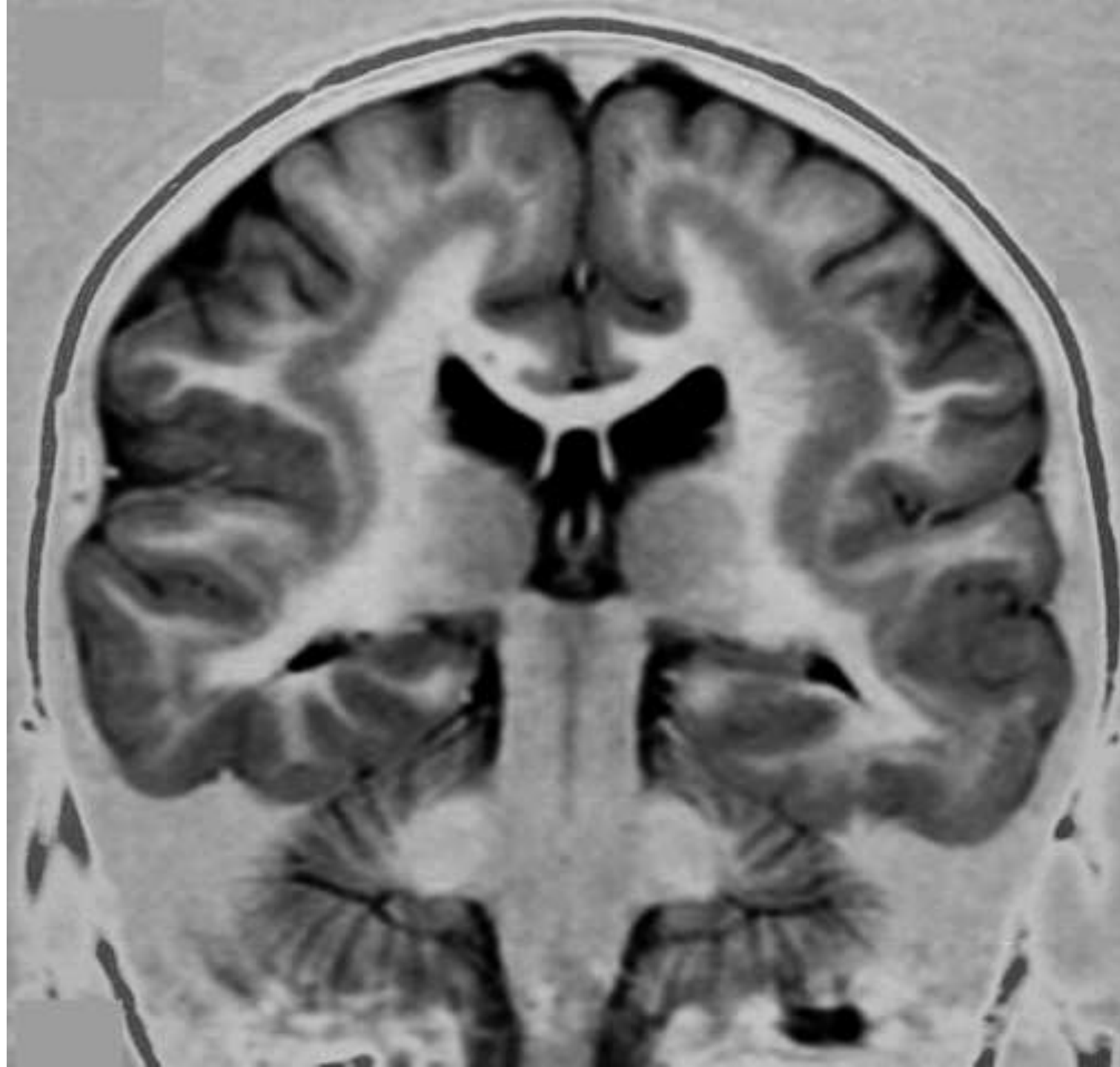
- Cortex is Duplicated = **Double Cortex**
- or **band** of cortex added = **Band Heterotopia**

Band Heterotopia

The severity of symptoms correlates with

- Thickness of the heterotopic band
- High signal on T2 WIs
- Degree of ventriculomegaly

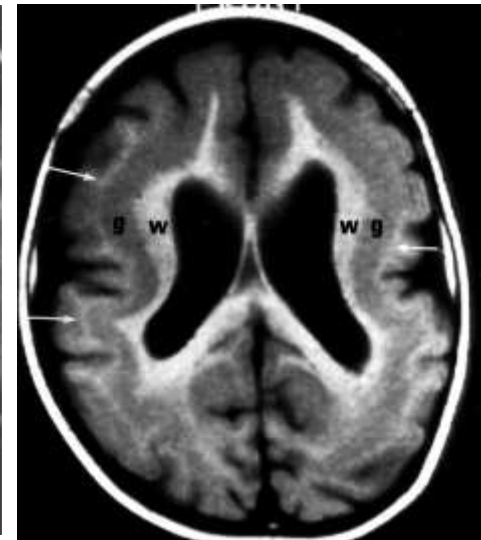
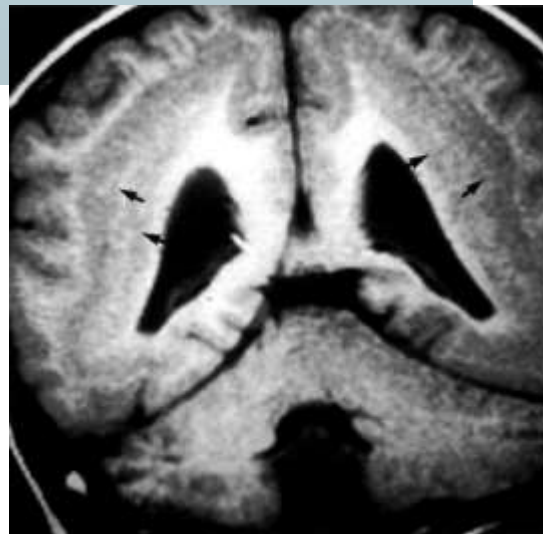




Band Heterotopia

The severity of symptoms correlates with

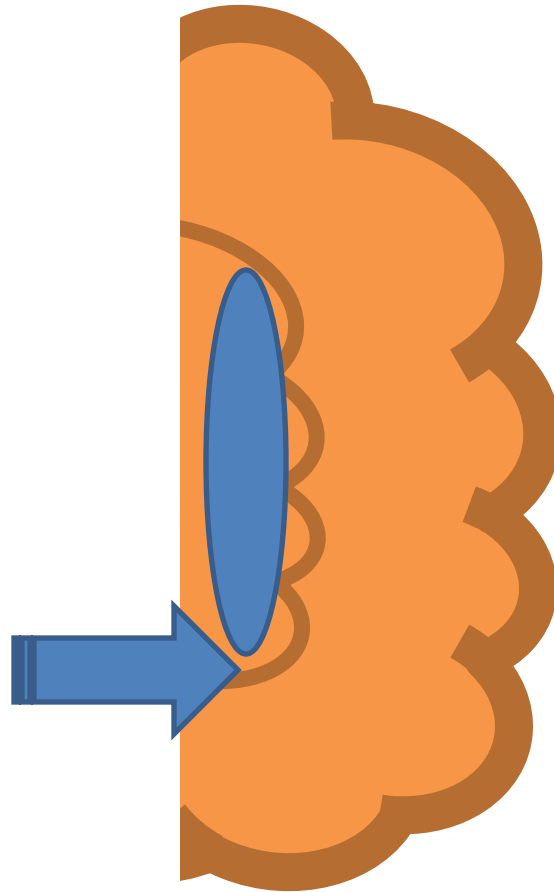
- Thickness of the heterotopic band
- High signal on T2 WIs
- Degree of ventriculomegaly

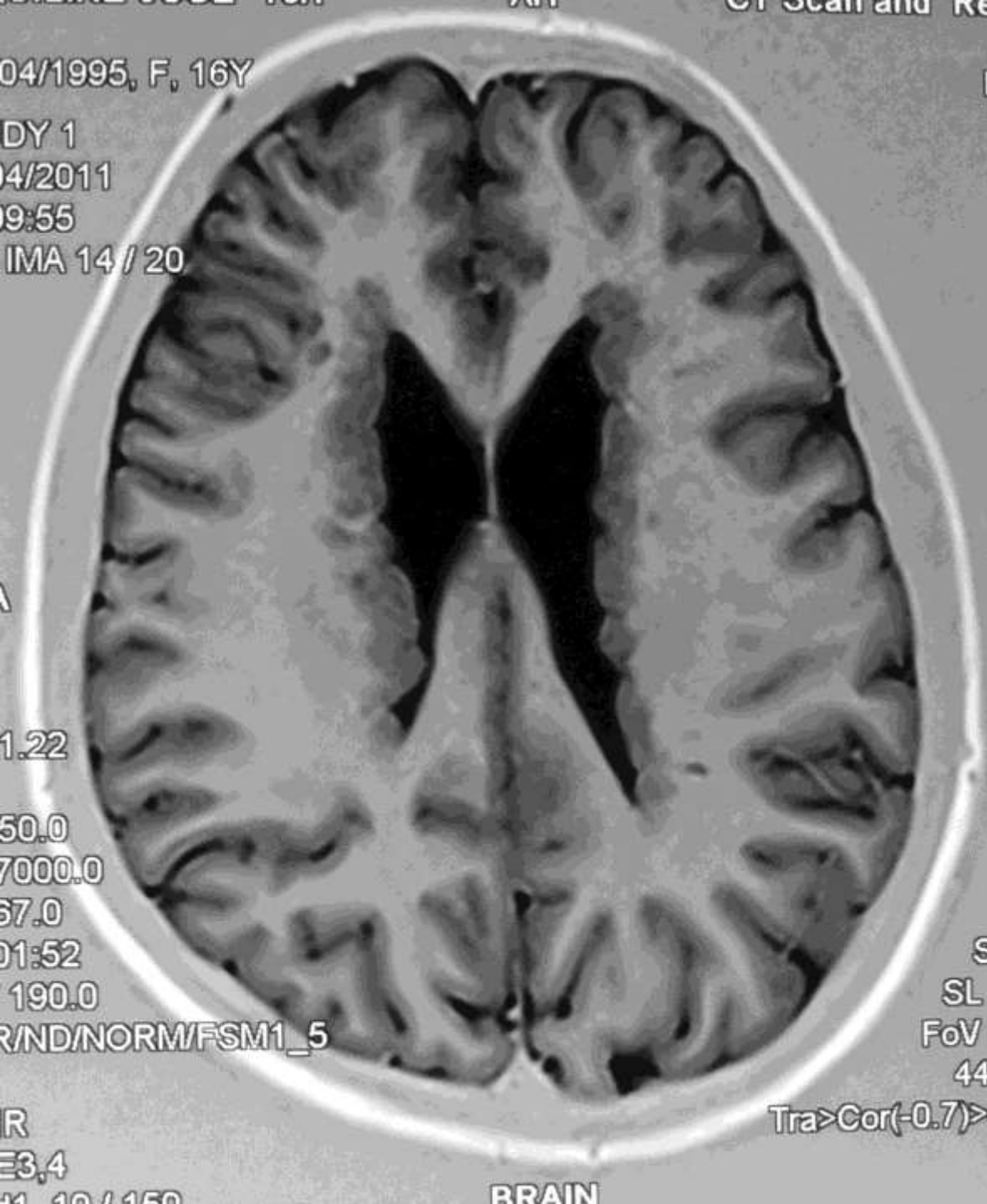


*If Band in lower in level
..... On ventricular wall*

→ i.e.

Subependymal





04/1995, F, 16Y

DY 1
04/2011
09:55
IMA 14 / 20

1.22
50.0
7000.0
67.0
01:52
190.0

R/ND/NORM/FSM1_5

R
E3.4
11 / 150

CT Scan and Re

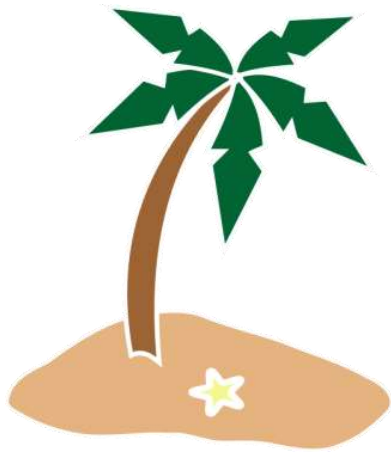
S
SL
FoV
44

Tra>Cor(-0.7)>

BRAIN

- *If Band was more lower*
→ *Subependymal Heterotopia*

ISLANDS OF CORTEX



Cortical dysplasia

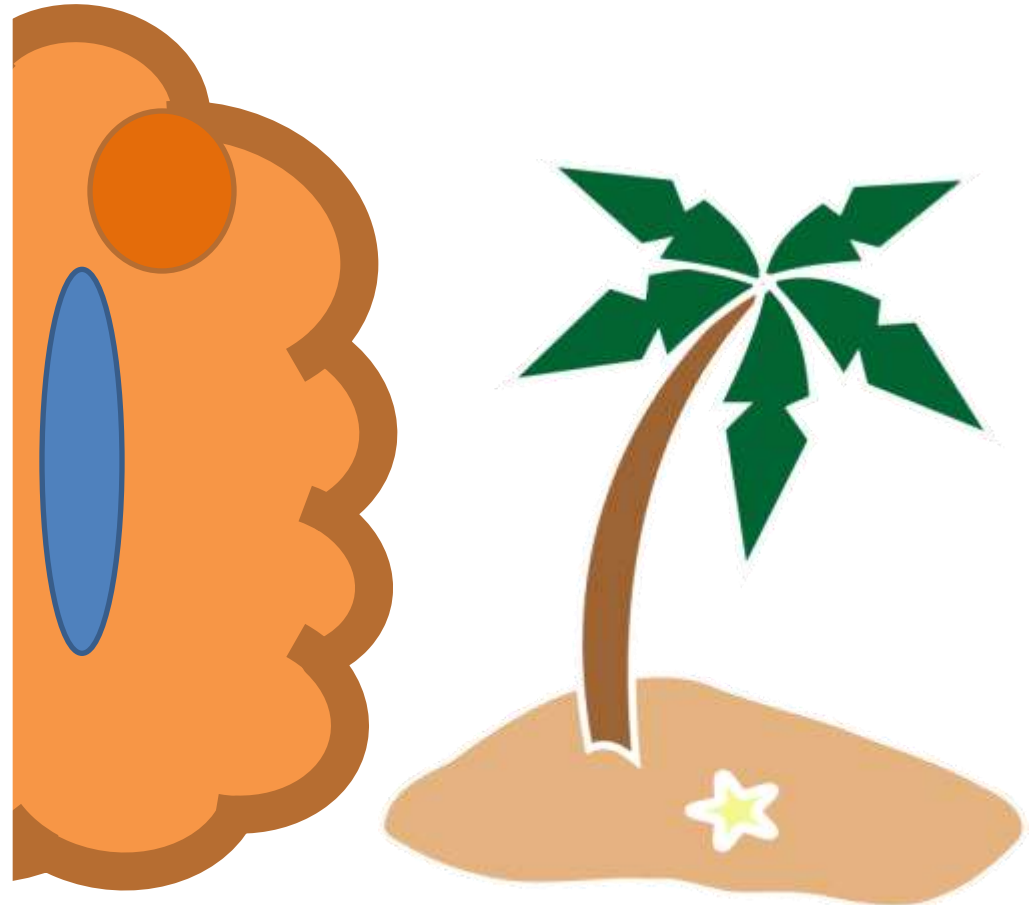


DNET



Actual neoplasm

ISLAND OF CORTEX



FOCAL CORTICAL DYSPLASIA

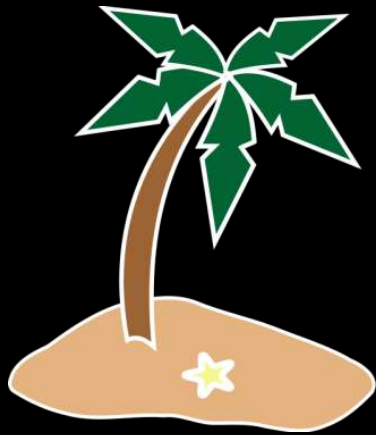
Cortical dysplasia

DNET

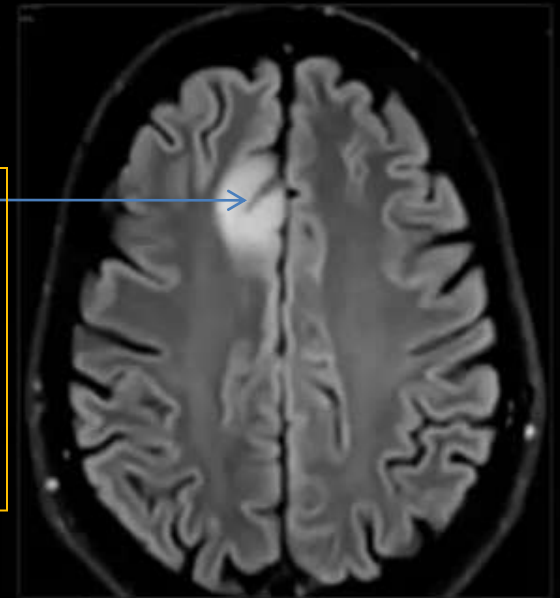
Actual neoplasm

Focal Cortical dysplasia

- ◆ Abnormal neurons arranged in focal areas in the cerebral cortex
- ◆ The incidence of FCD is **5- 15%** in patients with seizures.



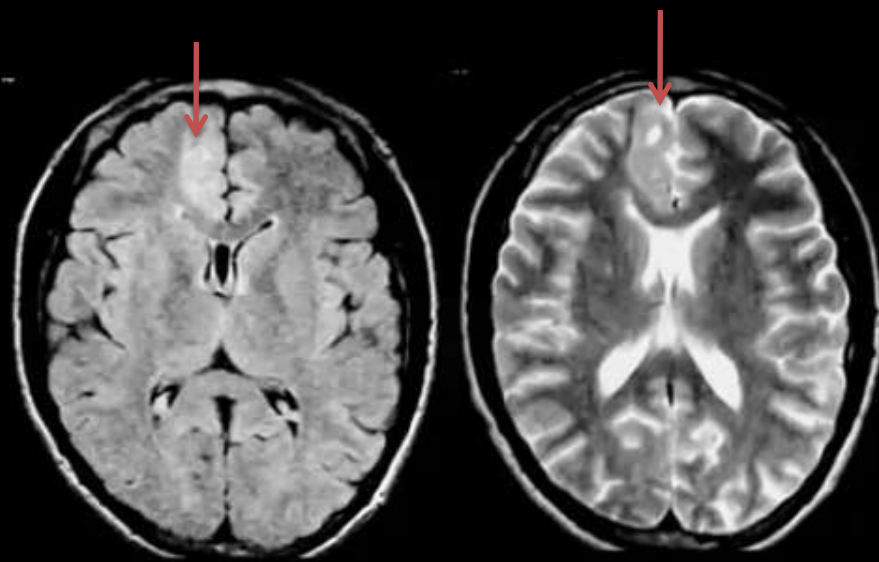
***Sulcus passed
with in lesion
=Not Tumor
Not Infarction***



Type I = architectural distortion of the cortex alone with no abnormal cells

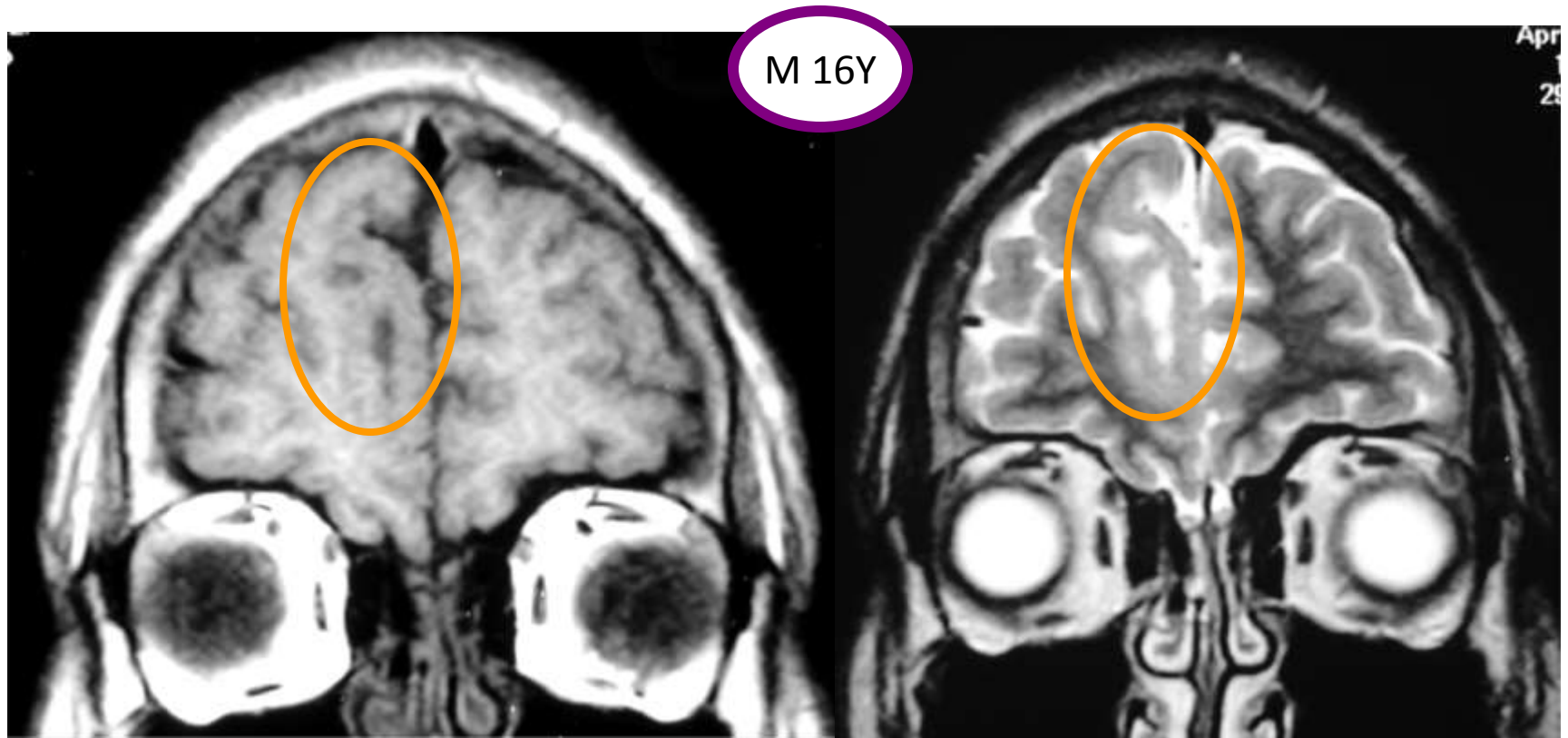
Type II = architectural distortion and dysmorphic neurons

Focal Cortical dysplasia **FCD**



MRI

- ◆ High T2 signal in the subcortical white matter
- ◆ Blurring of the gray/ white matter junction
- ◆ Thickening of the affected cortex

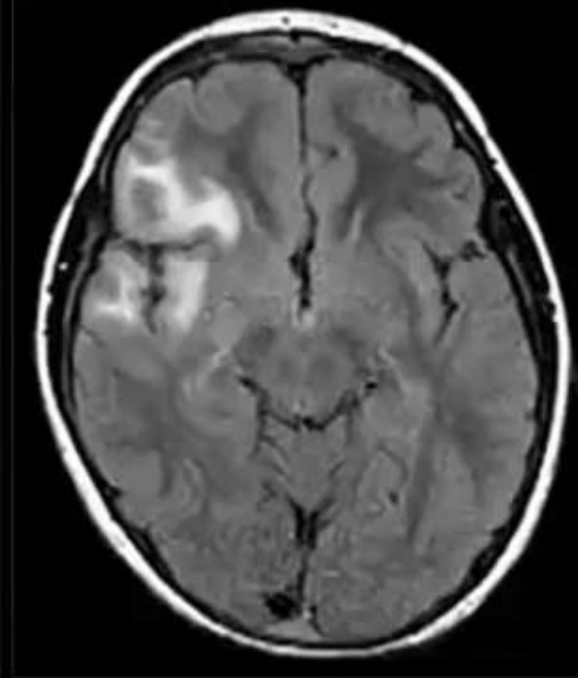
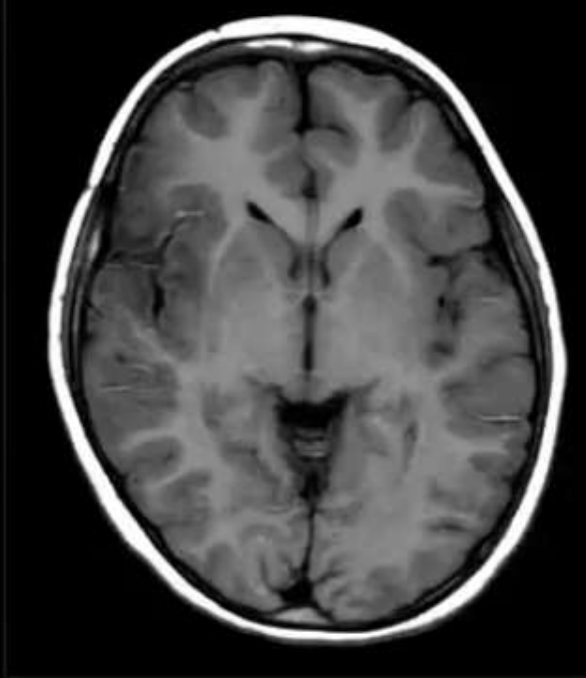


Focal Cortical dysplasia (FCD)

Focal Cortical Dysplasia

seizure

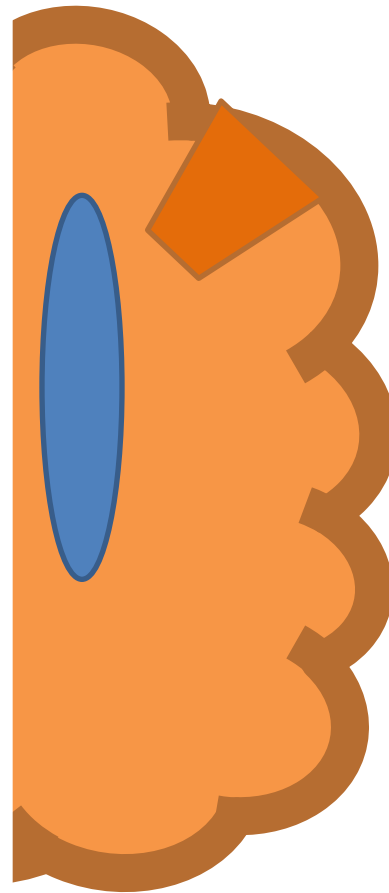
M 5Y



Pathologically proven cortical dysplasia

ISLAND OF DISTORTED CORTEX

It is An intermediate state between Dysplasia's & Tumor



DYSEMBRYOBLASTIC EPITHELIAL TUMORS DNET

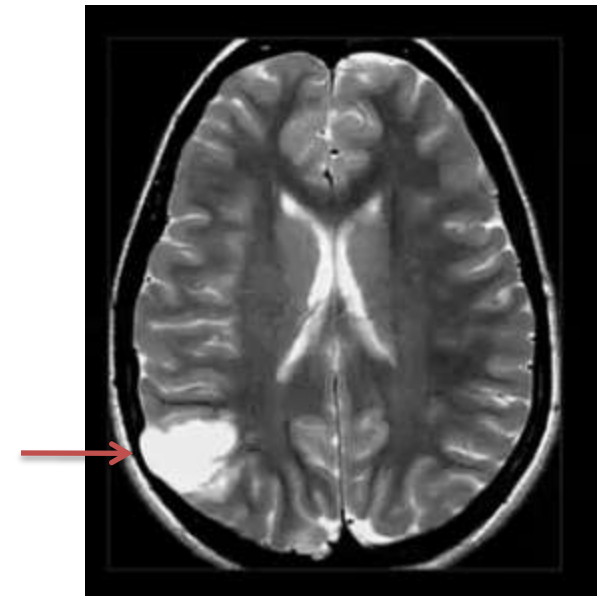
Cortical dysplasia

DNET

Actual neoplasm

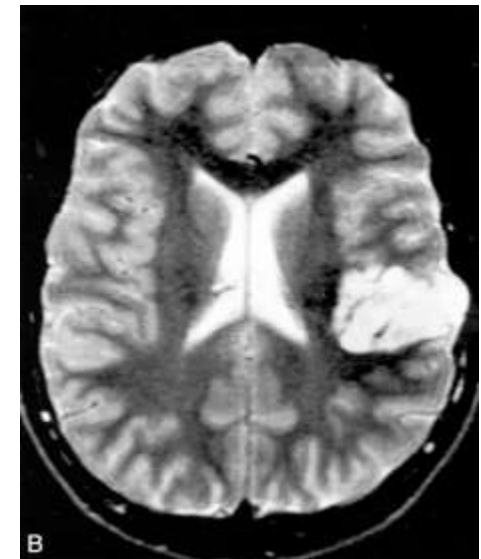
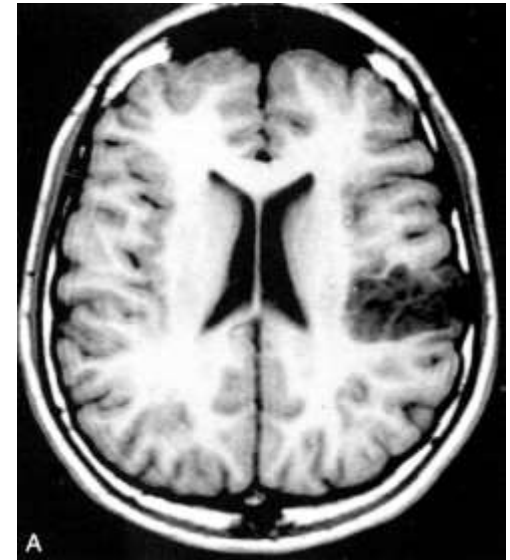
DYSEMBRYOBLASTIC EPITHELIAL TUMORS DNET

- **Benign**
- Slow growing → **Scalloping** of inner skull bones
“Best sign to detect”.
- Cortical , wedge shape
“from cortex To ventricle”
- **NO** “ca, Edeme, Enh”
-



- ***MRI:***
 - *Multinodular cystic appearance*
 - *Low T1 High T2*

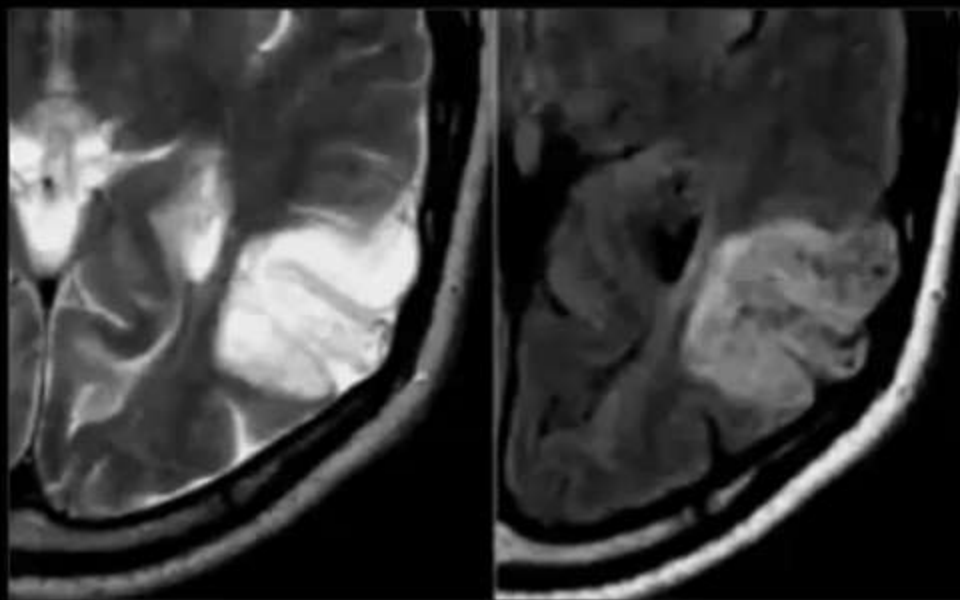
- ***Fate***
 - *No recurrence after removal*



Dysembryoblastic Epithelial Tumors

key findings

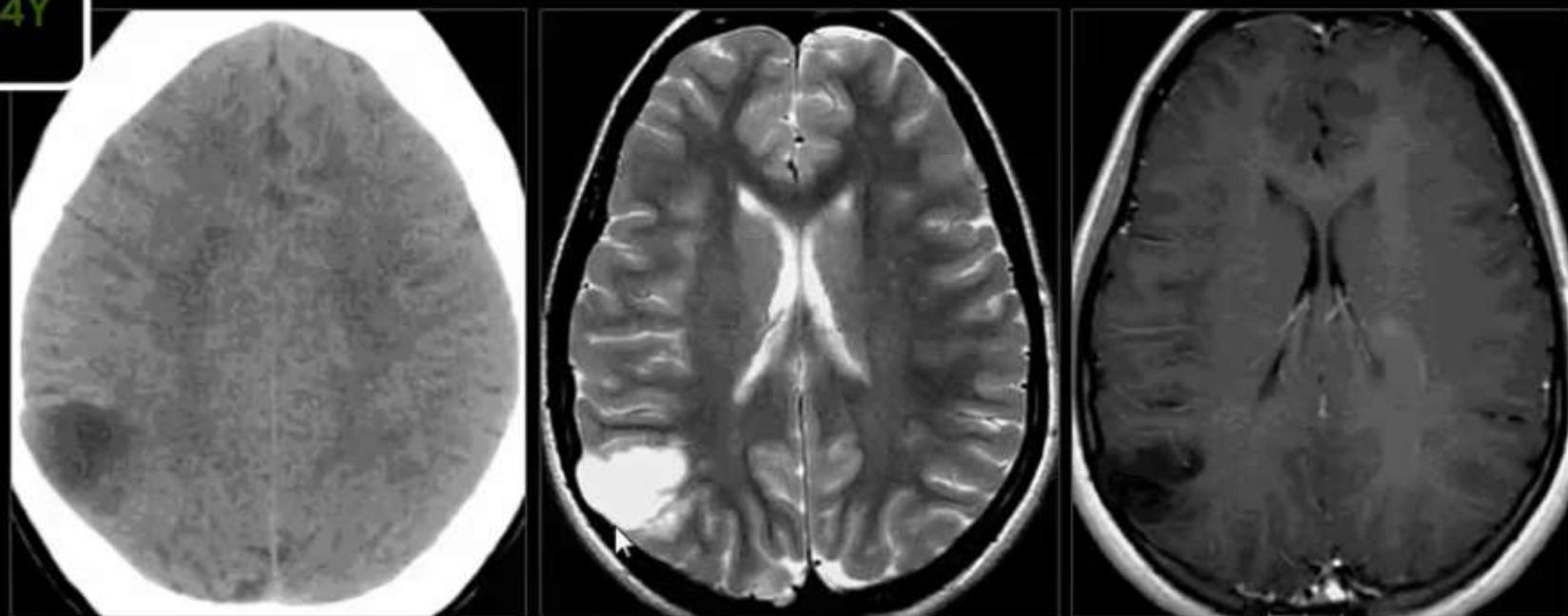
- ◆ Swollen gyrus
- ◆ Bubbly cystic appearance
- ◆ May be wedge shaped pointing to the ventricle
- ◆ Usually no or only little enhancement
- ◆ Associated with focal cortical dysplasia



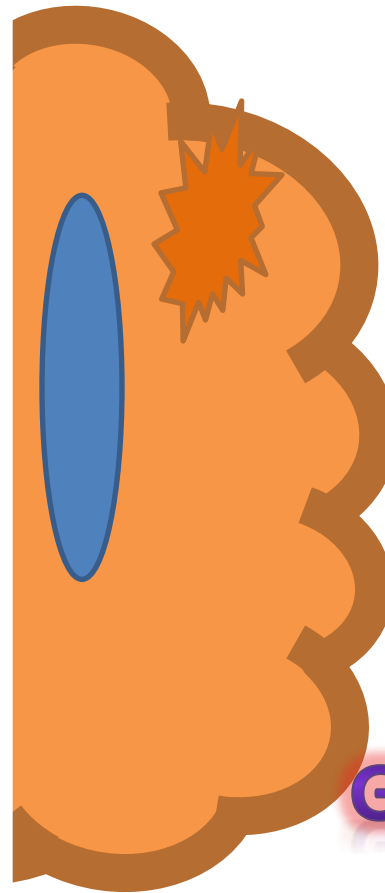
Dysembryoplastic neuroepithelial tumor

Seizure while sleeping

F 14Y



ISLAND OF NEOPLASM OF CORTEX



GANGLIOGLIOMA

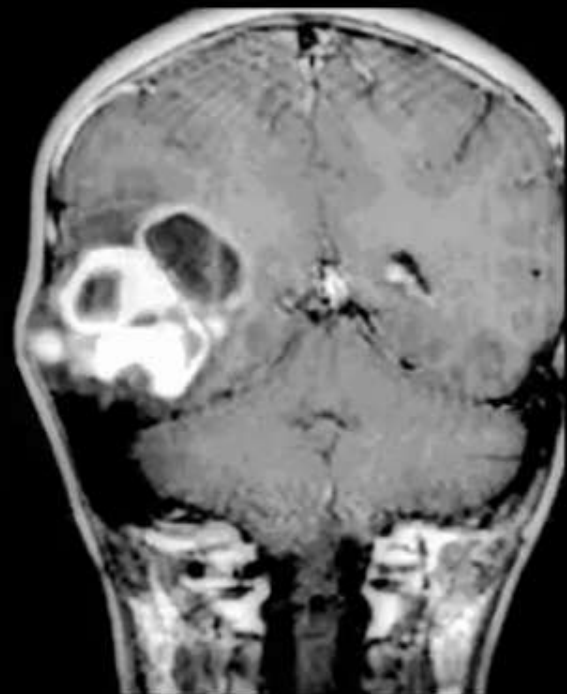
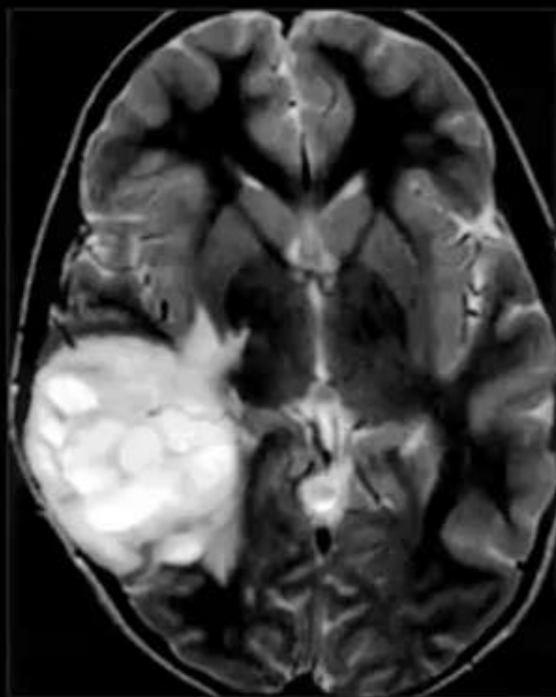
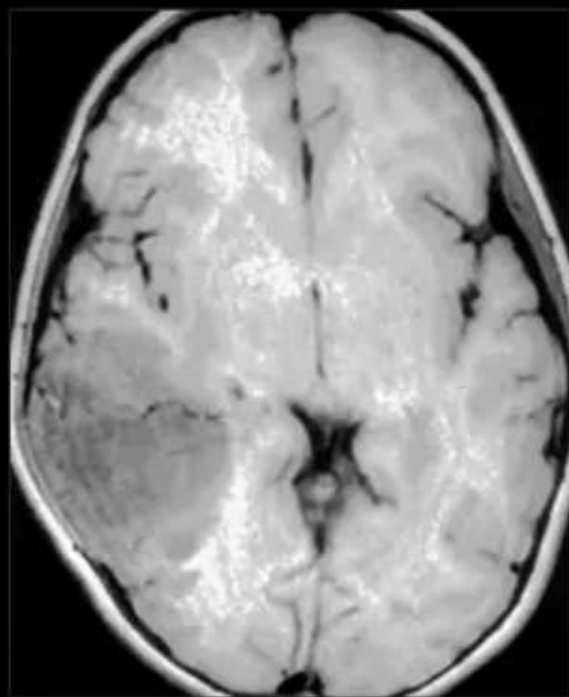
Cortical dysplasia

DNET

Actual neoplasm

Ganglioglioma

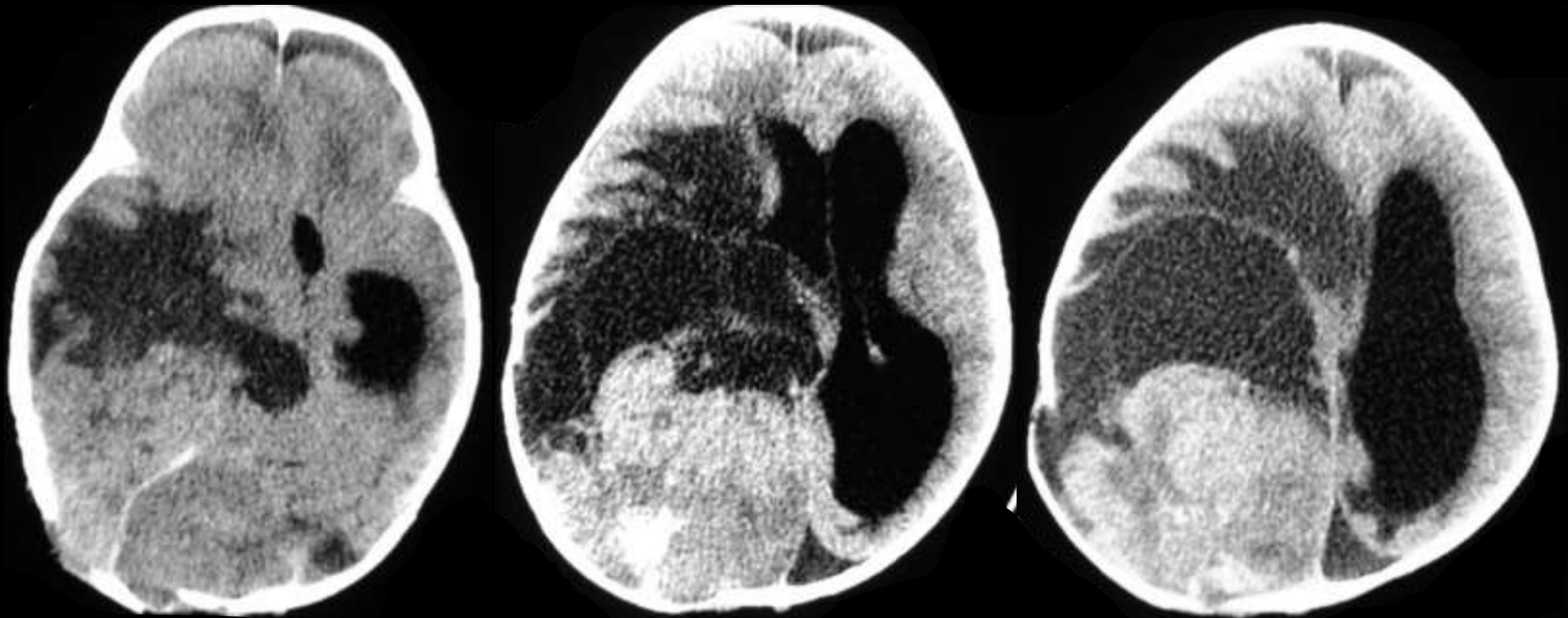
- ◆ Benign with calverial remodeling
- ◆ A solid enhancing part is the rule in all cases
- ◆ Non specific MR findings



Is it turn wild ?

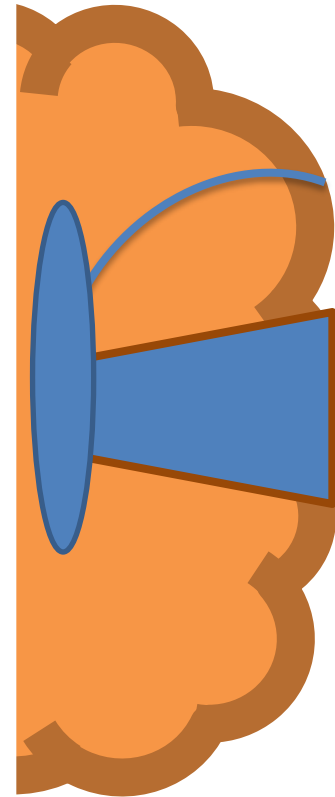


Anaplastic Ganglioglioma

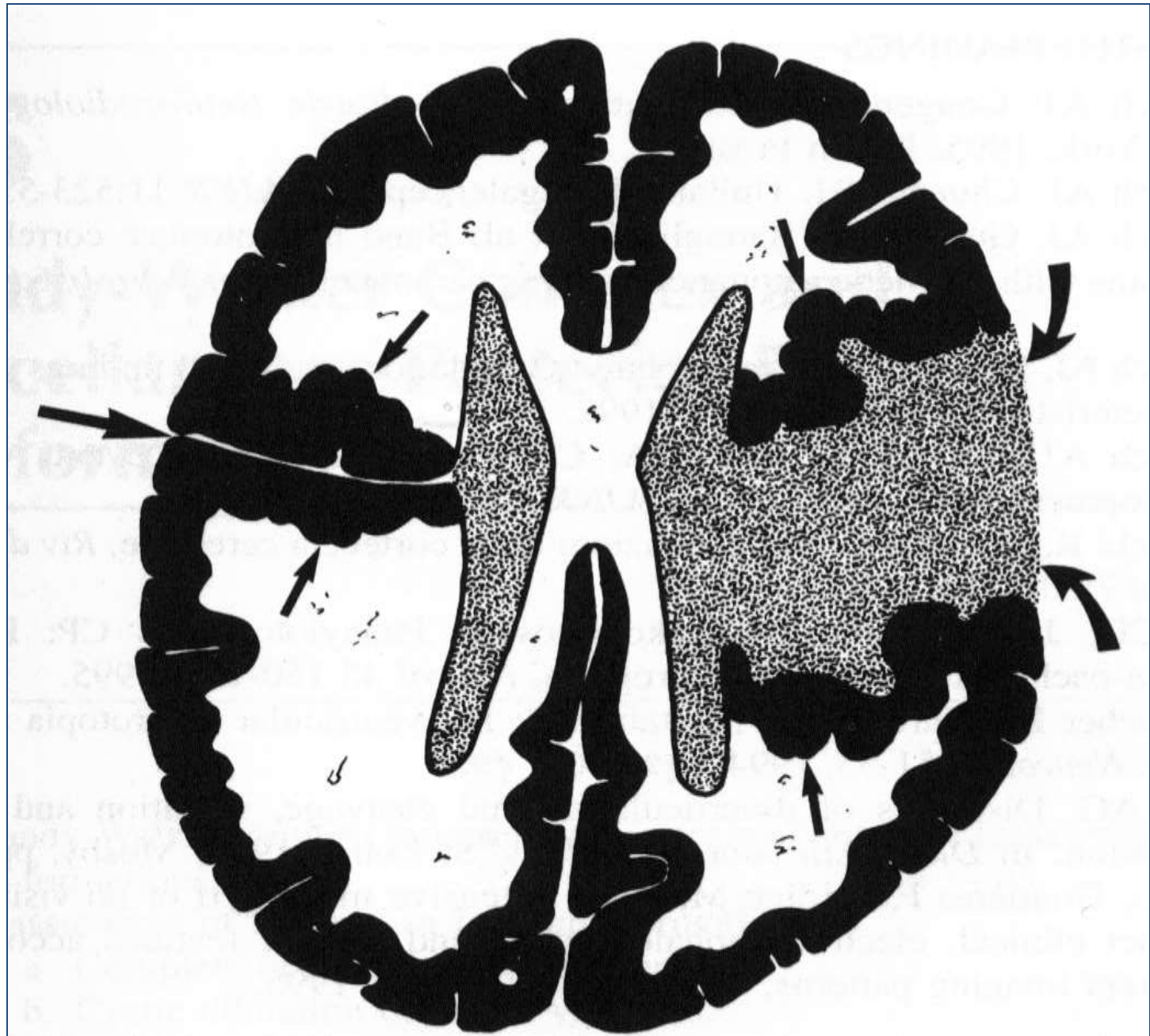


SPLIT THROUGH CORTEX

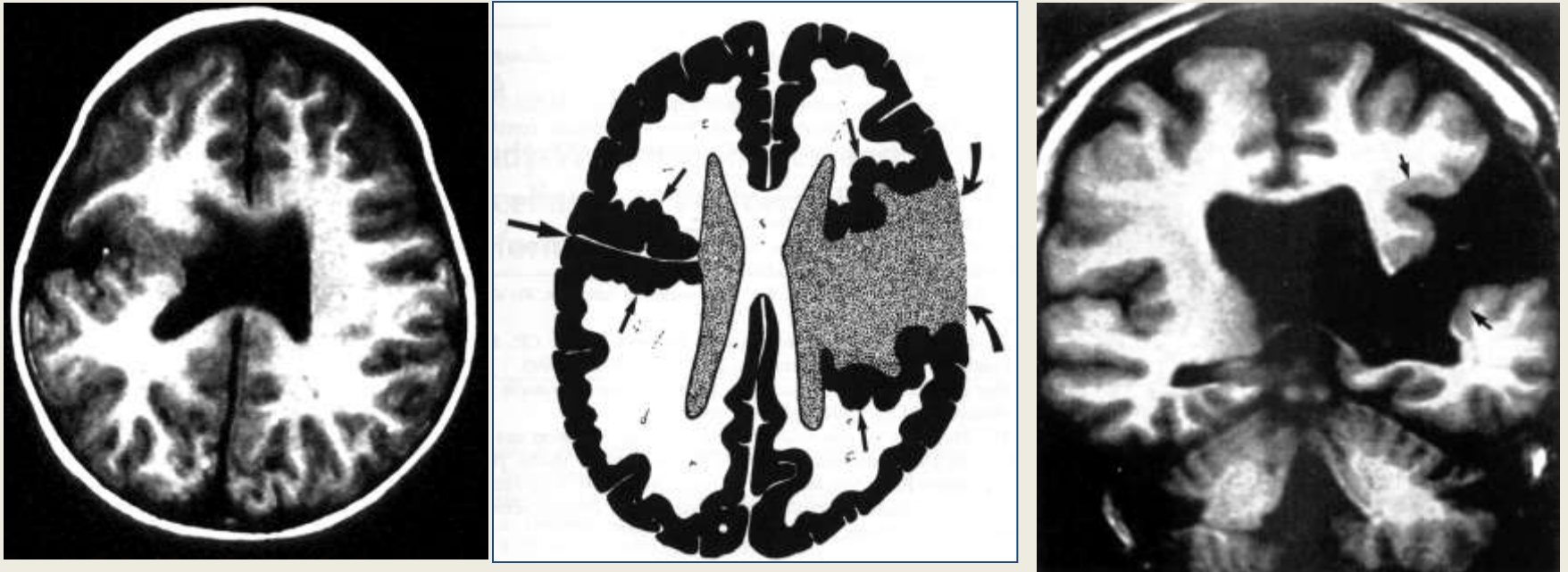
- Split = **Schizen**
- This Schizen ...may be
- Open Lip -Closed Lip



Notice it is
Lined by cortical tissue

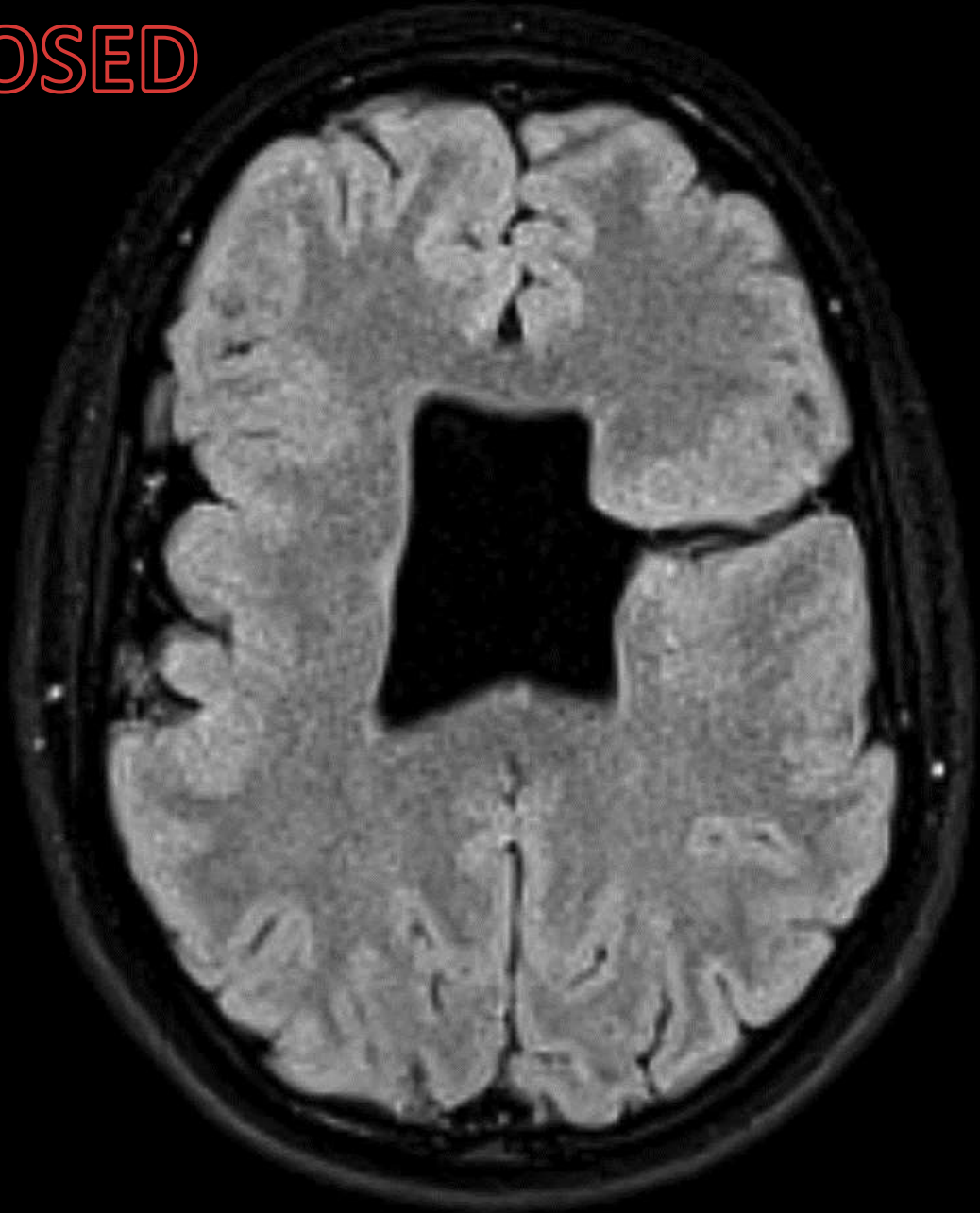


Schizencephaly

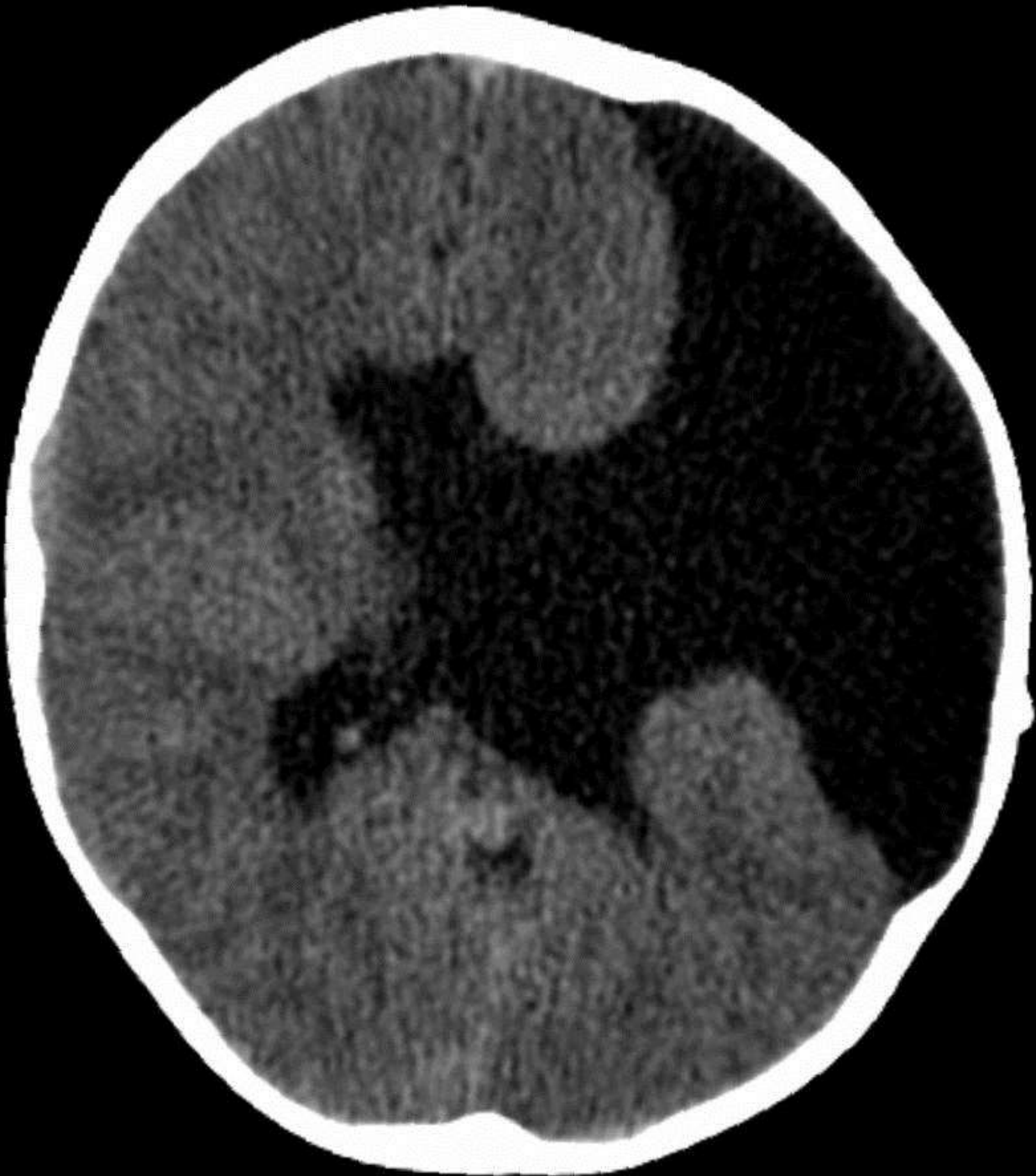


[Anne Osborn, Hand book of Neuroradiology, 1996]

CLOSED



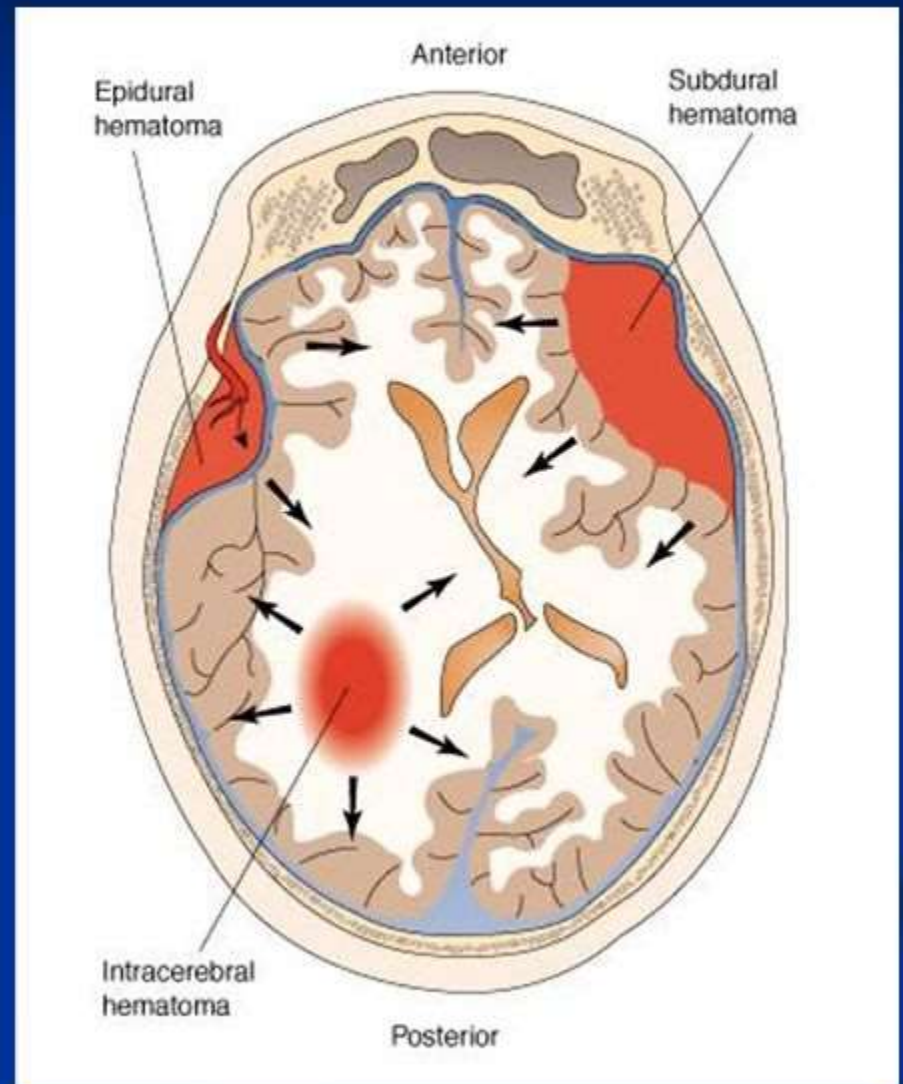
open

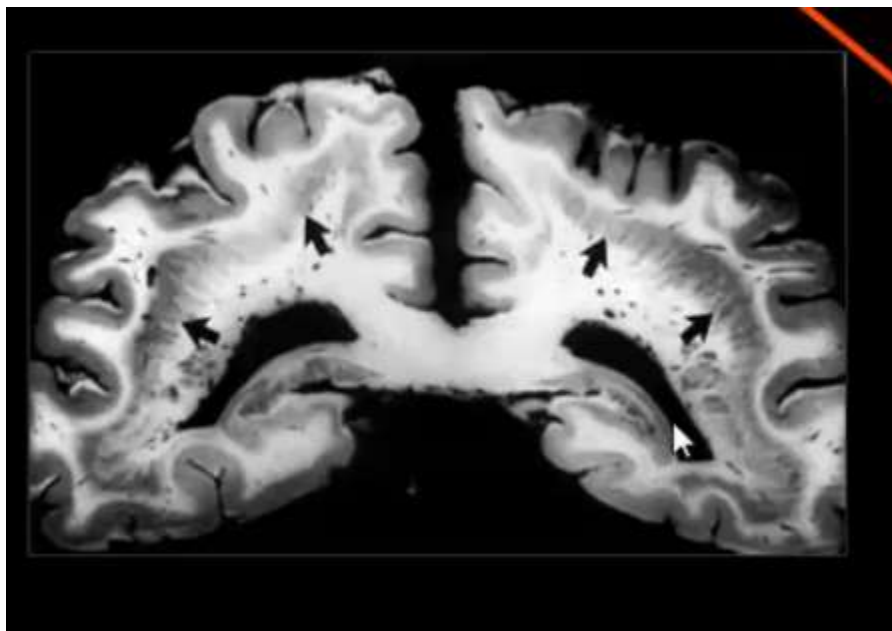


SUMMARY

Intracranial Bleeding

- Extradural
- Subdural
- Subarachnoid
- Intraventricular
- Intraparenchymal





Simply

Cortical Neurons are Migrating From Ventricular wall up to Cortex

If this migration arrested during any stage of its way , this will lead to :

- At Ventricular wall → Sub ependymal heterotopia
- in Its way between Ventricle & cortex → Focal Heterotopia
- Near Cortex → Double cortex

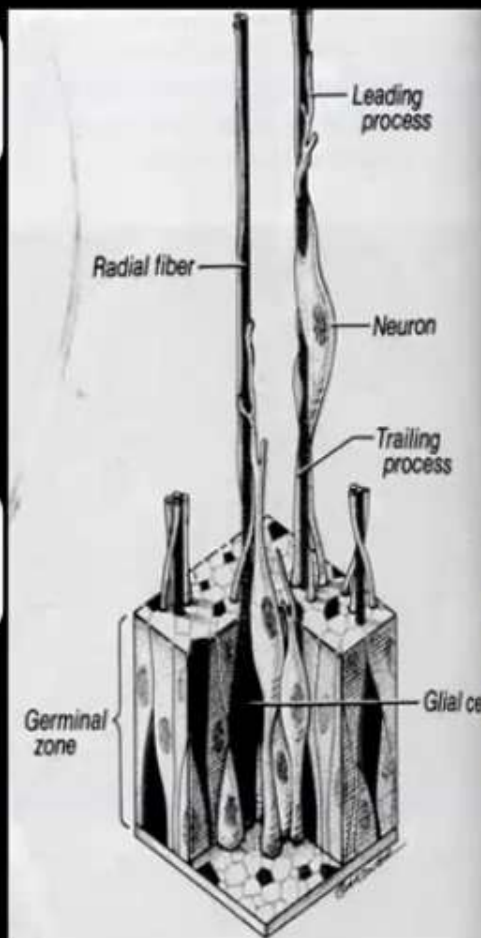
Disorders of Cortical Formation

Organization

- ◆ Polymicrogyria
- ◆ Schizencephaly

Proliferation

- ◆ Hemimegalencephaly
- ◆ Cortical dysplasia
- ◆ Tuberous sclerosis
- ◆ Ganglioglioma
- ◆ Dysembryoblastic NET



Migration

- ◆ Subependymal heterotopia
- ◆ Focal heterotopia
- ◆ Band heterotopia
- ◆ Lissencephaly

Disorders of Cortical Formation

Hetero- topias

- ◆ Subependymal
- ◆ Focal
- ◆ Band

Other lesions

- ◆ Hemimegalencephaly
- ◆ Schizencephaly
- ◆ Cortical dysplasia

Gyral lesions

- ◆ Agyria [Lissencephaly]
- ◆ Pachygyria
- ◆ Polymicrogyria

ISLANDS OF CORTEX



Cortical dysplasia

DNET

Actual neoplasm

Schizen = Split



Sources & Further Reading

- Lectures of Prof. Mamdouh Mahfouz
- MRI Sequences || Radiology Buzz

<https://www.youtube.com/watch?v=MaleOlmjMSE>

- <https://www.slideshare.net/rameshmutiki/mri-basics-how-to-read-and-understand-mri-sequences>
- <https://radiologyassistant.nl/>
- <http://www.learningradiology.com/>
- <https://radiopaedia.org/>

- **Link of Lecture Video:**

<https://www.youtube.com/watch?v=l7OlixF7DzY&t=1054s>

Thank You

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