# CT介紹及BRIAN CT基本判讀

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# Computed Tomography??

- 電腦斷層攝影乃利用無數的X光射線穿透人體，取得影像後，再由電腦予以組成二度空間影像，以觀察身體的內部。

# CT是Beatles的"最大遺產"？

**Sir Godfrey Newbold Hounsfield.**

1919-2004.

CT for brain: 1972-73.

CT for whole body: 1975.

Worked on NMR.

EMIDEC 1100.

Magnetic films for information storage.

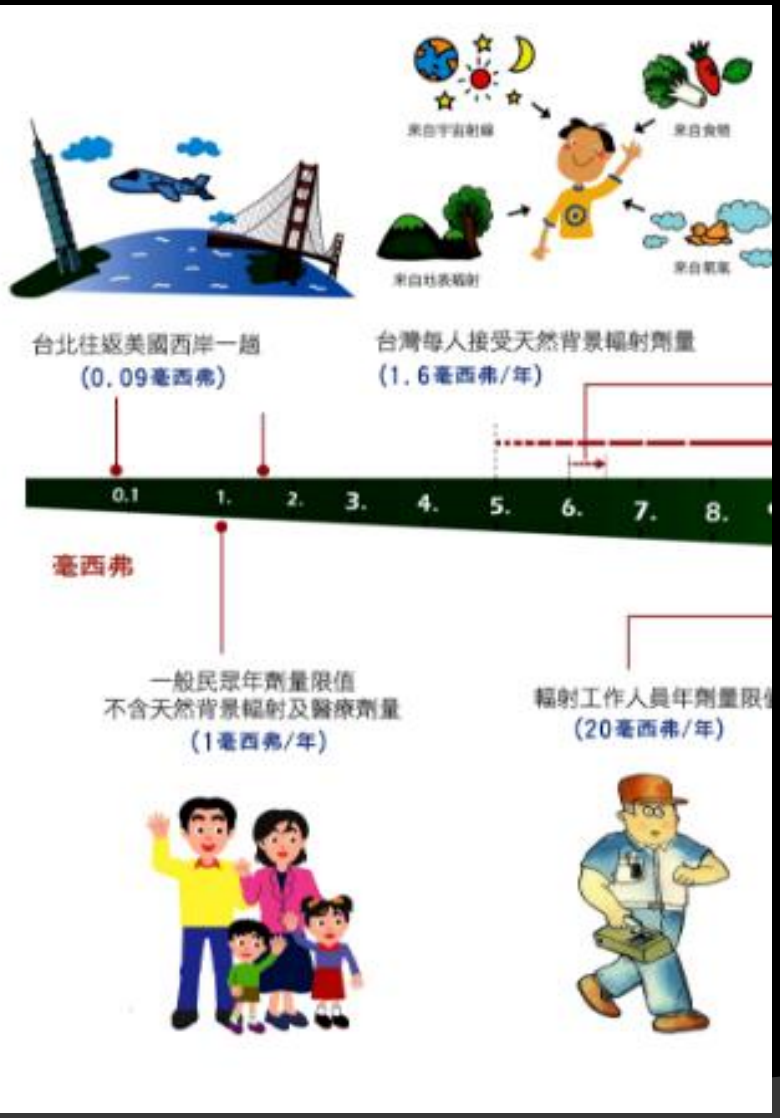
**Nobel prize in 1979.**

Knighted in 1981.

# CT vs MRI,哪個優?

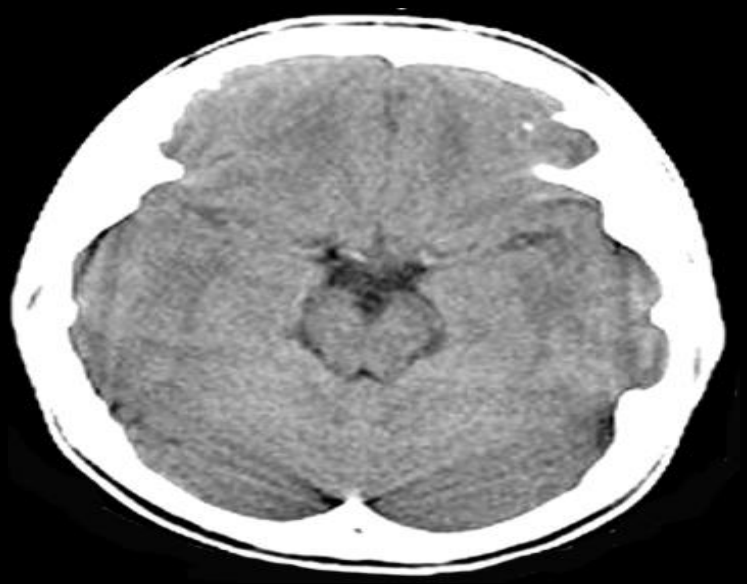
| 部位 | 優劣 |
| --- | --- |
| 頭部 | MRI>CT |
| 頸部 | MRI>CT |
| 胸部 | CT>>MRI |
| 腹部 | MRI>CT, but range… |
| 骨骼 | CT=MRI |
| 肌肉 | MRI>CT |
| 乳房 | ?? |

# 劑量高不高?




| 輻射來源 | 輻射劑量 **mSv** |
|---|---|
| 胸部X光正面 | 0.01-0.03 |
| Head CT | 1-2 |
| Low dose Chest CT | 0.8-1 |
| Chest CT | 5-7 |
| Abdomen + pelvis CT | 8-10 |
| Cardiac CT angiography | 10-20 |
| PET-CT (whole) body scans | 20-25 |

# Which is not CT images ??




(a) (b)

# Window

**Typical Window Settings for Common CT Examinations**

| Examination | Width | Level |
|---|---|---|
| Head | | |
| Posterior fossa | 150 | 40 |
| Brain | 100 | 30 |
| Temporal bone | 2,800 | 600 |
| Neck | | |
| | 250 | 30 |
| Chest | | |
| Mediastinum | 350 | 50 |
| Lung | 1,500 | −600 |
| Abdomen | | |
| Soft tissue | 350 | 50 |
| Liver (high contrast) | 150 | 30 |
| Pelvis | | |
| Soft tissue | 400 | 50 |
| Bone | 1,800 | 400 |
| Spine | | |
| Soft tissue | 250 | 50 |
| Bone | 1,800 | 400 |

- Soft tissue
- Lung
- Bone

# Hounsfield unit (HU)

| Substance | HU |
|---|---|
| Air | −1000 |
| Lung | −500 |
| Fat | −100 to −50 |
| Water | 0 |
| CSF | 15 |
| Kidney | 30 |
| Blood | +30 to +45 |
| Muscle | +10 to +40 |
| Grey matter | +37 to +45 |
| White matter | +20 to +30 |
| Liver | +40 to +60 |
| Soft Tissue, Contrast | +100 to +300 |
| Bone | +700 (cancellous bone) to +3000 (cortical bone) |

# 為何要做CT?

- Right side limb weakness
- trauma with headache
- Lung cancer suspect metastases

- Running nose with cough for 2 days

-
- Check up,check, fu
- .


Go Ahead
It Will Be Fun

# Brain CT的基本概念

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參考資料

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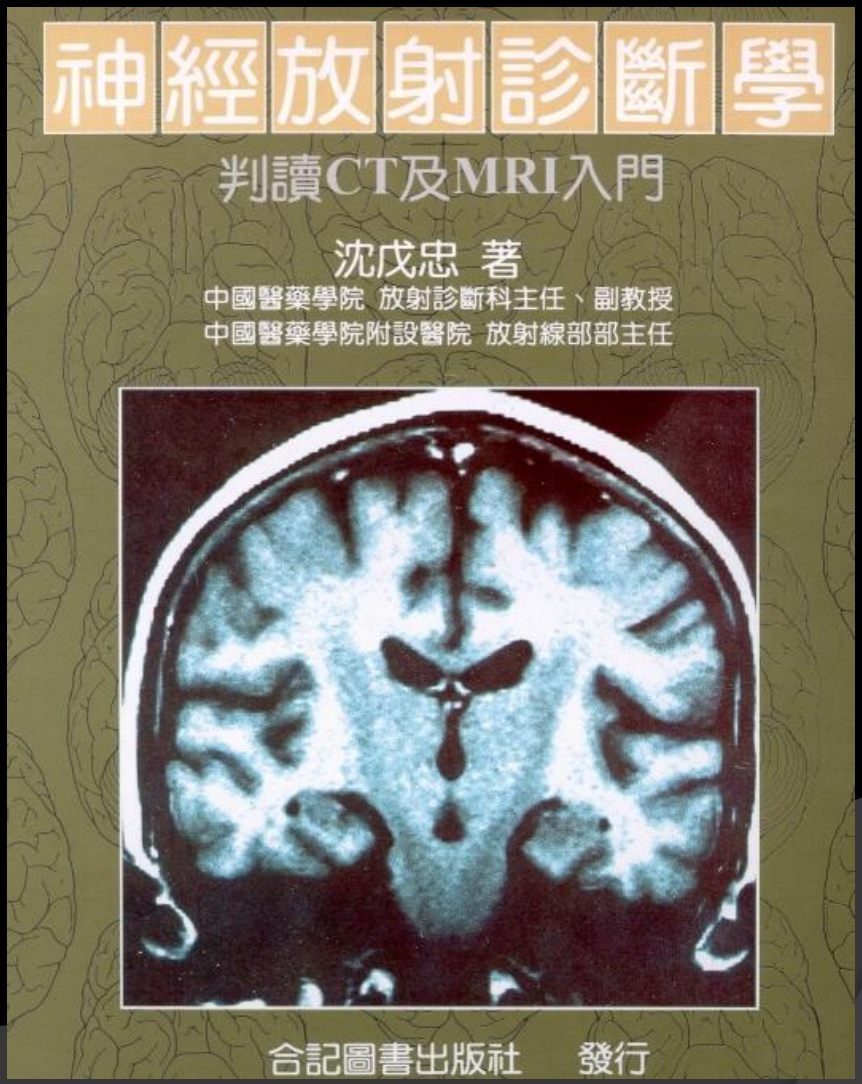
參考書
沈戊忠著：神經放射診斷學
合記書局出版




項次:

腦的CT解剖

腫塊效應

腦疝脫herniation

出血HU

像出血但不像

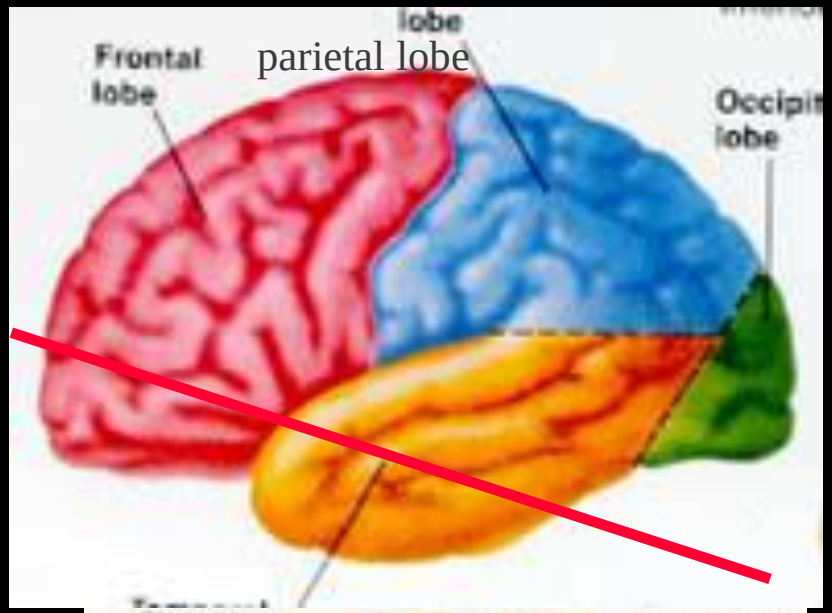
# Why brain CT ?

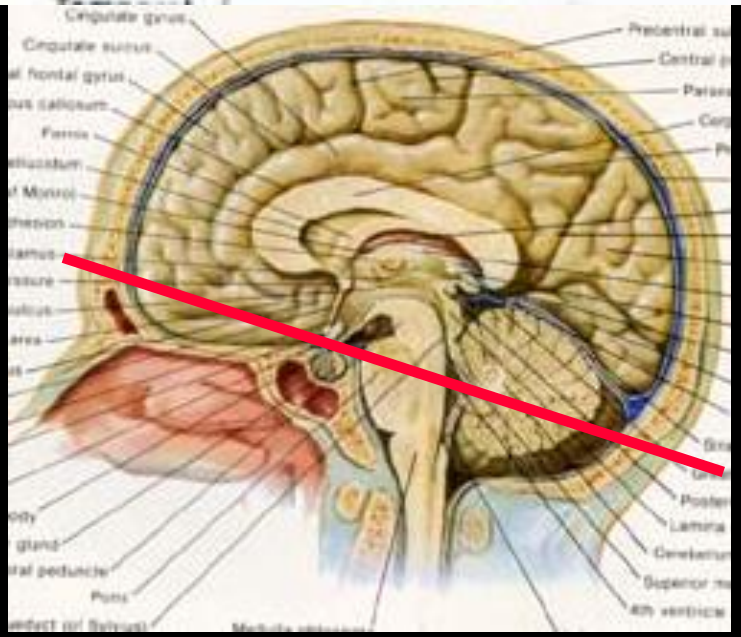
- Greater availability, lower cost, and superior ability to show bone and acute hemorrhage (*emergent patient)
- Acute infarction

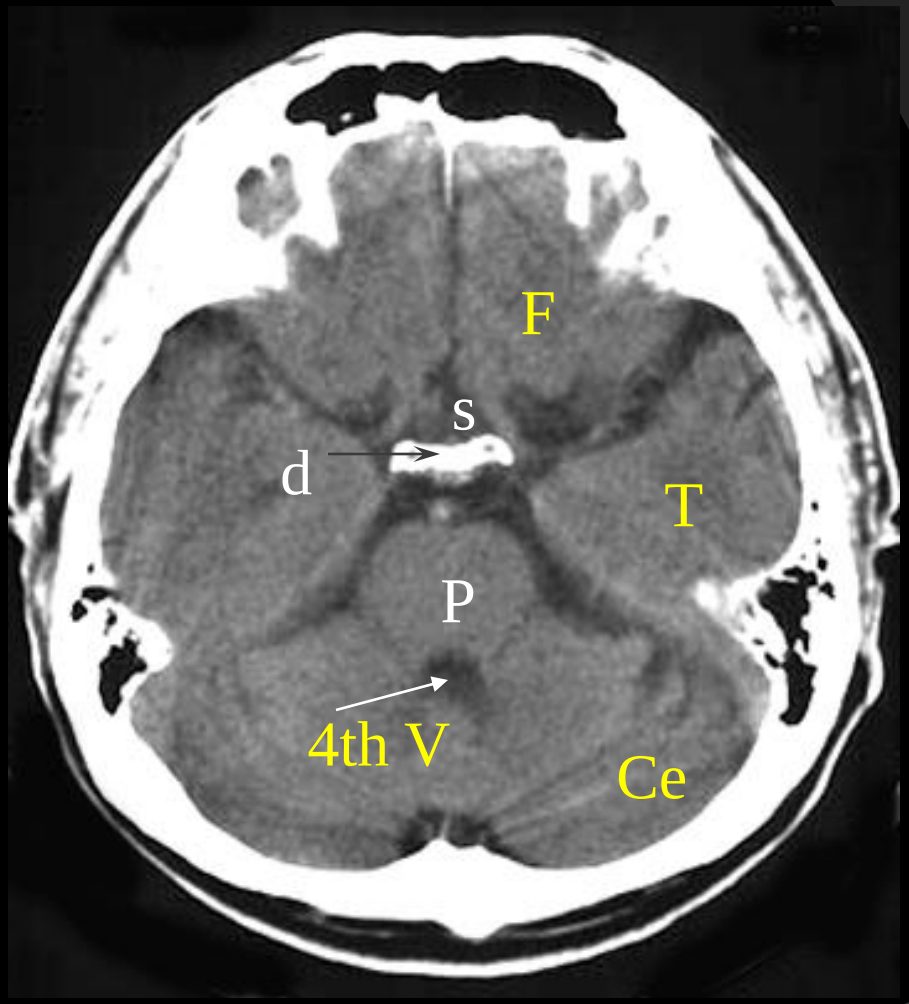
- Brain tumor →MRI
- Brain abscess →MRI
- Meningitis → lumbar puncture

# 認識CT of Brain 的解剖

- Brain parenchyma (腦實質)
  - frontal lobe, temporal lobe, parietal lobe, occipital lobe, cerebellum, basal ganglia, brainstem, corpus callosum
- Subarachnoid spaces (蜘蛛網膜下腔, CSF spaces)
  - Ventricles (腦室)--- lateral, 3rd, 4th ventricles
  - Cisterns (腦池)--- suprasellar, quadrigeminal cisterns….
  - Fissures (腦裂)--- Sylvian, interhemispheric fissures…
  - Sulci (腦溝)



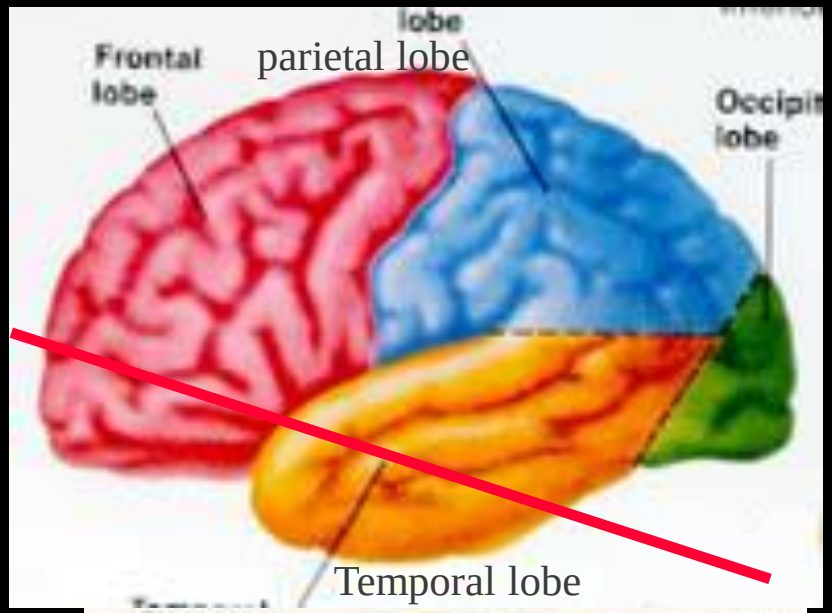


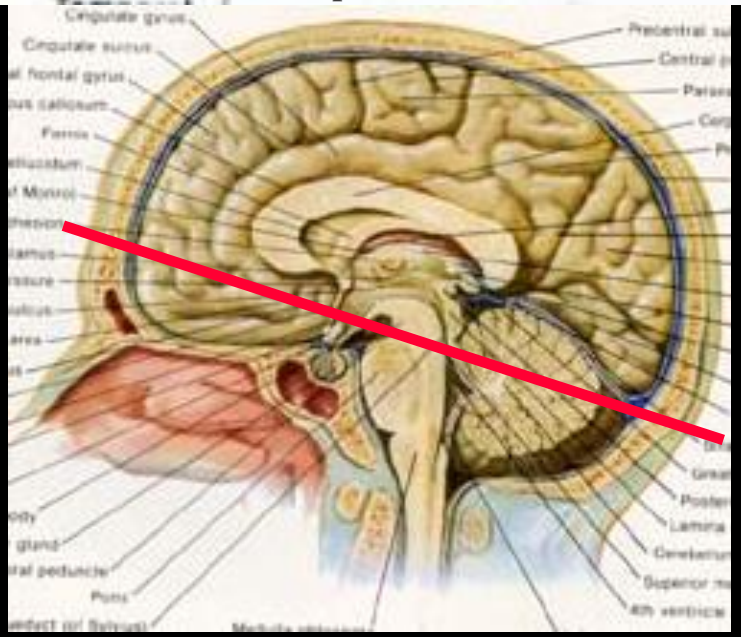

F: frontal lobe P: pons

T: temporal lobe

s: suprasellar cistern (碟鞍上腦池)

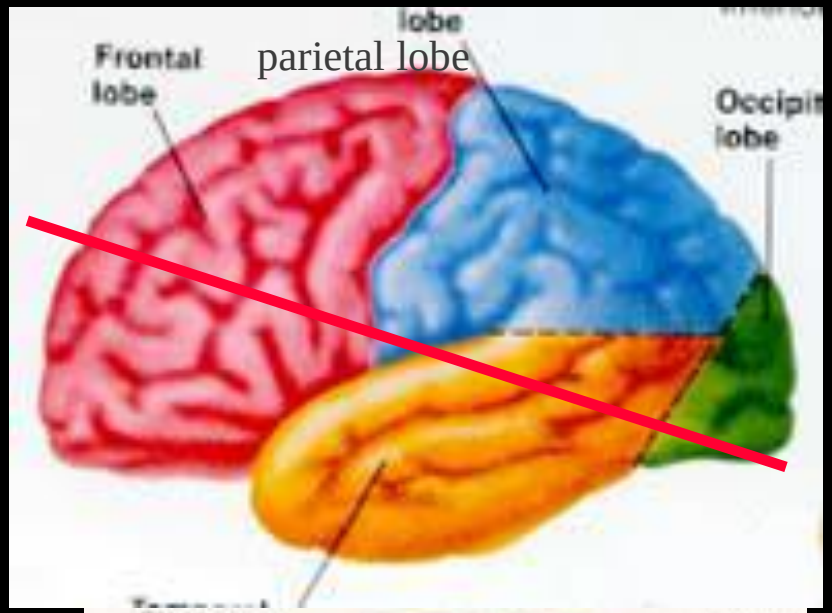
Ce: cerebellum d: dorsum sella

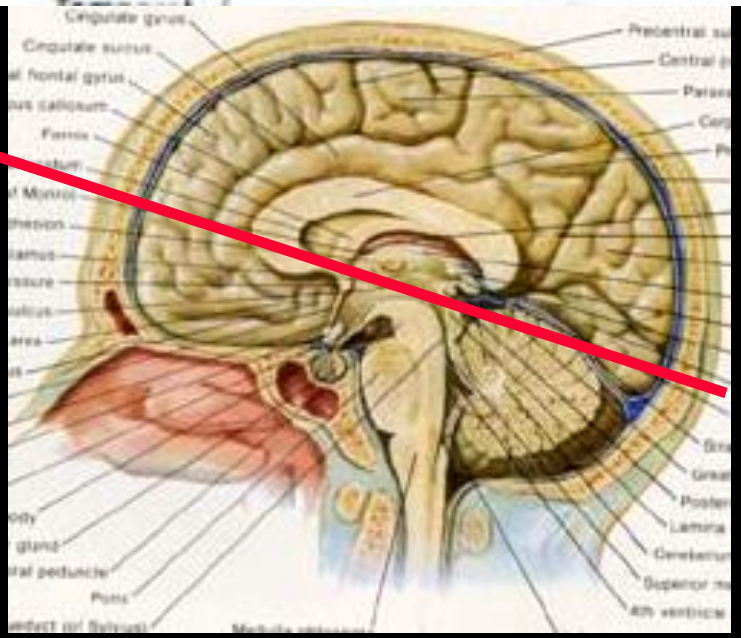


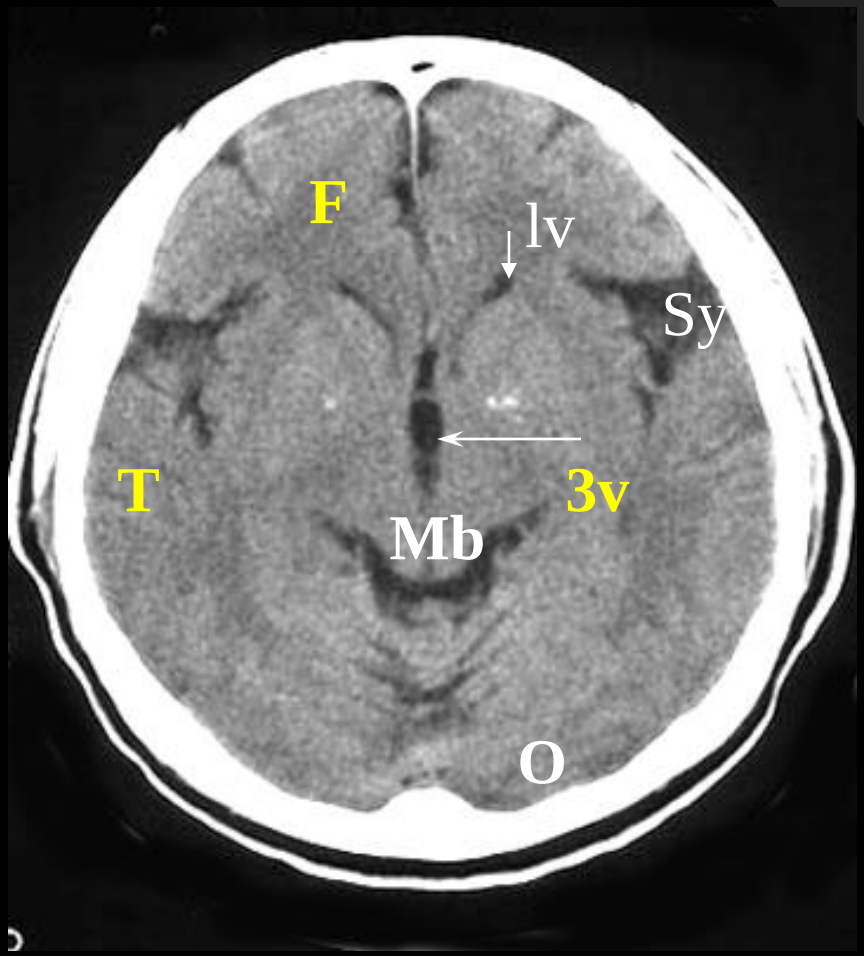




F: frontal lobe
T: temporal lobe
Ce: cerebellum

Mb: midbrain

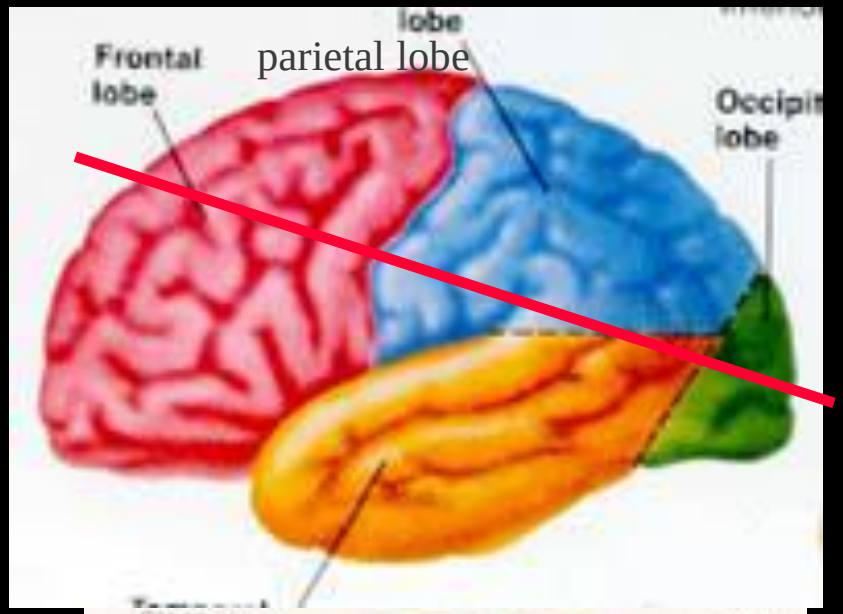


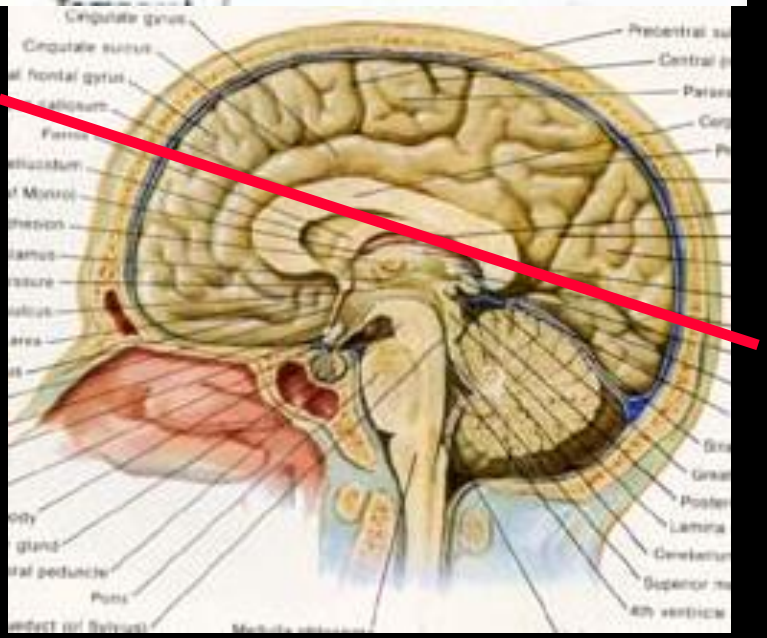



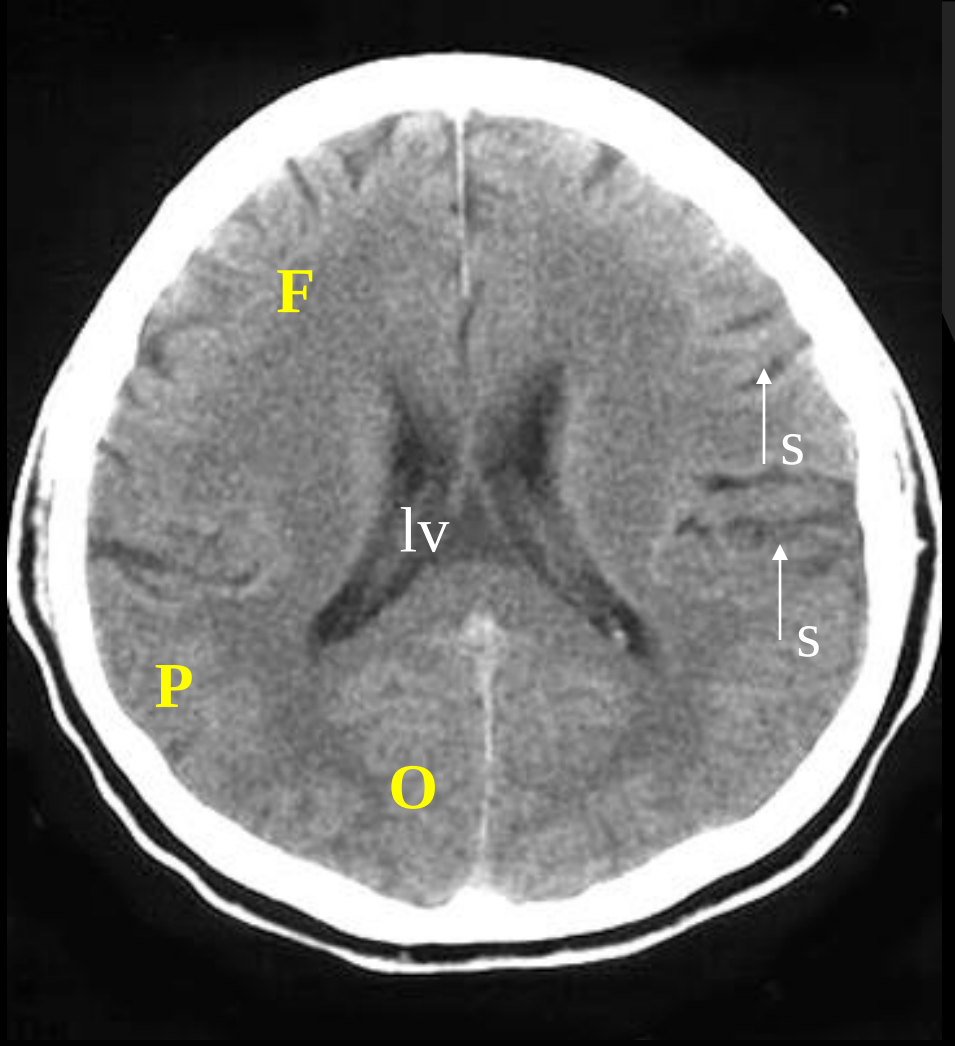



F: frontal lobe
T: temporal lobe
Mb: midbrain
lv: lateral ventricle

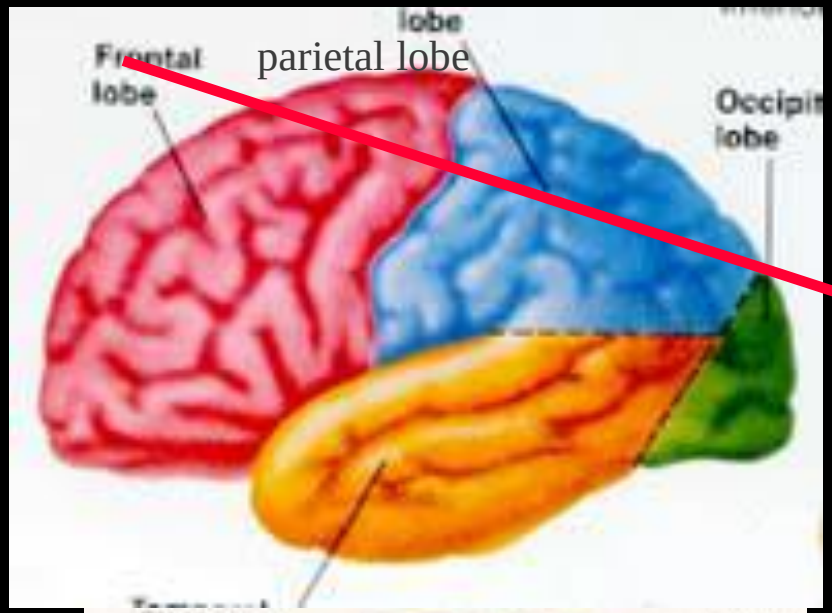
Sy: Sylvian fissure
O: occipital lobe
3v: 3rd ventricle

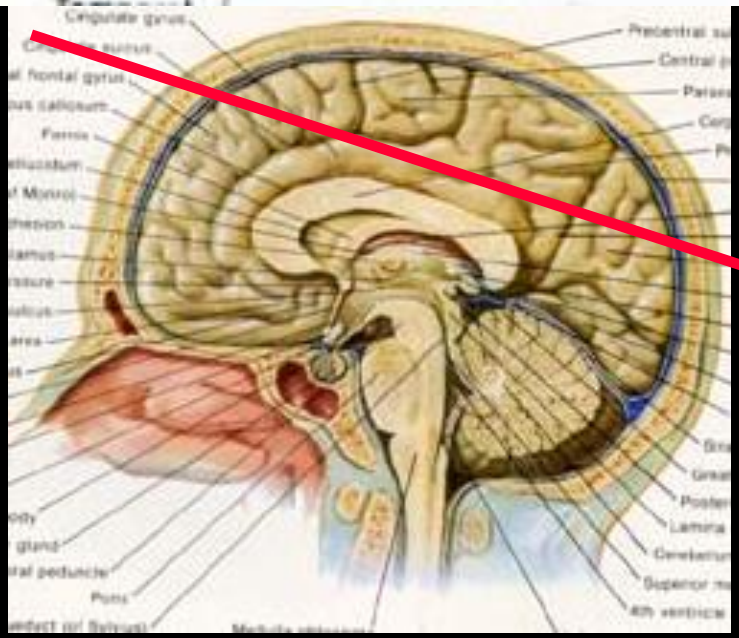


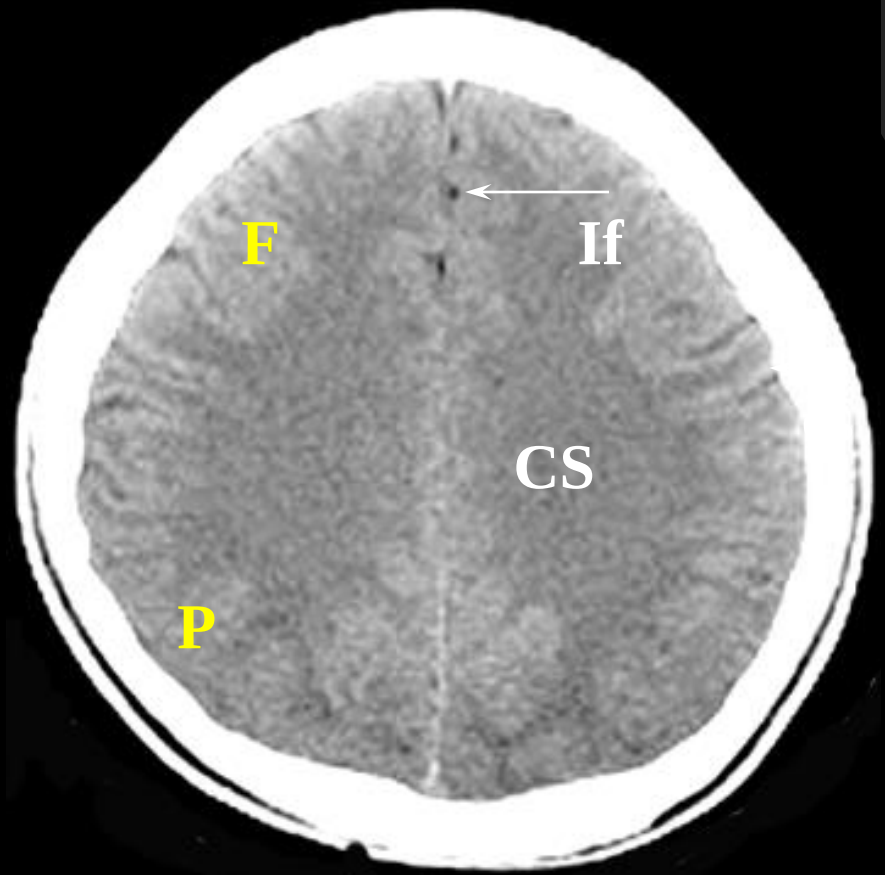






F: frontal lobe P: parietal lobe
O:occipital lobe
lv: lateral ventricle
s: sulcus

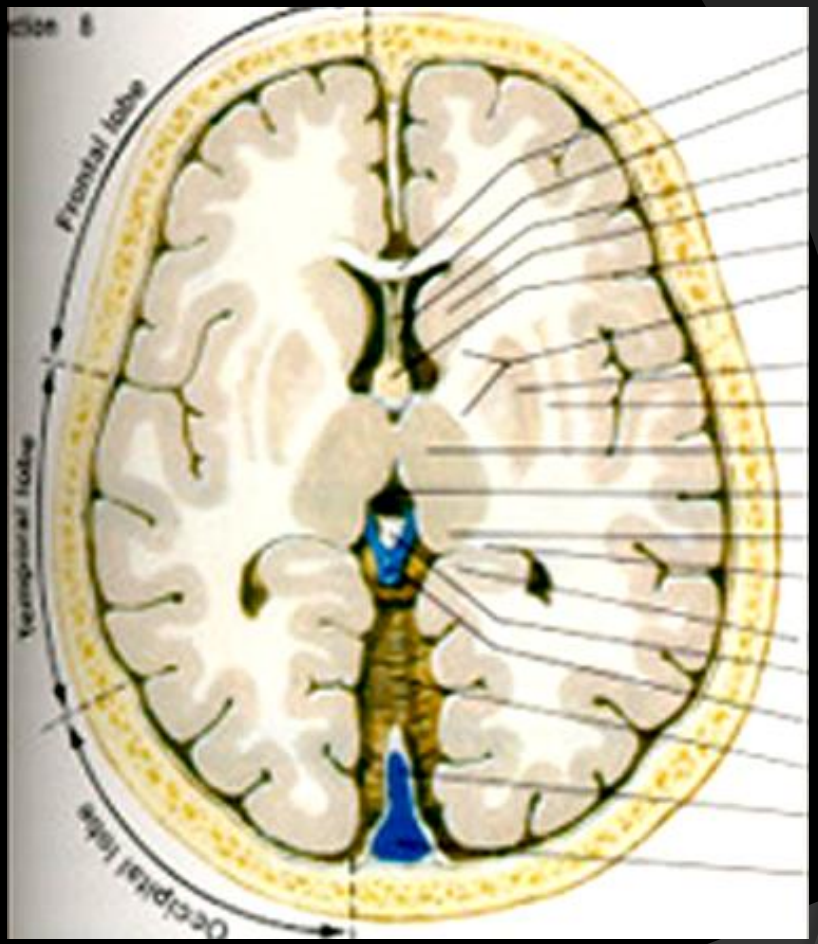





F: frontal lobe  If: interhemispheric fissure
P: parietal lobe
CS: centrum semioval

# Basal ganglia


c: caudate nucleus p: putamen g: globus pallidus
t: thalamus i: internal capsule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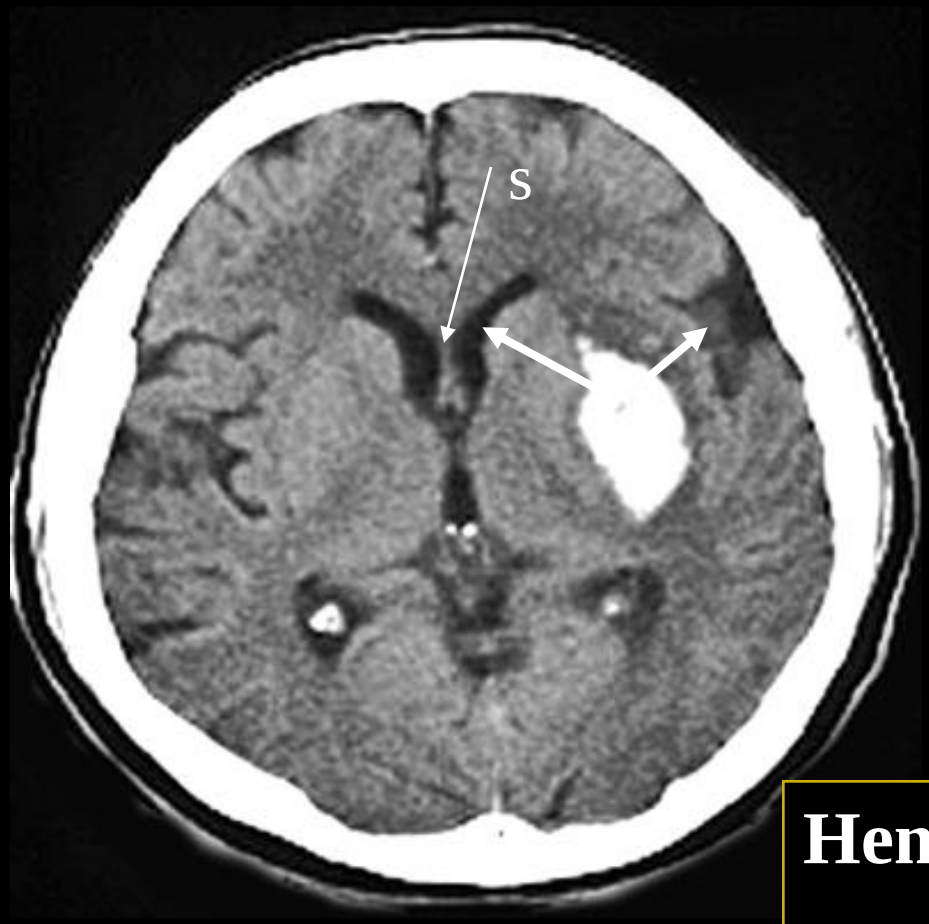
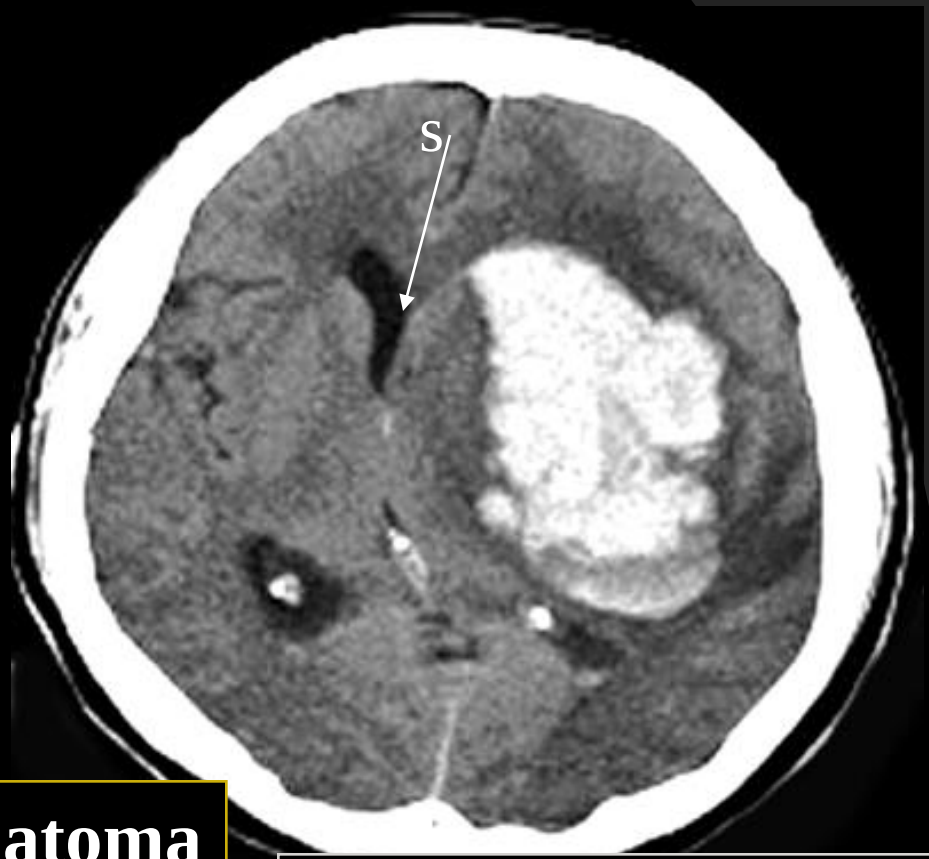
# 腫塊效應 Mass Effect

- 在判讀CT及MRI時, 腫塊效應的觀念非常重要。 腫瘤, 血塊, 腦水腫等等會對腦組織造成壓迫, 就是一種腫塊效應。
- 腫塊效應的判讀以觀察蜘蛛網膜下腔構造被壓迫較觀察腦組織被壓迫來得明顯, 其徵象如下:
  - 1. 病灶周圍的腦室, 腦池, 腦裂, 腦溝等蜘蛛網膜下腔構造被壓扁或完全消失
  - 2. 中線構造, 如大腦簾, 透明中隔(septum pellucidum)往對側移。
  - 3. 如foramen of Monro也被壓迫, 引起對側腦室CSF循環不良, 對側腦室會稍為擴張。
  - 4. 當腫塊效應壓迫第三或第四腦室, 或大腦導水管時, 會造成腦室積水 (hydrocephalus)。
  - 5. 當雙側都有腫塊效應時，側腦室的額角因被壓迫, 呈現兔耳朵狀。
  - 6. 嚴重的腫塊效應會造成腦的疝脫 (herniation), 即大腦簾下疝脫 (subfalcial herniation), 海馬鉤疝脫(uncal herniation), 經小腦天幕疝脫 (transtentorial herniation), 小腦舌部疝脫(tonsilar herniation)。



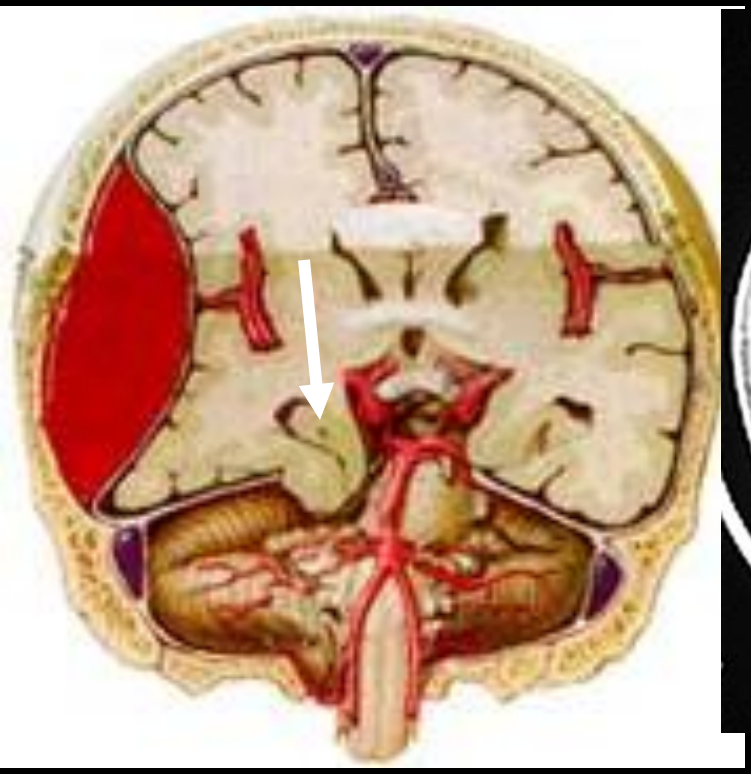



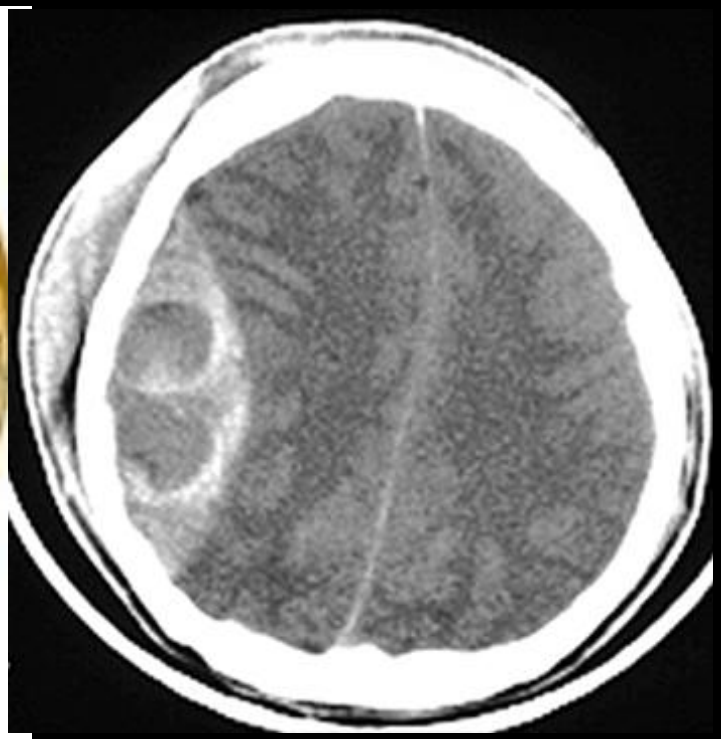

**Hematoma**
血腫

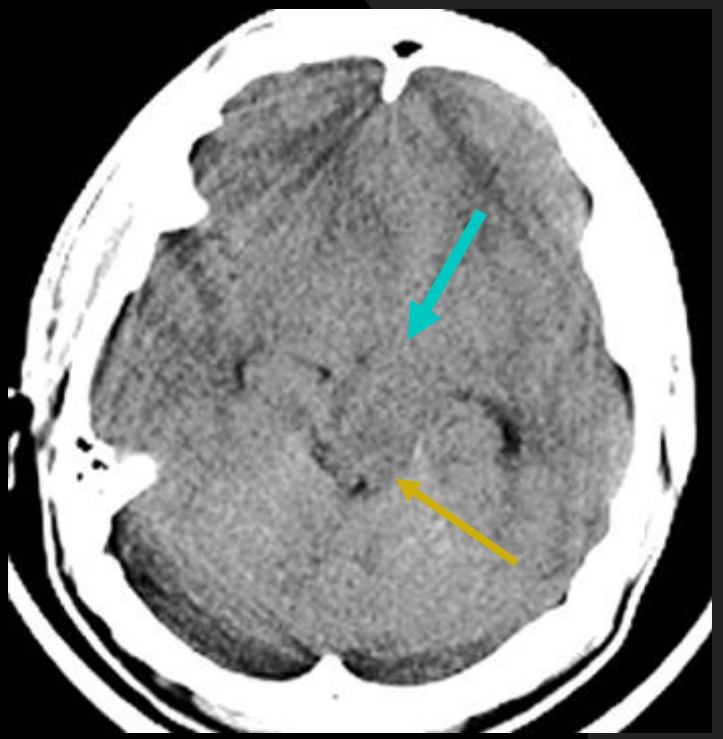
hematoma more enlarged
mass effect is stronger

Mass effect:

1. The ipsilateral ventricle, sulci, fissures are compressed and obliterated, disappeared.
2. Midline is shifted.
3. The contra-lateral ventricle is dilated.



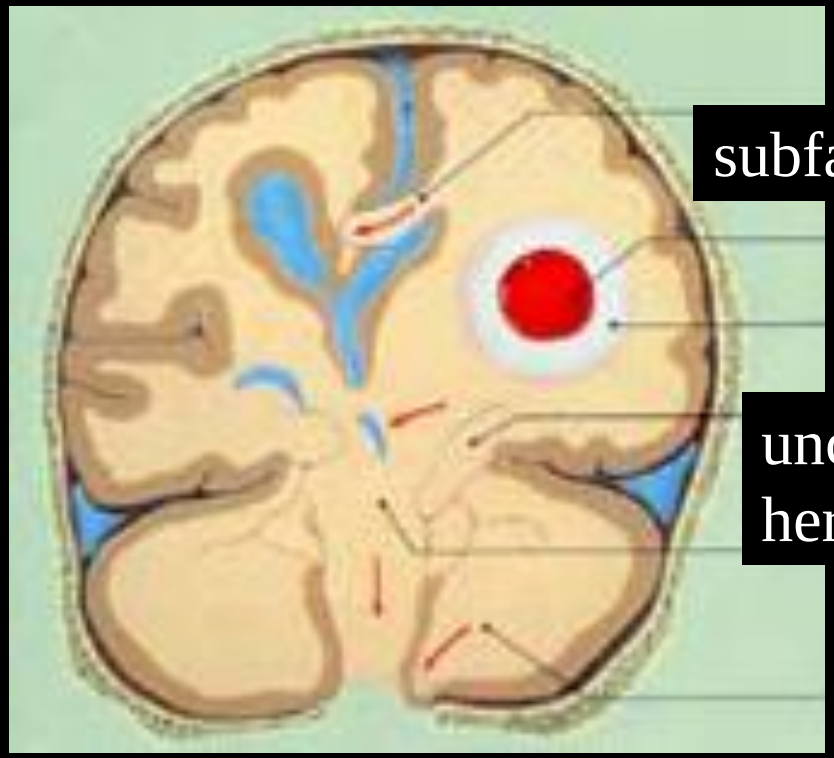




# Hematoma
# 血腫

Acute epidural hematoma,
causes strong mass effect with
uncal/transtentorial herniation
---obliteration of the suprasellar cistern (red arrow)
and the quadrigeminal cistern (green arrow)

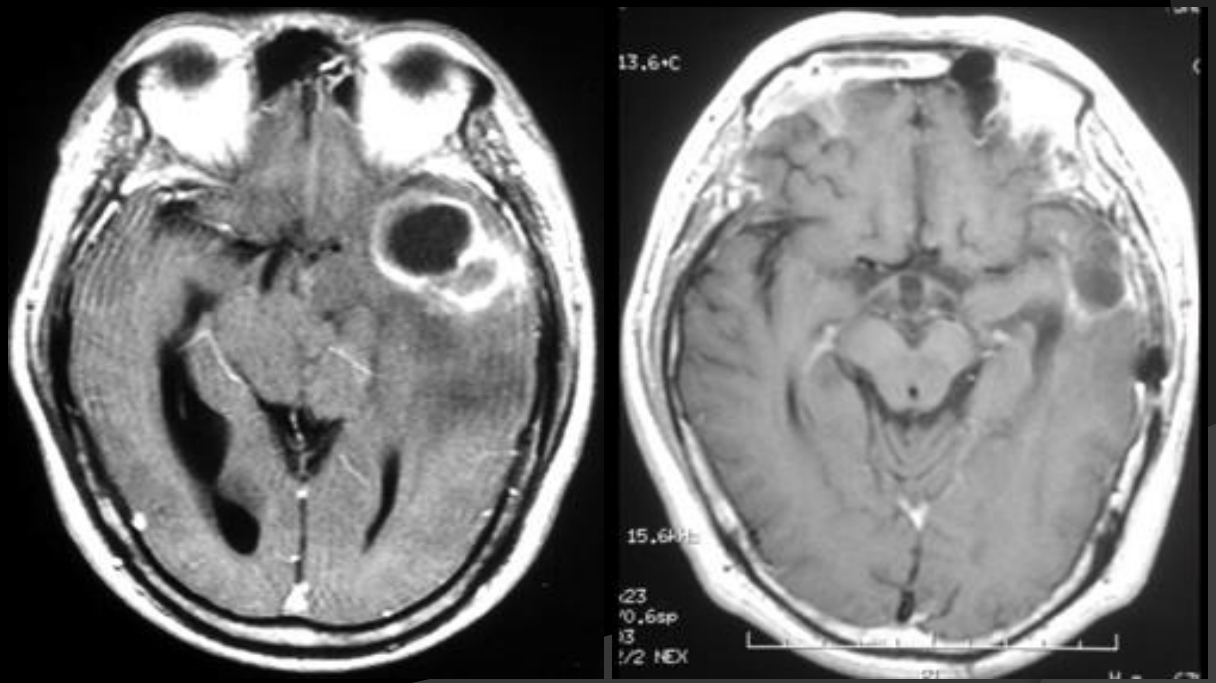
# Strong mass effect



subfalcine herniation

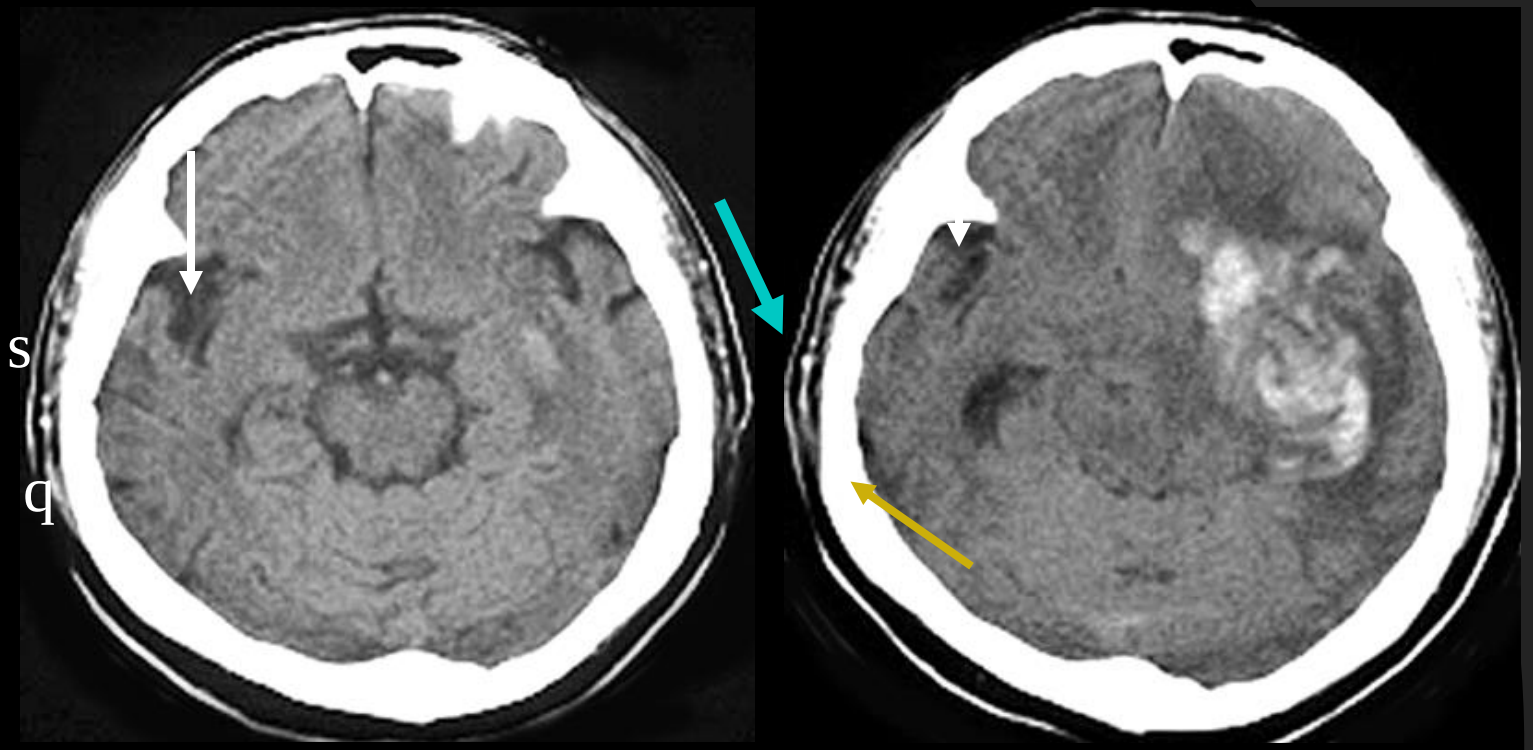
uncal/transtentorial herniation

(obliteration of the suprasellar cistern/quadrigeminal cistern)



Before surgery, a big GBM in the left temporal lobe with uncal herniation.
After surgery, the GBM was removed, the suprasellar cistern and quadrigeminal cisterns are normal.

CVA with ICH



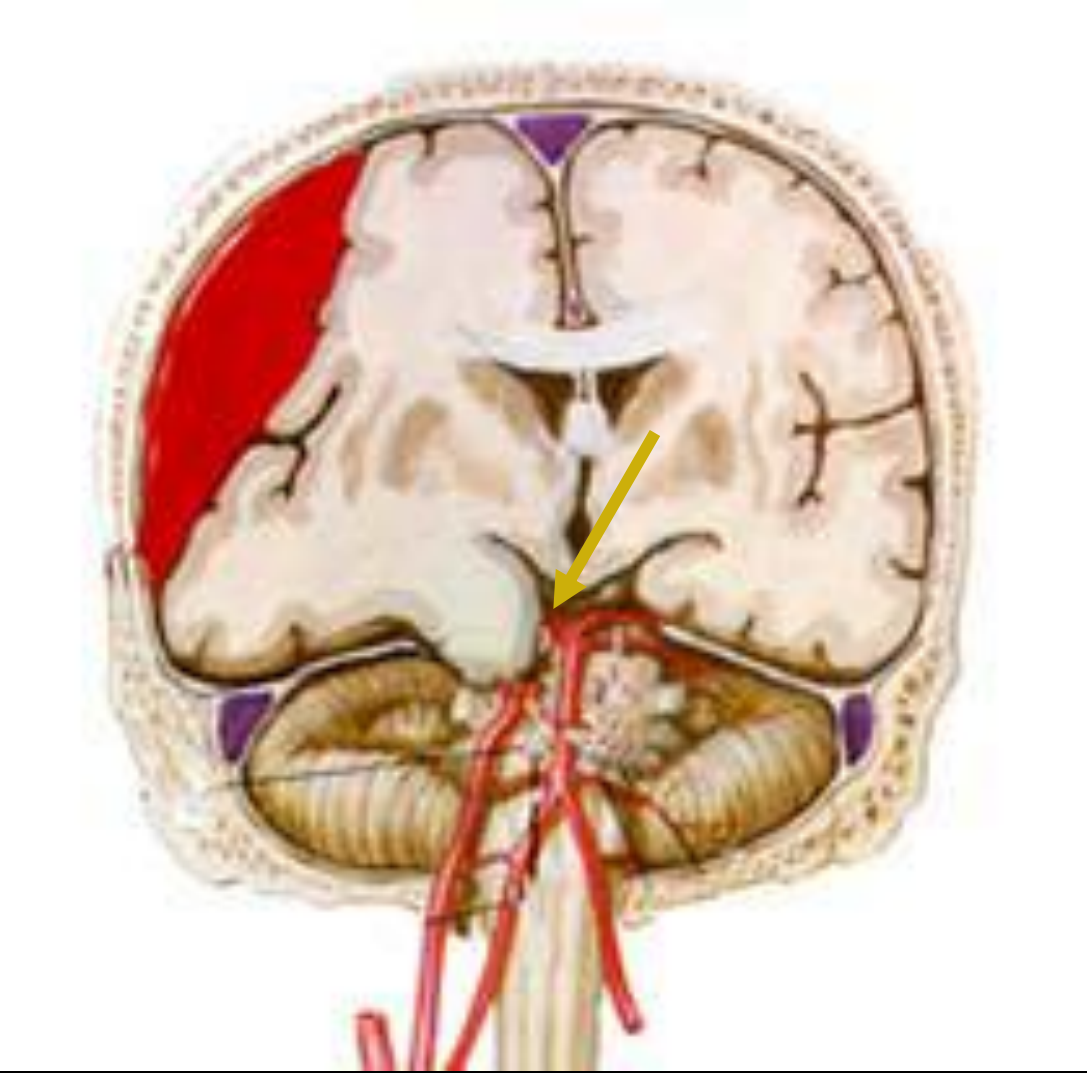

Mass effect:

1. The ipsilateral ventricle, sulci, fissures are compressed and obliterated, disappeared.
2. Midline is shifted.
3. The contra-lateral ventricle is dilated.

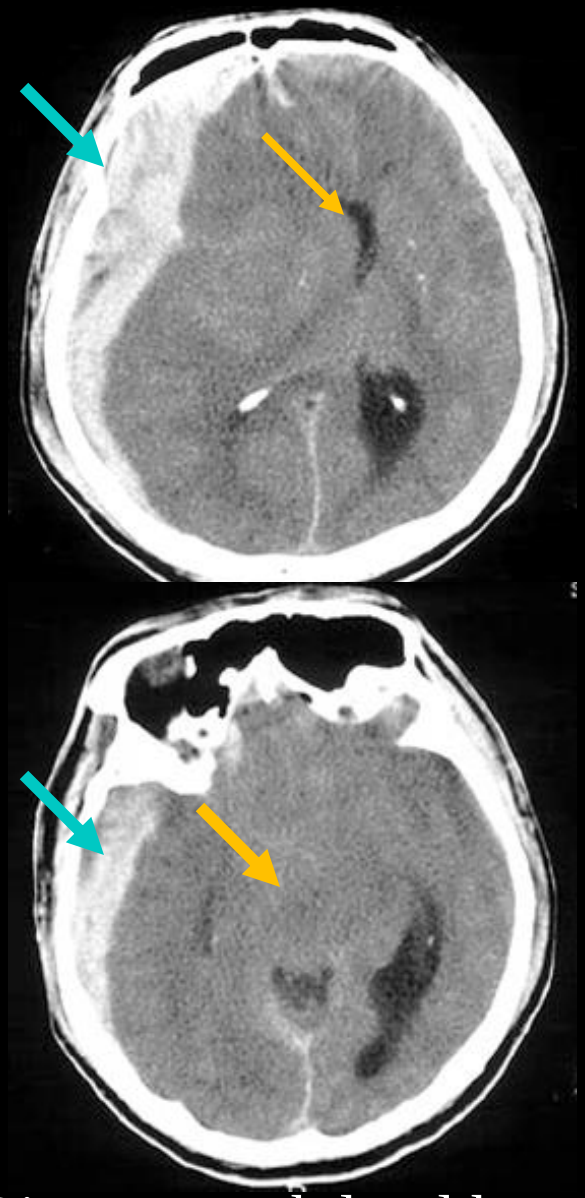
Severe mass effect:

Uncal/transtentorial herniation---- obliteration of the **suprasellar cistern(s) and quadrigeminal cistern(q)**

# Complication of uncal/transtentorial herniation:



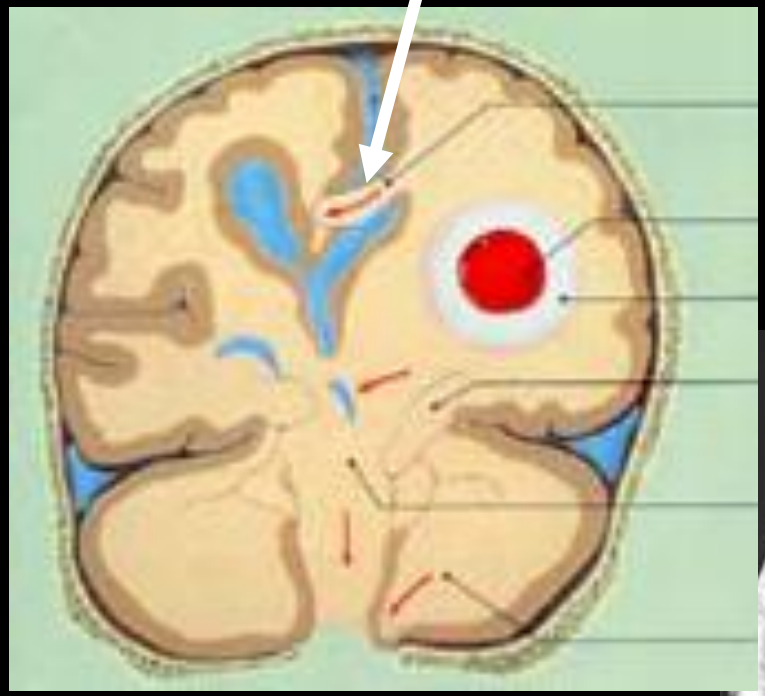
Posterior cerebral artery (PCA) is compressed, causing infarction. Sometime, middle cerebral artery (MCA), or other small artery supplying the basal ganglia are compressed and causing infarction.

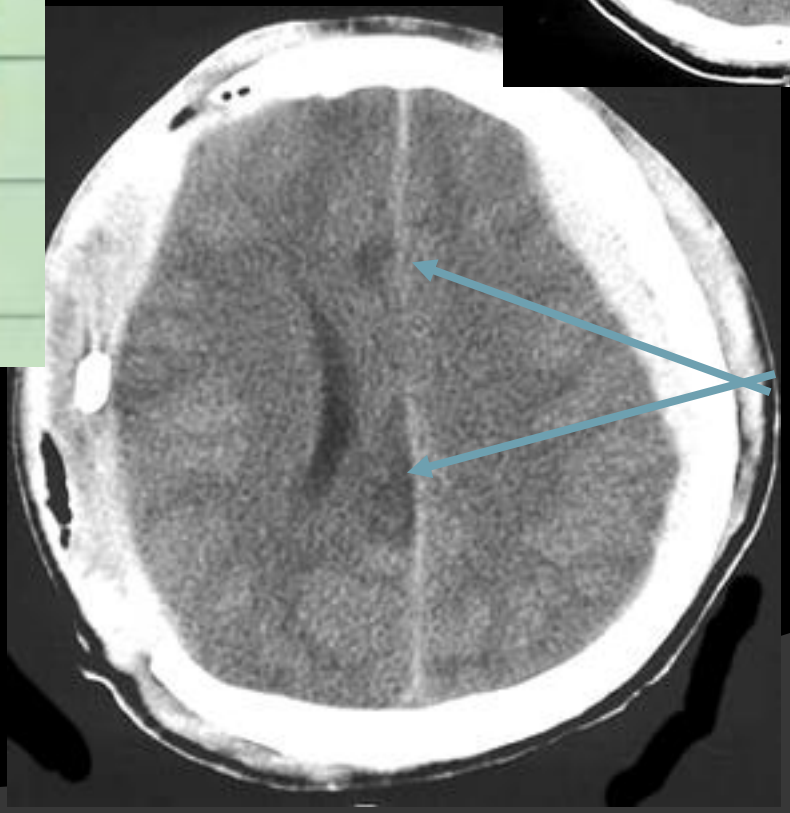


Acute infarction of right posterior artery (PCA), this is a complication of uncal/transtentorial herniation, because the PCA was compressed by brain herniation.

Big acute subdural hematoma caused strong mass effect with uncal/transtentorial herniation.

Subfalcial herniation may compressing the anterior cerebral artery (ACA), causing infarction



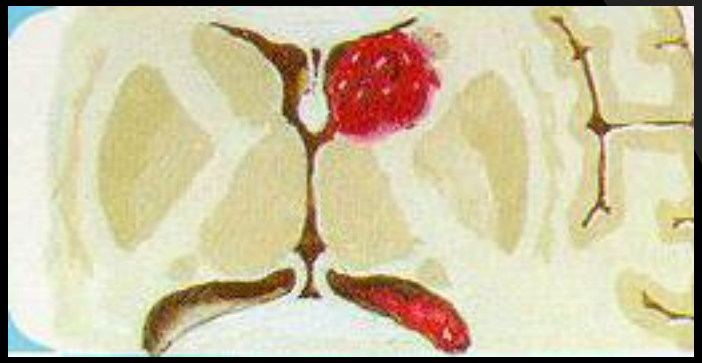


ACA infarction

# Hounsfieldunit (HU)

| Substance | HU |
|---|---|
| Air | −1000 |
| Lung | −500 |
| Fat | −100 to −50 |
| Water | 0 |
| CSF | 15 |
| Kidney | 30 |
| Blood | +30 to +45 |
| Muscle | +10 to +40 |
| Grey matter | +37 to +45 |
| White matter | +20 to +30 |
| Liver | +40 to +60 |
| Soft Tissue, Contrast | +100 to +300 |
| Bone | +700 (cancellous bone) to +3000 (cortical bone) |


Gray matter 40 Hu
White matter 35Hu
Bone 1000Hu
CSF 4Hu



fresh blood clot 70-90Hu

blood clot 30-50Hu

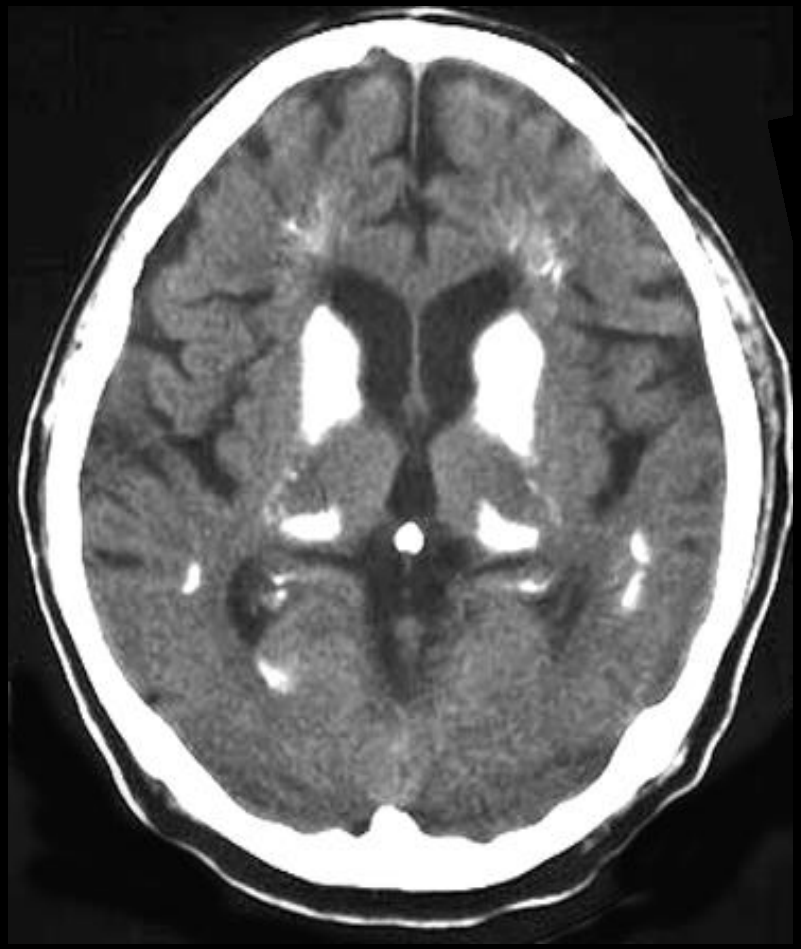
A case of hyperparathyroidism with big calcifications in the bil. basal ganglia, thalami, dentate nuclei

Calcification:  100-500 Hu

# 像出血!!??

- 有那麼剛好,兩邊同位置出血
- 這麼會躲 我好細心

# 有那麼剛好,兩邊同位置出血??



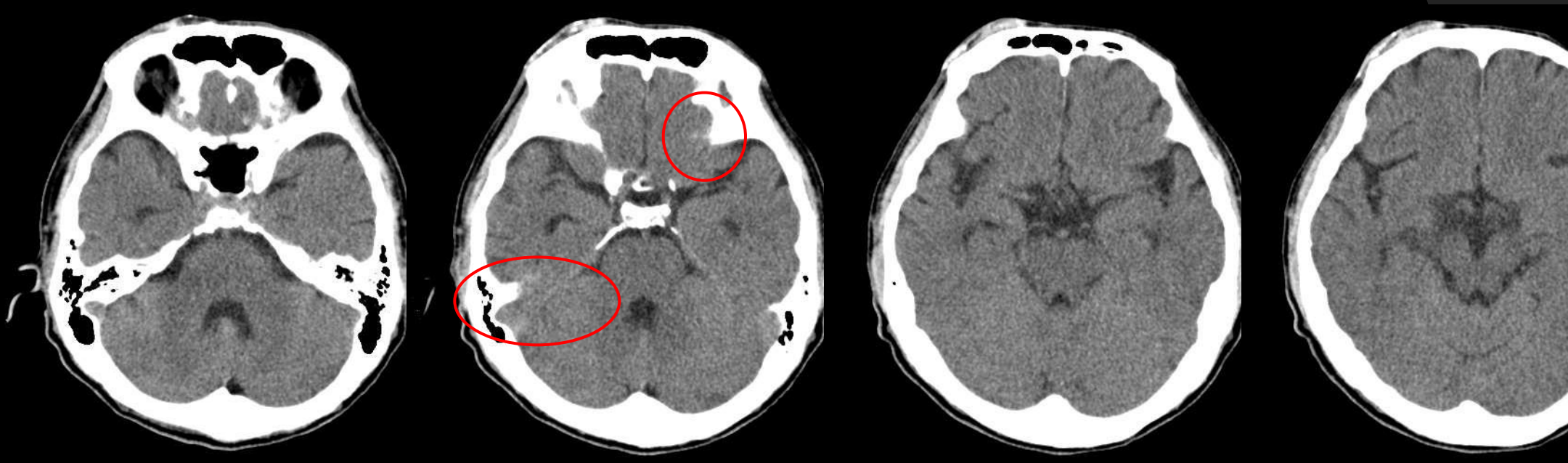
# 有急性出血,我好細心

# d. Partial volume effect



**Floor of ant cranial fossa, as frontal bone is irregular (bone and brain) DDx hge (bright)**

# 這麼會躲 我好細心



該怎麼辦...誰說的對?

# 別太貪心!!

- Brain CT without contrast

before contrast

Contrast medium enhancement

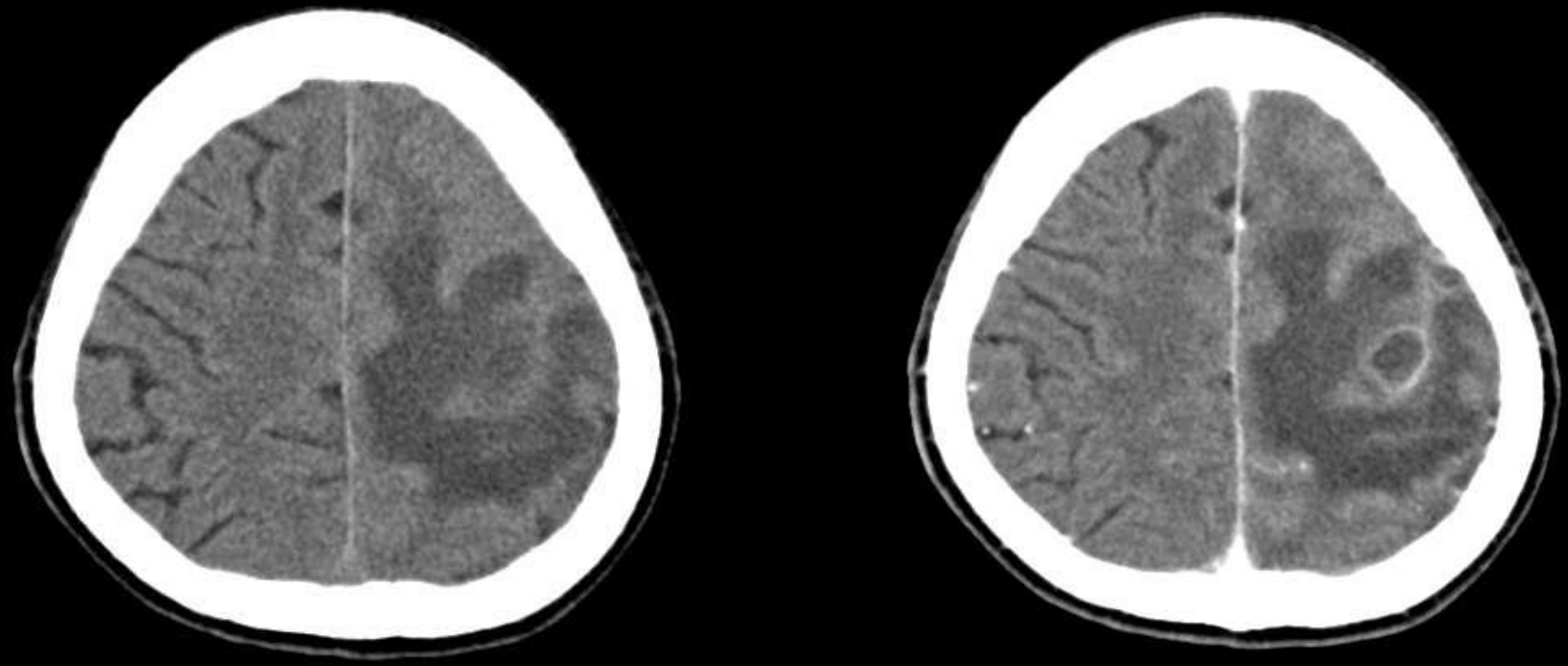
- Brain abscess-- ring enhancement
- enhancement of the capsule of abscess

Plain CT

Contrast medium enhancement

- Brain tumors---breast ca. with right occipital bone metastasis

# M/50 , HIV(+)



# 最後 請起床 請記得

- 開單要寫原因
- 記得換窗戶(window)
- 中庸之道 不偏不倚
- 哪些是出血-
  - 有點亮又不是很亮
  - 有那麼剛好,兩邊同位置出血
- 別太貪心
- 歡迎來討論