



山东省医学影像学研究所

Shandong Medical Imaging Research Institute



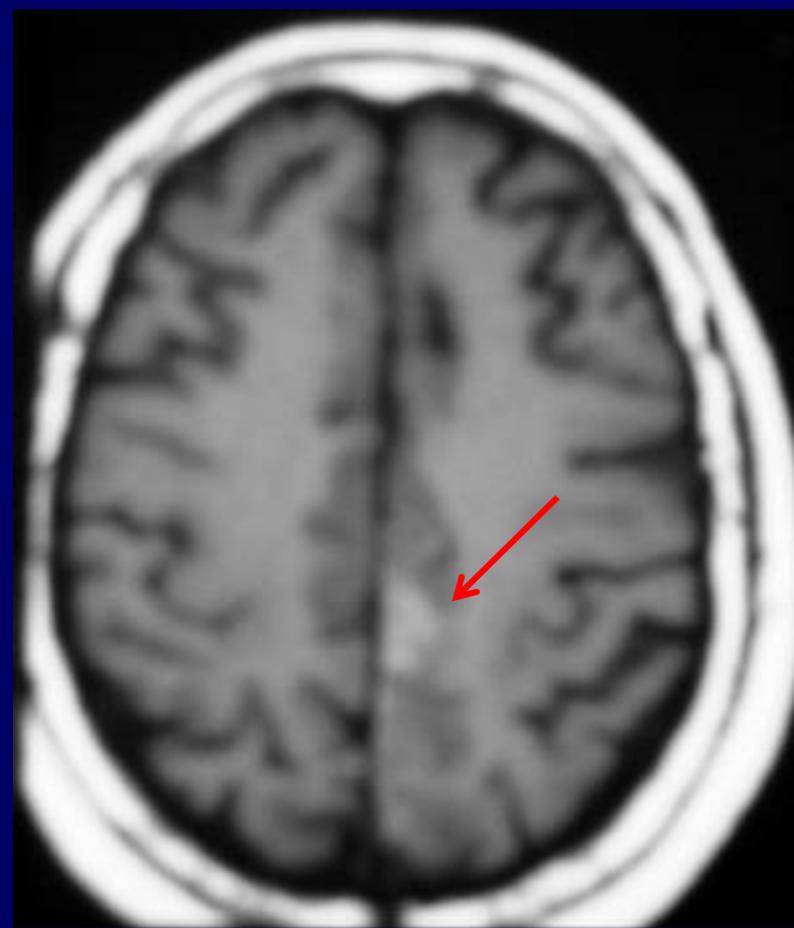
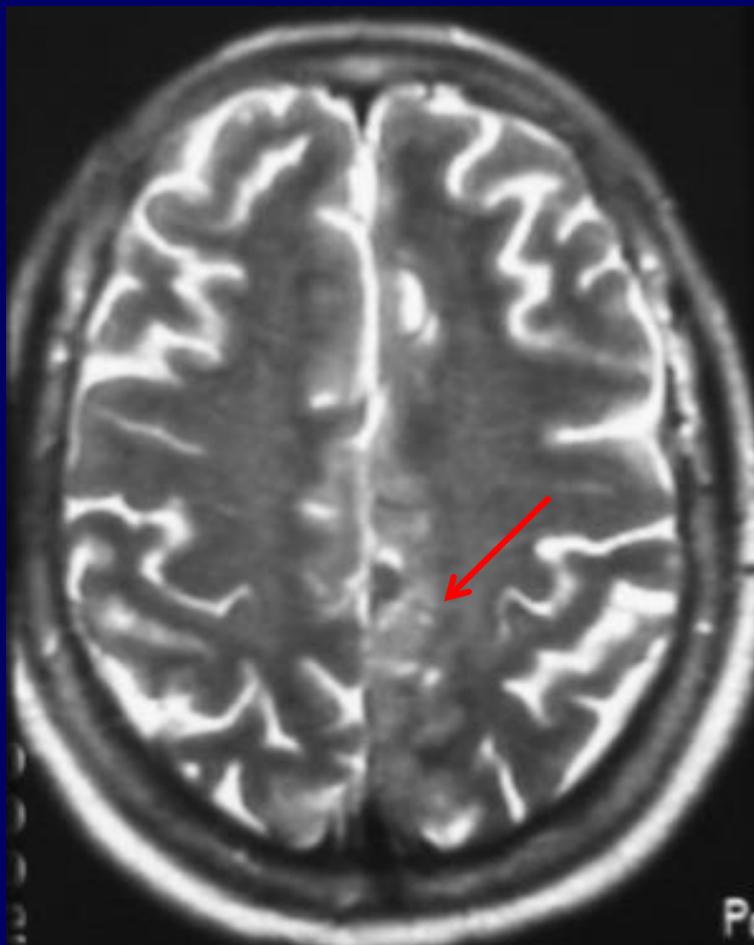
# 脑血管分布与缺血性脑血管病

山东省医学影像学研究所

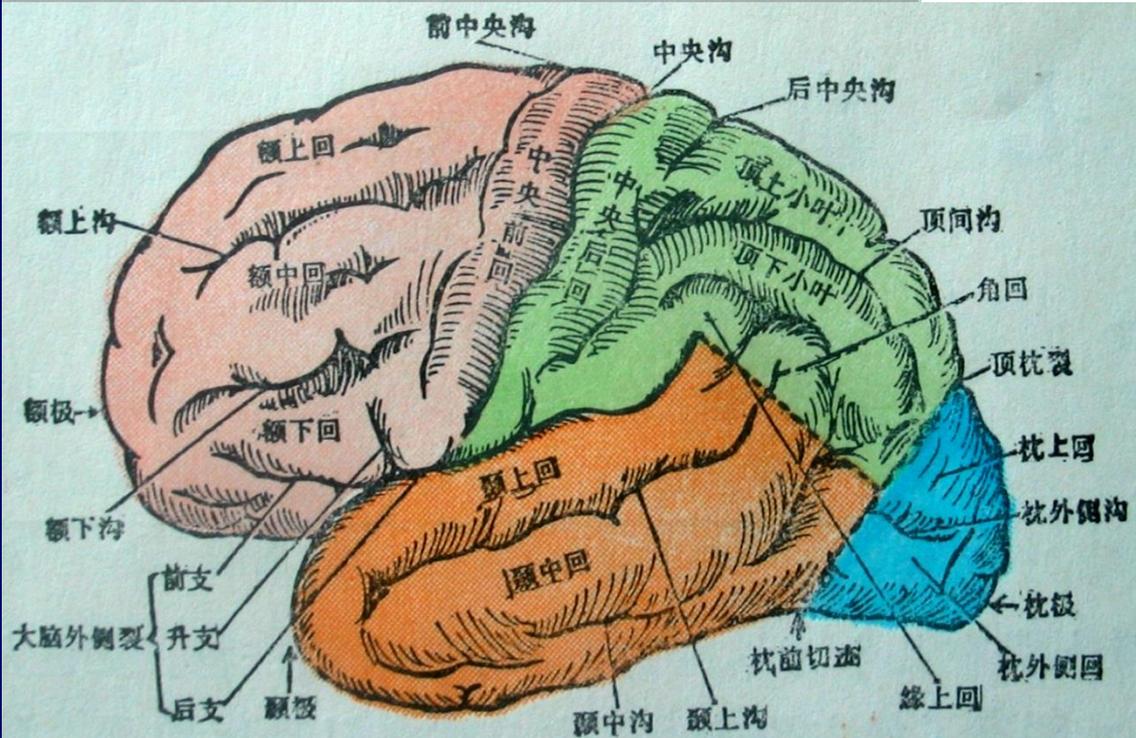
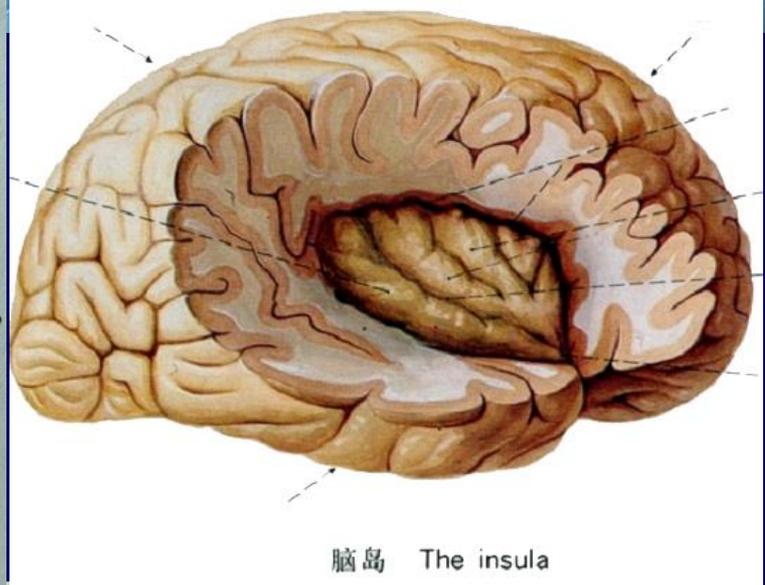
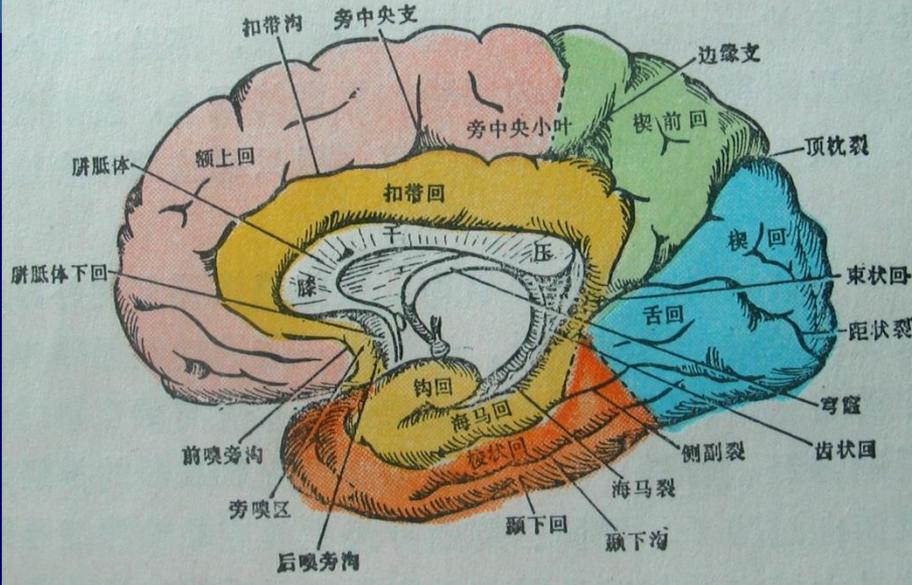
王光彬



# 脑叶的定位



病变位于：A, 顶叶 B, 额叶



- 额叶
  - 顶叶
  - 枕叶
  - 颞叶
  - 岛叶
- 中央沟  
顶枕沟  
外侧裂

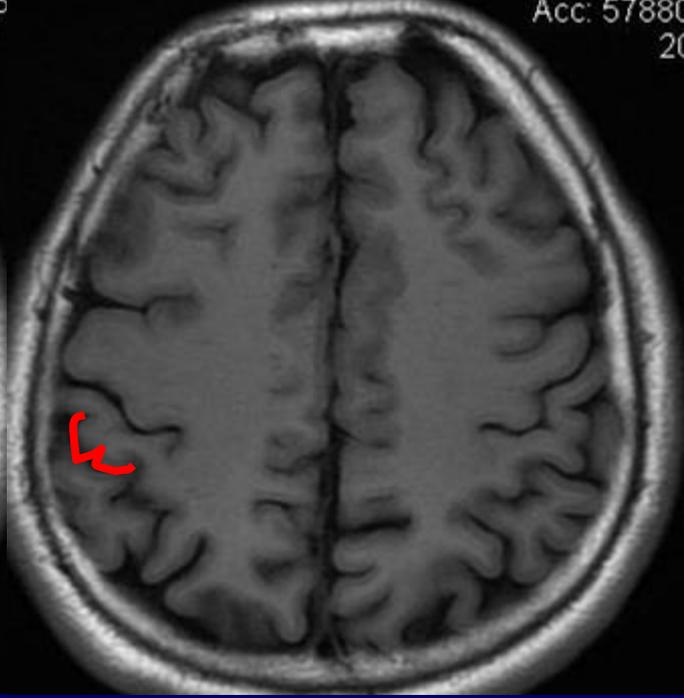
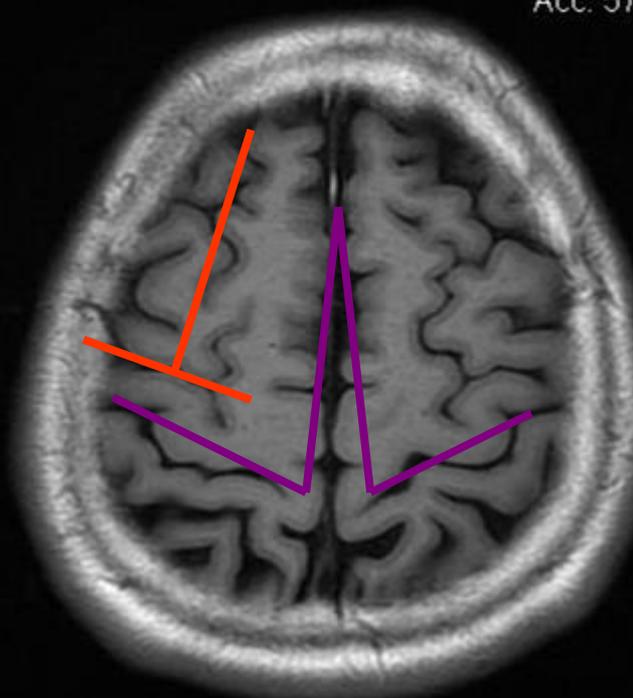


ACC: 517

ACC: 518

Acc: 57880

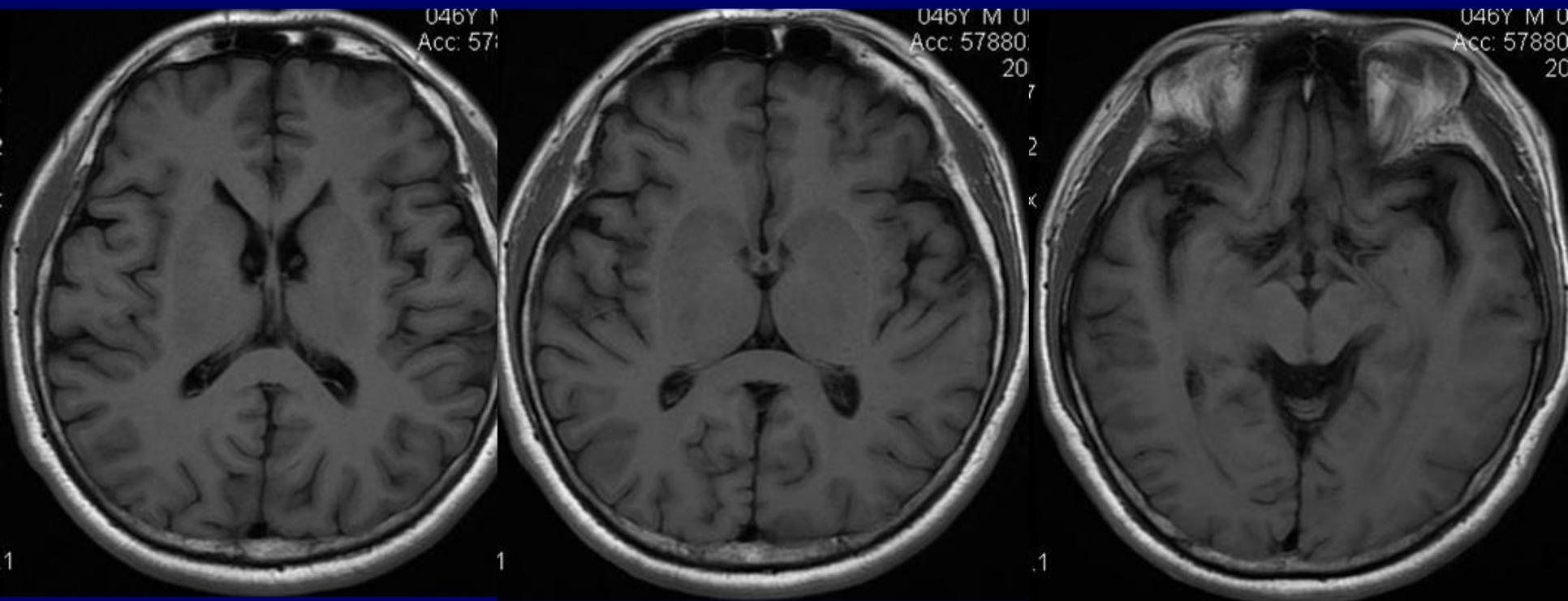
20



- 中央沟由后上走向前下，沟中不再有沟
- 最深，中央前、后沟与之平行
- 中央前回较中央后回粗大
- “Ω”征，“ε”征
- “W”征
- 额上沟与中央前沟垂直（倒T征）

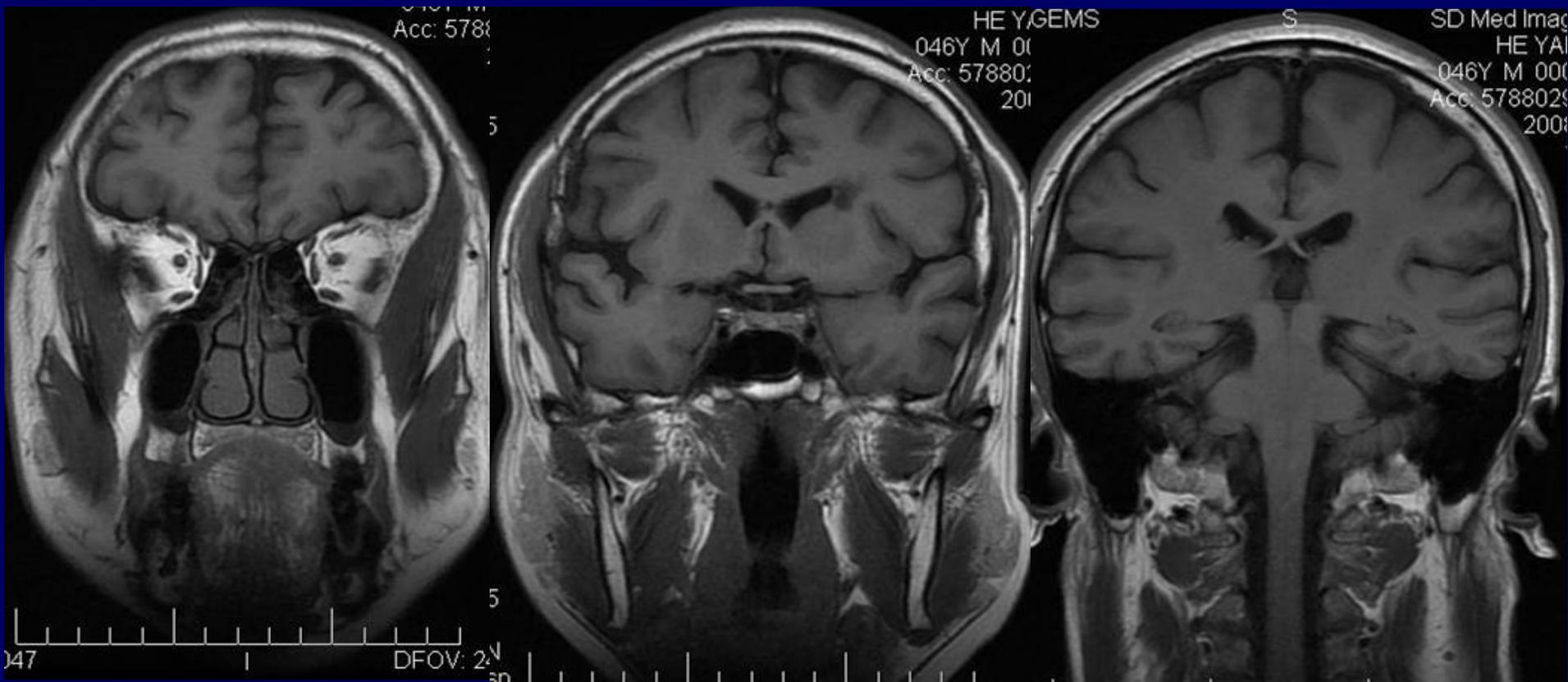


# 轴位显示外侧裂：岛叶显示明确 但额叶岛盖、颞叶岛盖难以分辨



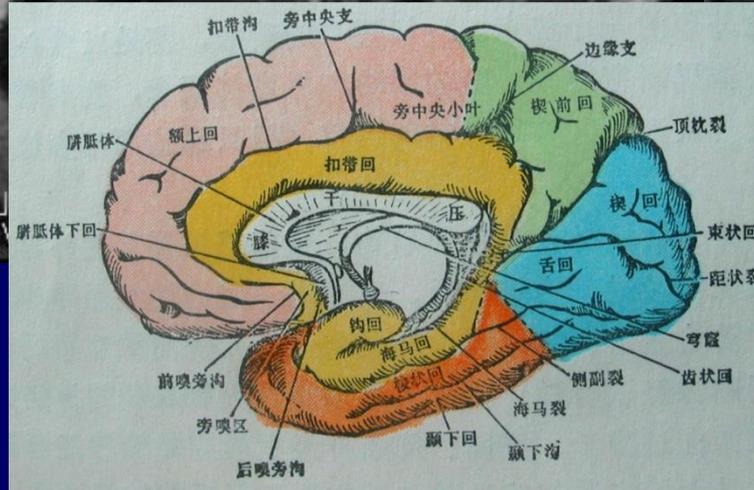
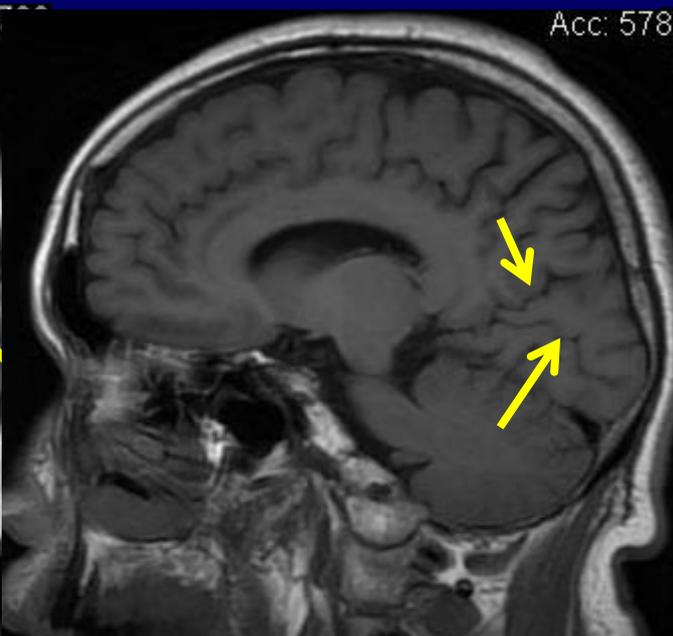
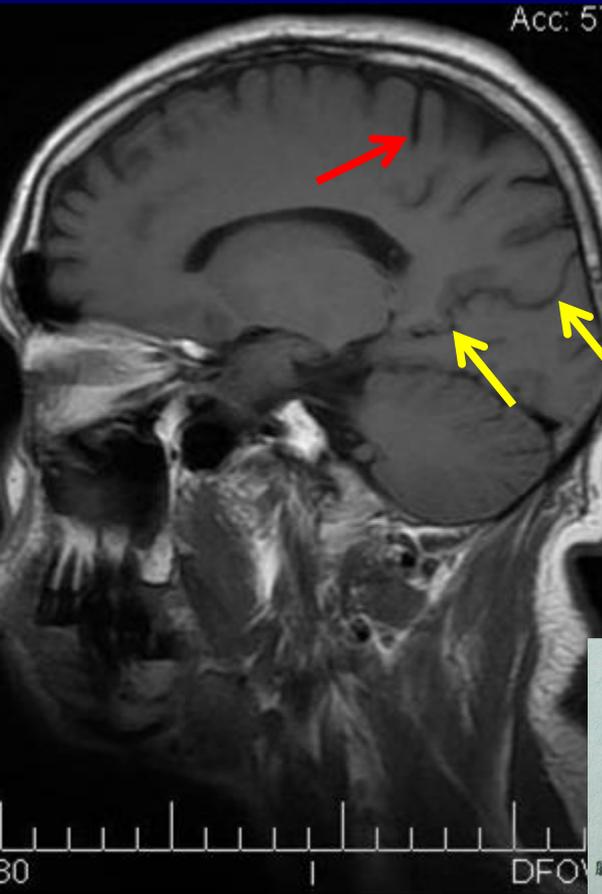


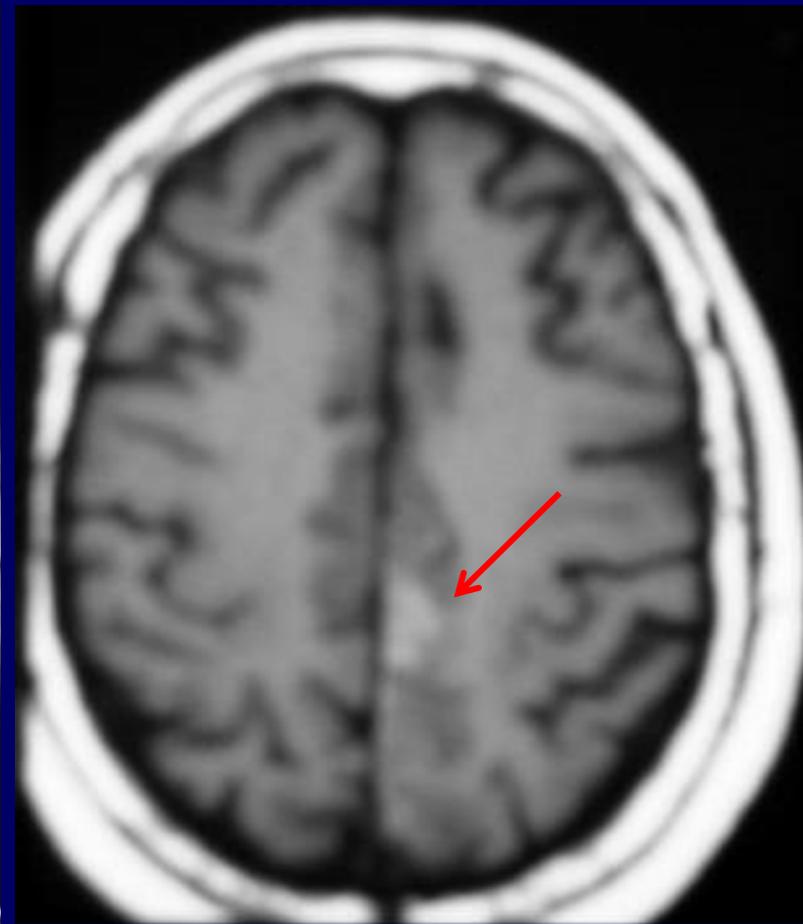
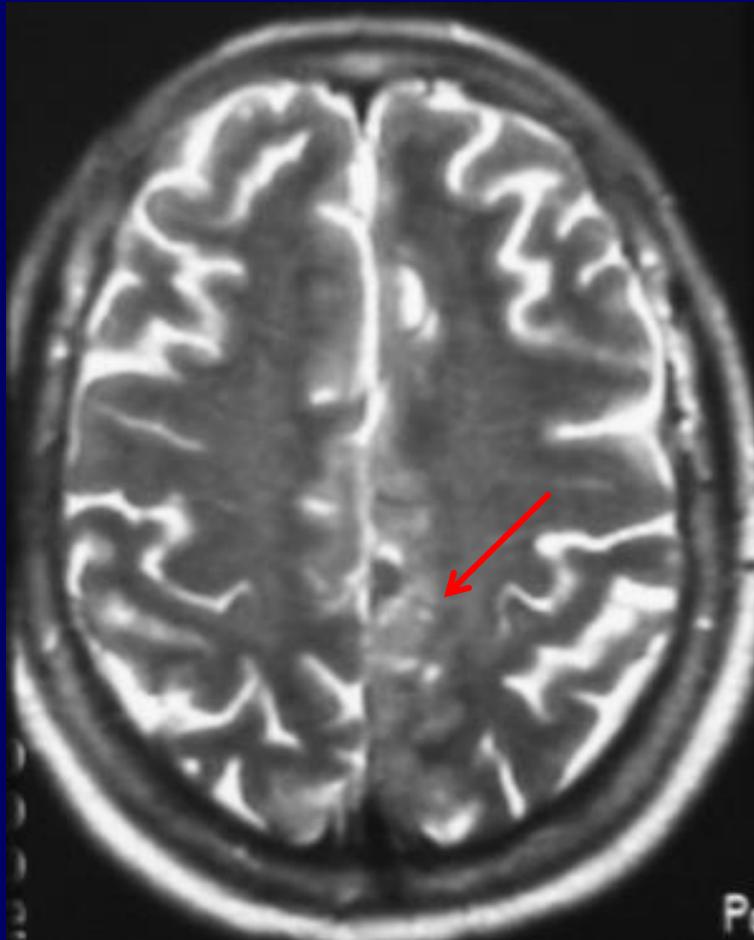
# 冠状位显示外侧裂：额叶岛盖、颞叶岛盖、岛叶



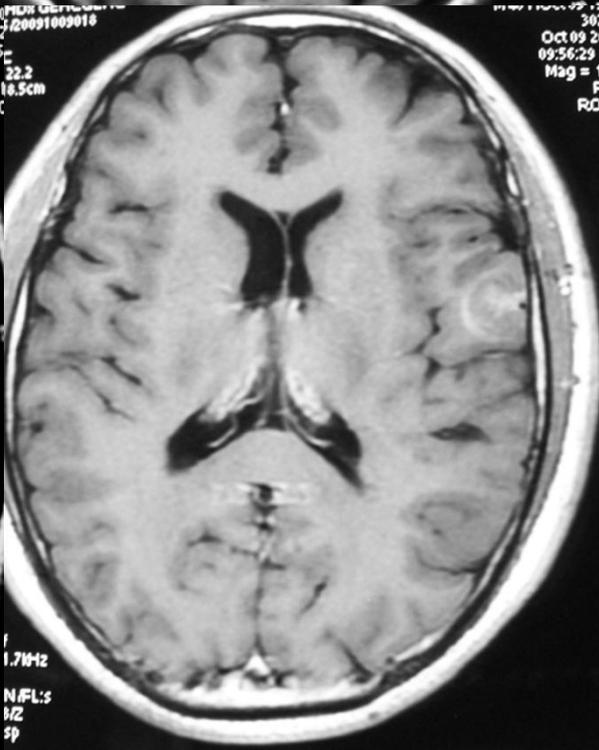
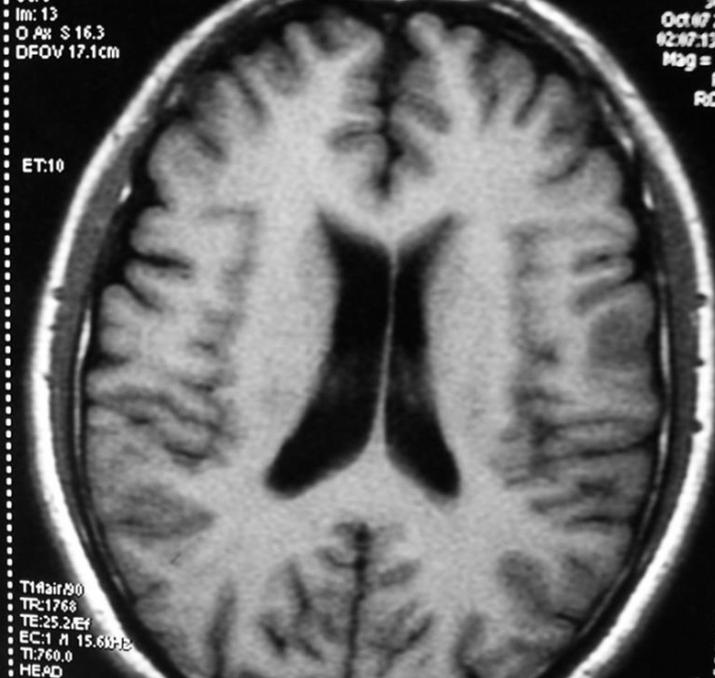
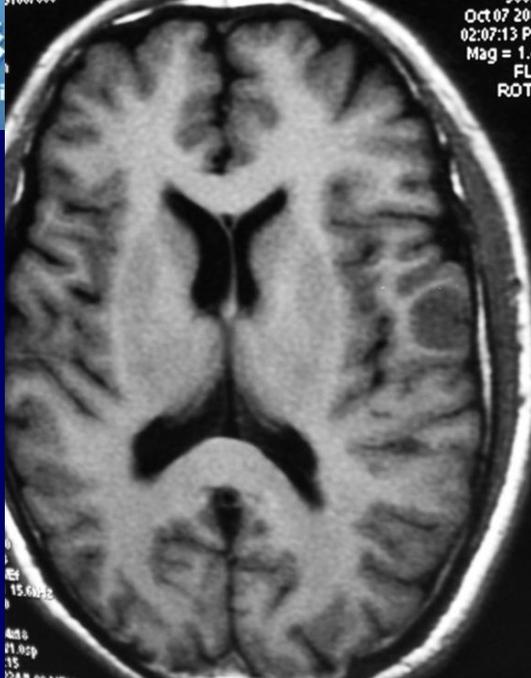


# 矢状位：确定中央沟、顶枕沟、距状沟





病变位于：A, 顶叶 B, 额叶



A, 颞叶  
B, 额叶  
C, 岛叶

Oct 07 2009 02:07:13 PM  
Mag = 1.40  
FL  
ROT:

ET:10

T1fair90  
TR:1768  
TE:25.2Erf  
EC:1 N 15.60Hz  
TI:760.0  
HEAD

Oct 07 2009 02:07:13 PM  
Mag = 1.40  
FL  
ROT:



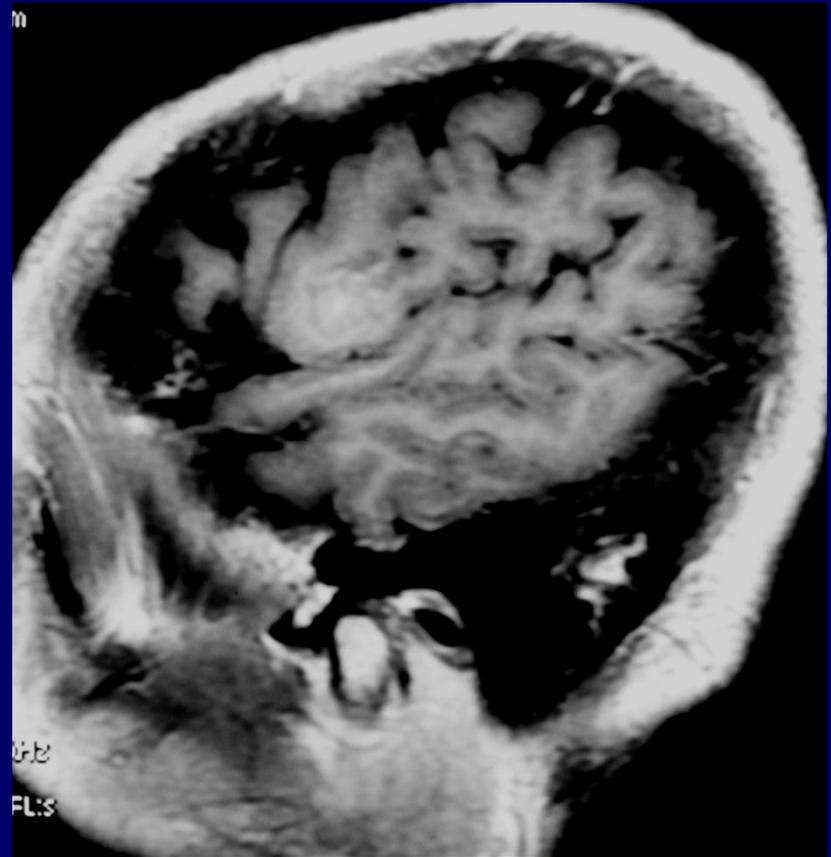
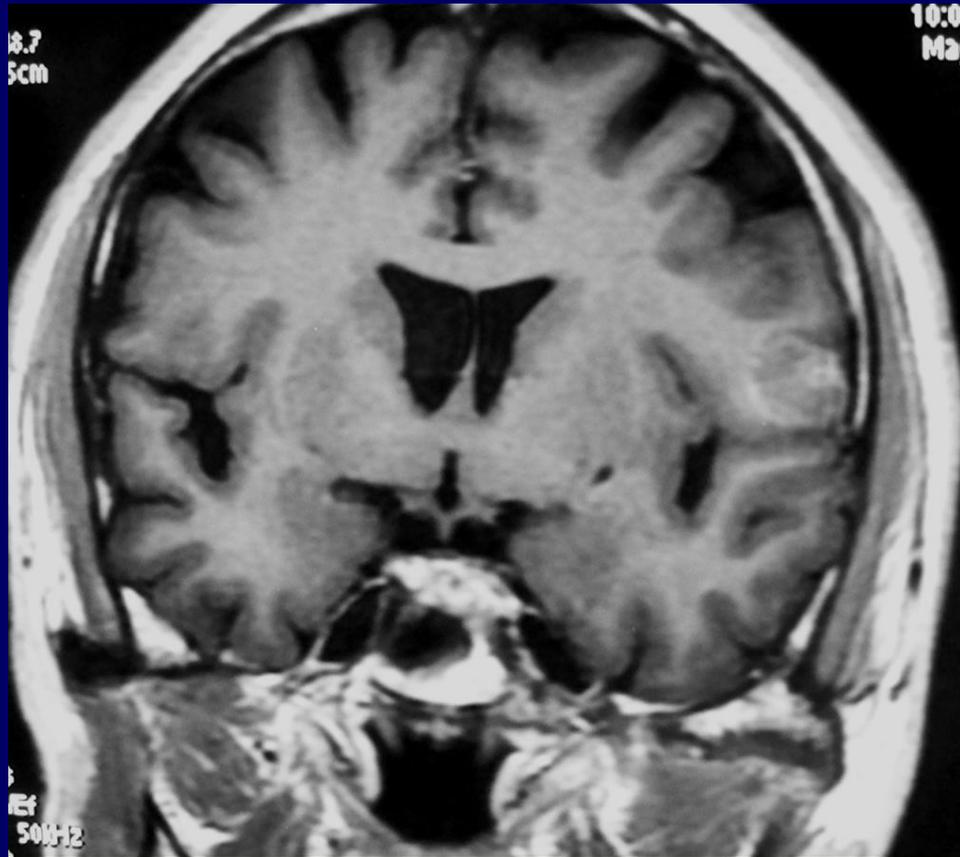
Adi  
PL:asp  
35  
ISAN:as  
27283/2009100/000  
7  
12  
w S 9.3  
OV 17.1cm

30 MHz  
Oct 07 2009 02:16:16  
Mag = 22.2  
16.5cm  
RC

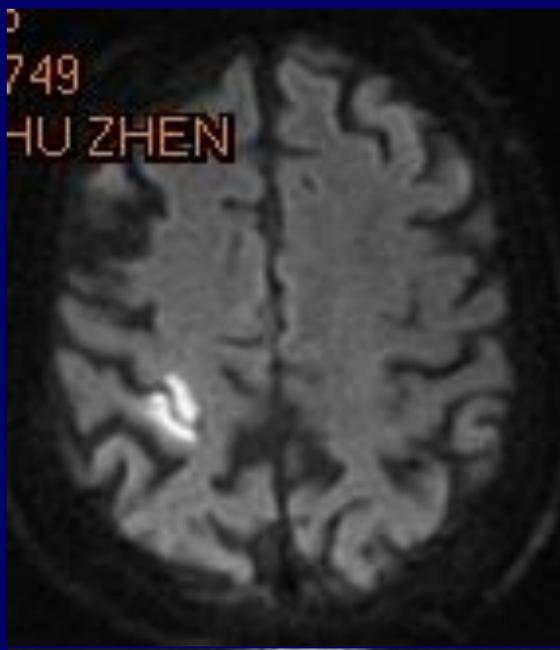
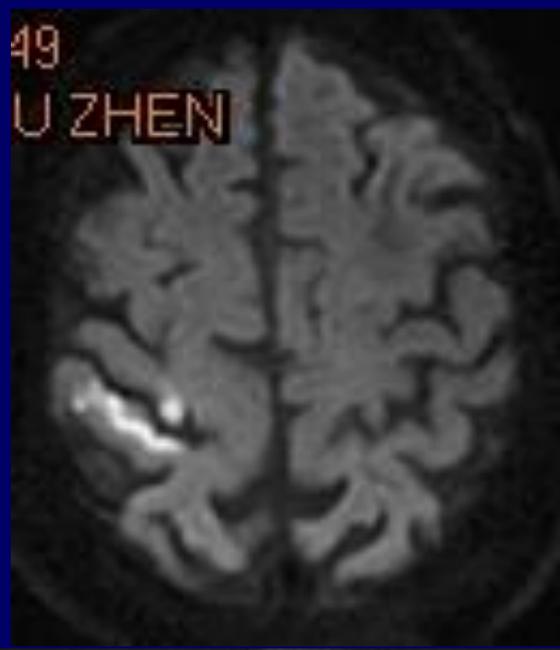
Oct 09 2009 09:56:29 AM  
Mag = 1.40  
FL  
ROT

T1fair90  
TR:1768  
TE:25.2Erf  
EC:1 N 20.80Hz  
TI:2200.0  
EAD  
DV:2404

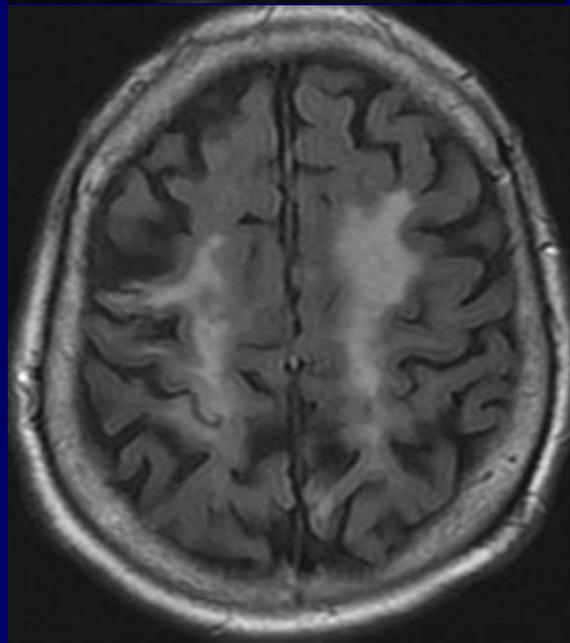
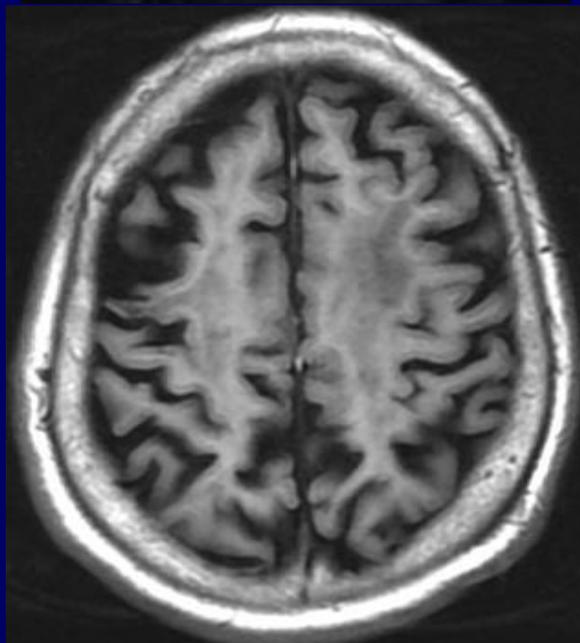
1.70Hz  
N/FL:  
1/2  
SP



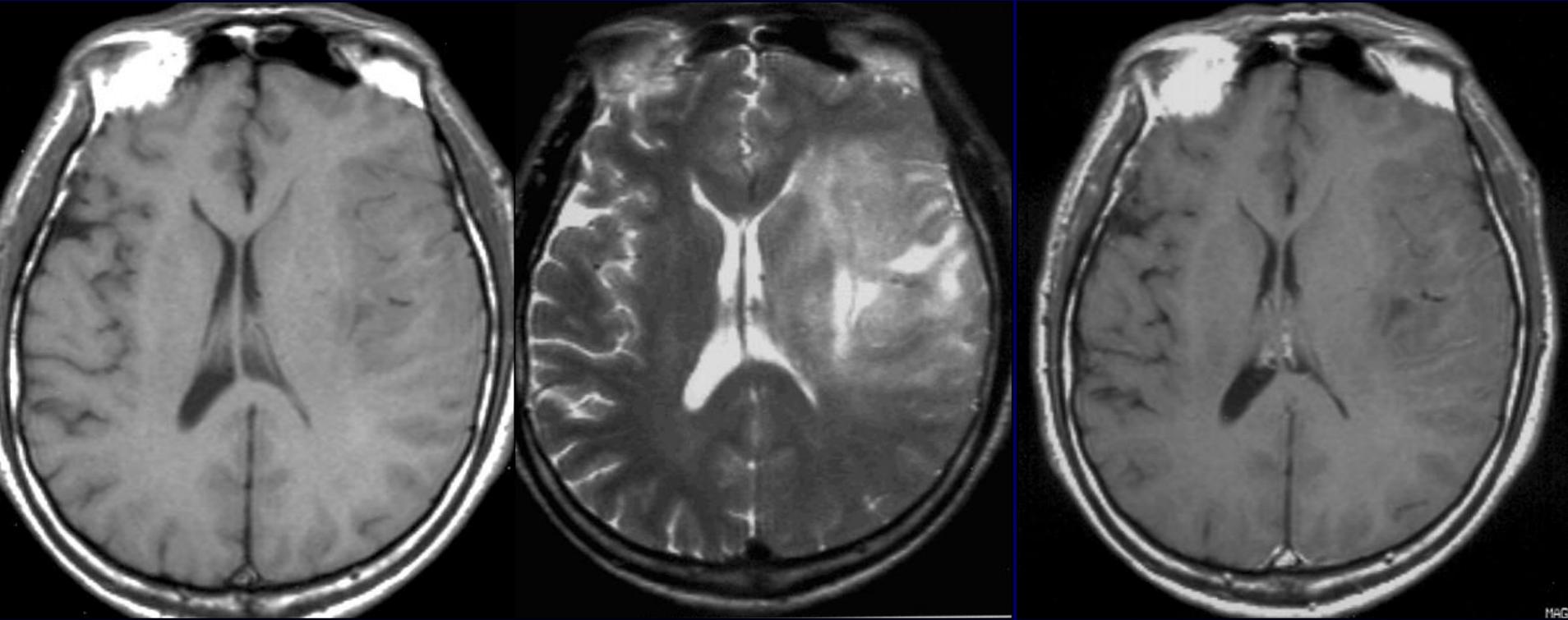
A, 颞叶  
B, 额叶  
C, 岛叶



~~额叶?  
顶叶?~~

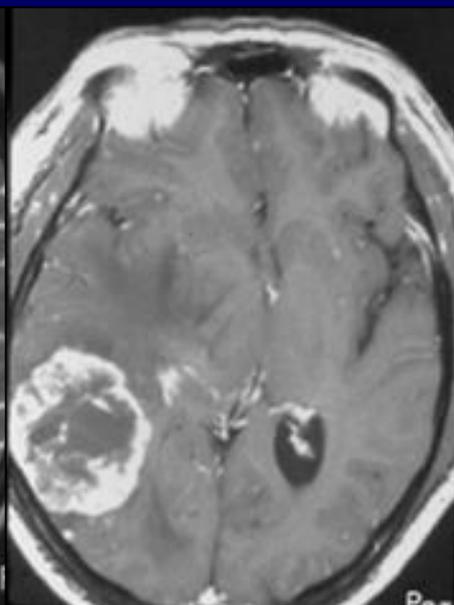
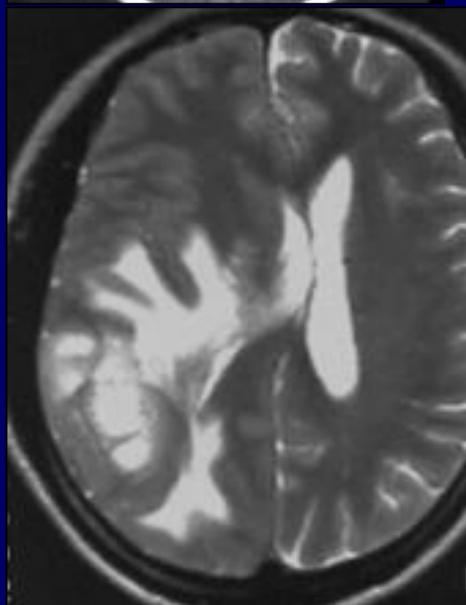
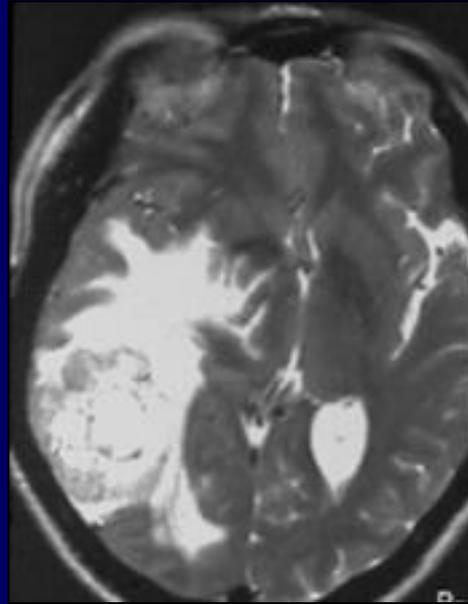
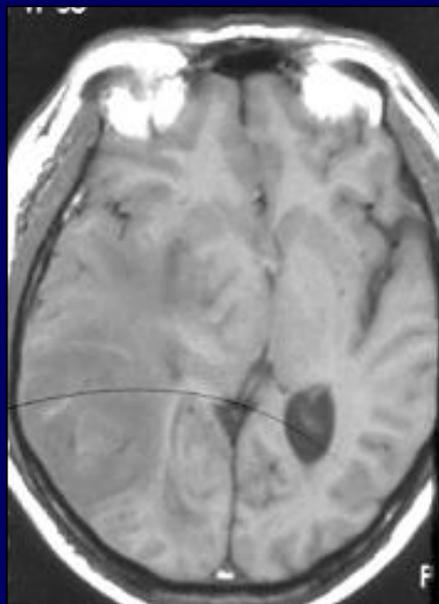


中央前回  
中央后回



# Astrocytoma I~II

- A, 颞叶
- B, 额叶
- C, 岛叶
- D, 额叶、颞叶、岛叶
- E, 额叶、岛叶



- A, 颞叶
- B, 顶叶
- C, 岛叶
- D, 枕叶
- E, 颞、顶、枕叶交界区



# 脑部定位小结

- 脑叶的分界
- 中央沟的确定



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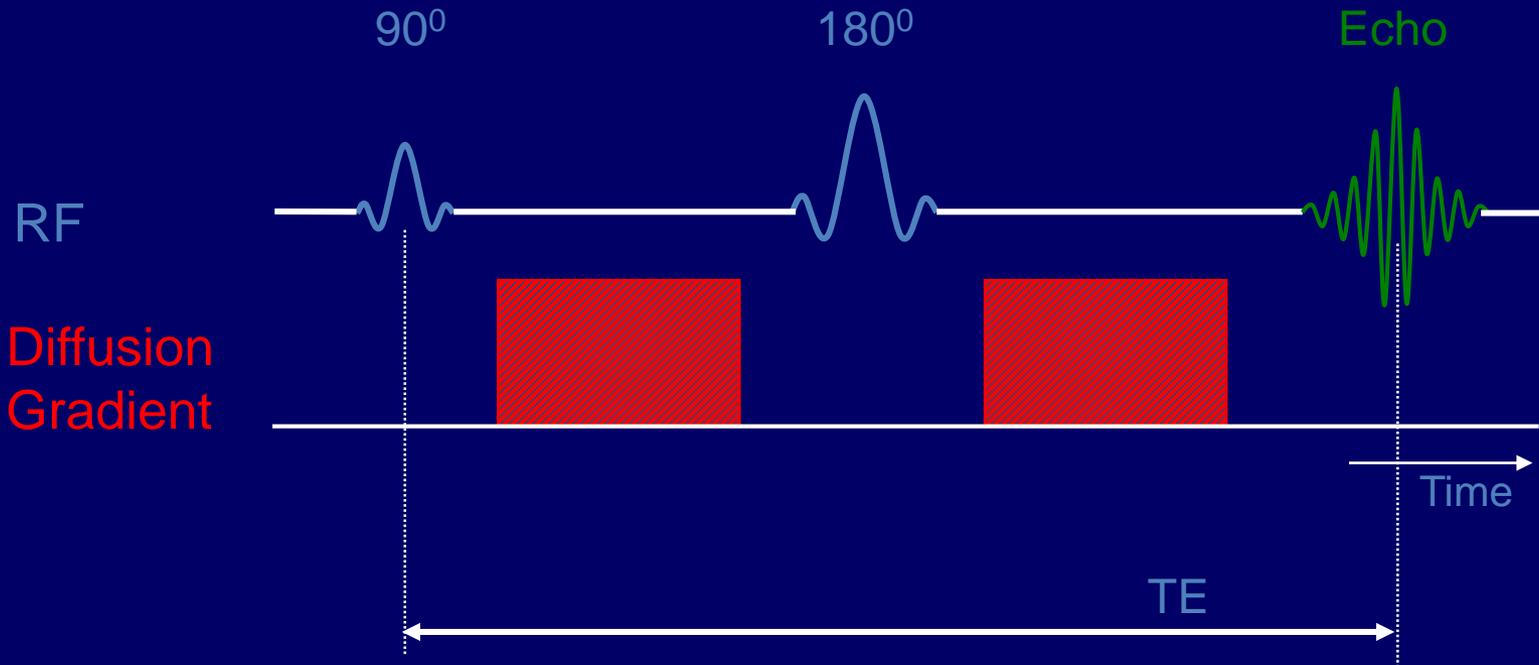


# DWI 的原理及临床价值



# Diffusion, basic technique to measure

## Spin Echo sequence

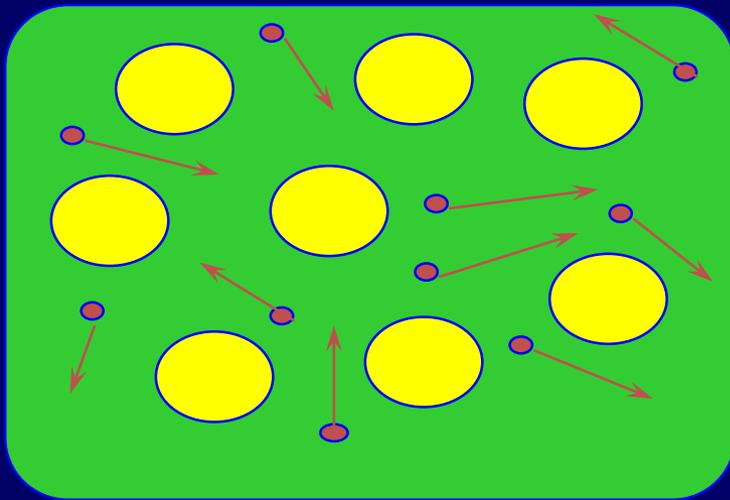


弥散加权成像（DWI）通过在常规序列上对称性施加弥散敏感梯度来探测水分子运动

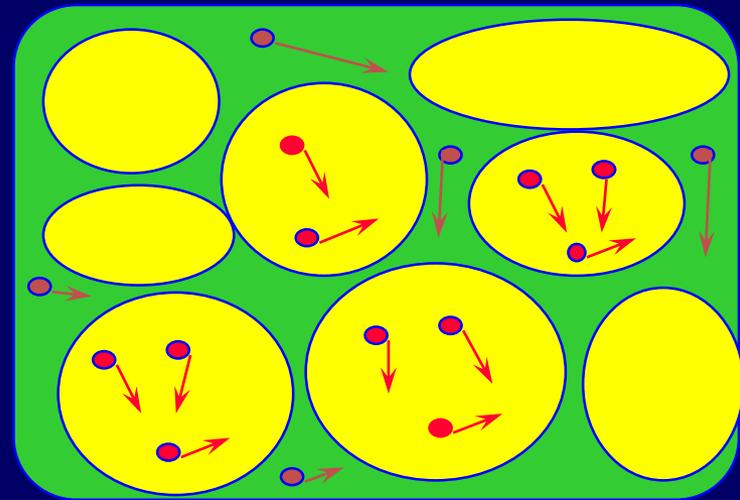


# 弥散加权成像(DWI)基本原理

- 质子在沿着梯度场方向运动时，自旋频率发生改变，导致在回波时间内相位不能重聚，信号下降



自由弥散的水分子表现为低信号



弥散受限的水分子表现为高信号



# Diffusion Weighted Imaging (DWI)

## 弥散加权成像

- **b value: 弥散度**

- the degree of diffusion-weighting

- $b = 0$  no diffusion weighting  $\Rightarrow$  T2WI

( $b=0$ 时相当于T2WI)

- 带有T2WI成分的图像， $b$ 值越高T2成分越少

( $b = 1,000 \text{ sec/mm}^2$ )



## ADC map(s)—Apparent Diffusion Coefficient 表观弥散系数图 (at least 2 DWIs)

ADC --- decrease, ↓↓ 3-5 days

⇒ **ADC map(s) – Dark, DWI--Bright**

ADC --- returns to baseline at about **4 weeks**

**DWI序列的最终目的是构建ADC图!!!**

**ADC值降低，弥散受限!!!**



# 弥散受限及T2滤过效应

	弥散不受限	弥散受限	T2滤过效应
DWI	低	高	高
ADC图	高	低	高

组织ADC值降低所致 | 组织T2值延长所致

只有ADC图呈低信号为弥散受限，单纯DWI高信号则不一定



# CNS病变DWI高信号

- 细胞毒性水肿：

神经元/胶质细胞细胞毒性水肿—急性脑梗死、脑炎  
轴索水肿（弥漫性轴索损伤DAI）、神经髓鞘细胞水肿—  
MS早期、进行性多灶性脑白质病

- 细胞密度高或/和细胞外间隙小： 肿瘤

胶质母细胞瘤、淋巴瘤、转移瘤；  
伴有大量肿瘤细胞浸润的瘤周水肿

- 高粘度： 脓肿、表皮样囊肿（胆脂瘤）

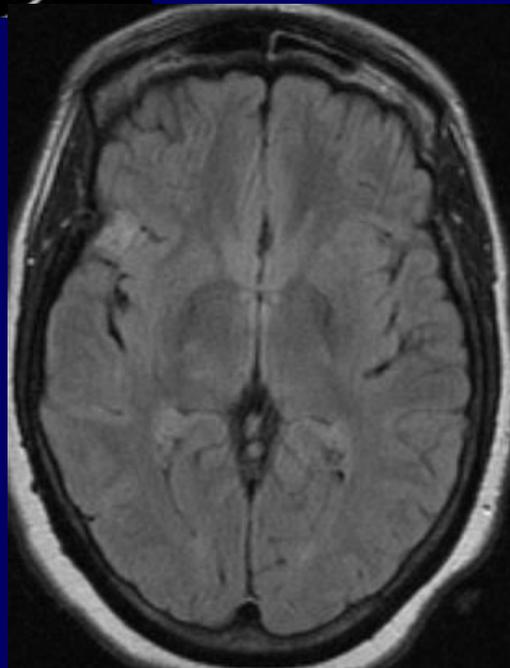
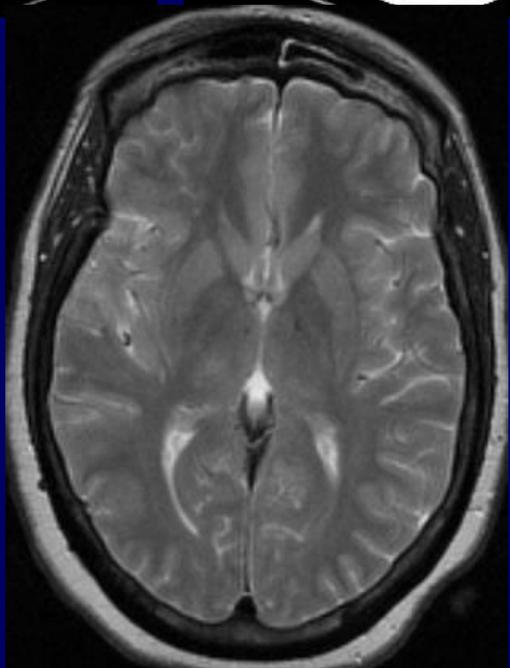
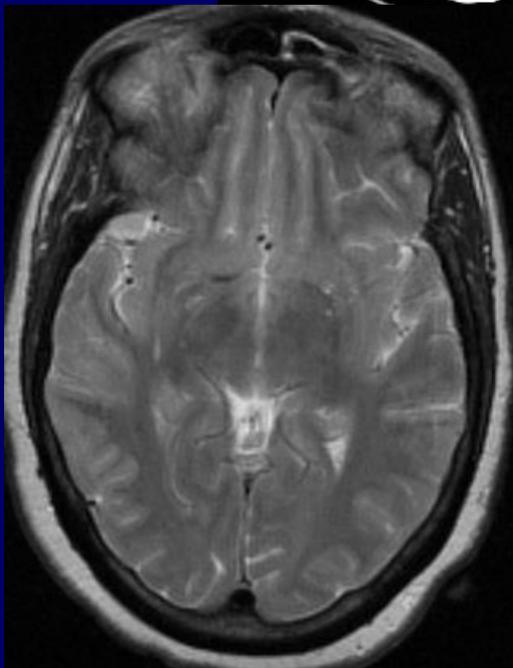
- 长T2组织： T2滤过效应

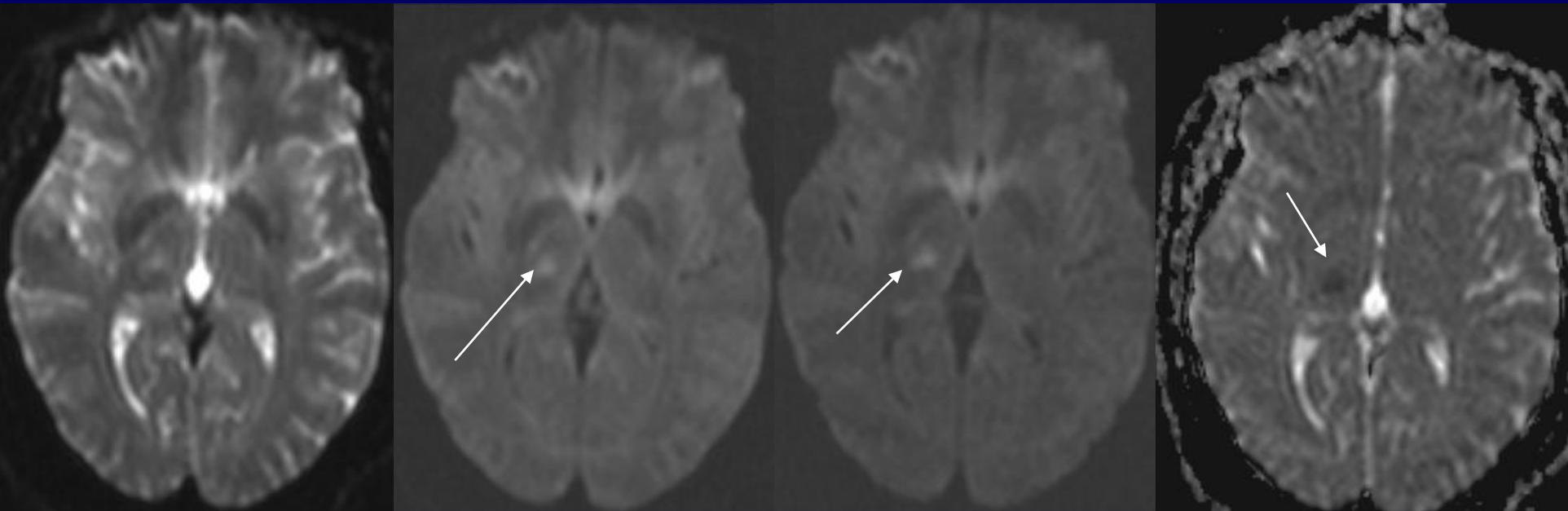


# DWI在神经系统的应用

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- 检出急性、亚急性脑梗死  
(炎症、肿瘤、血肿等病变均可弥散受限)
- 肿瘤囊变与脓肿鉴别
- 蛛网膜囊肿与表皮样囊肿鉴别
- 其它



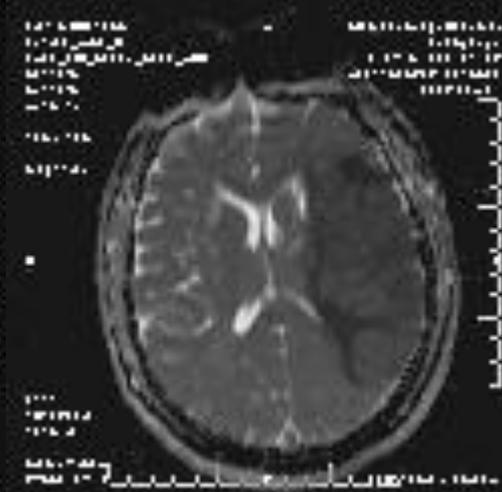
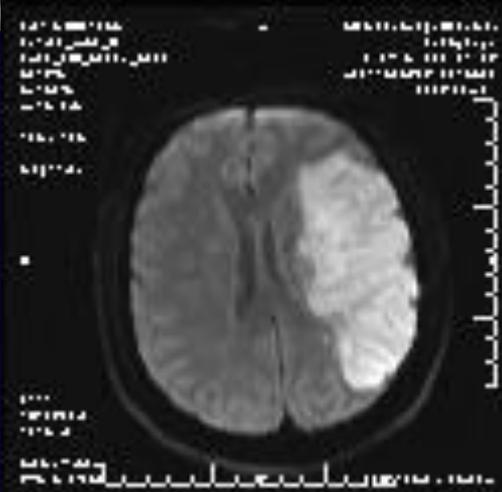
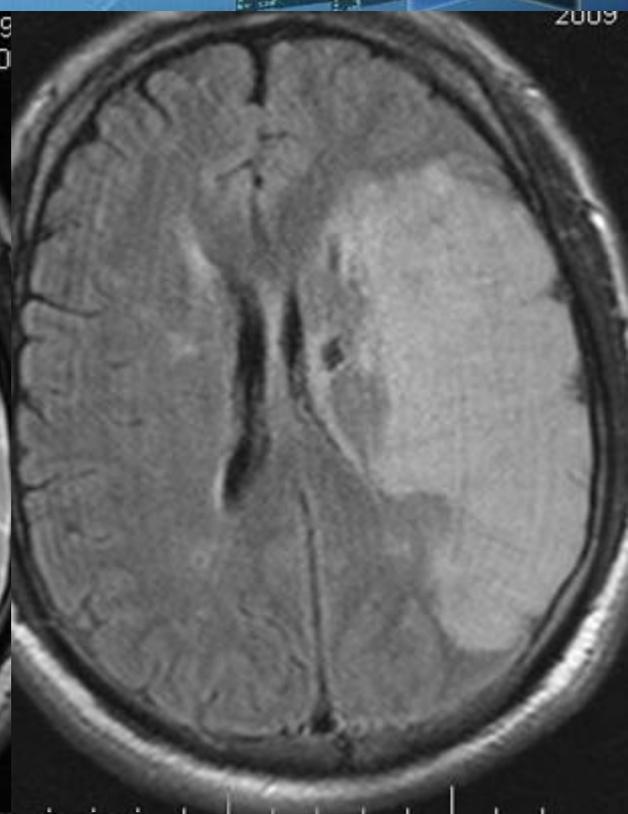
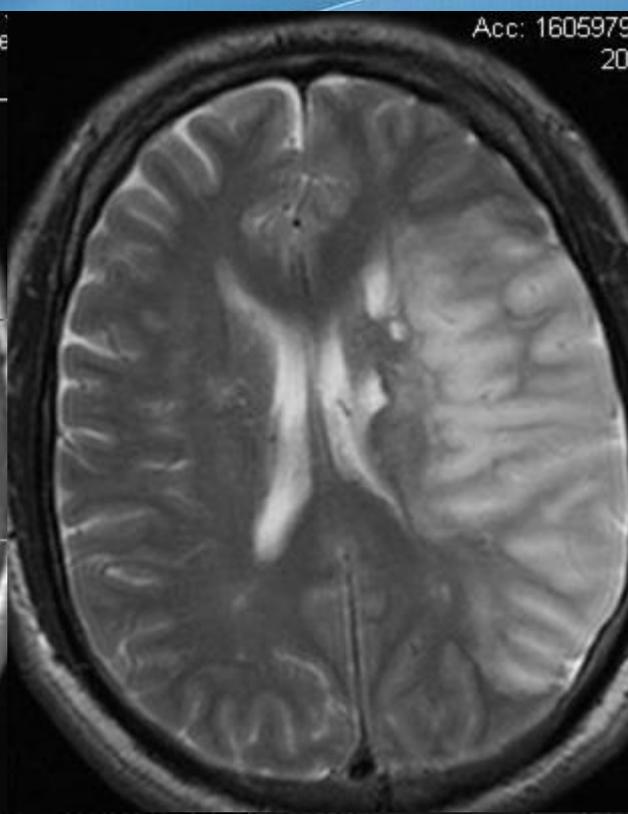
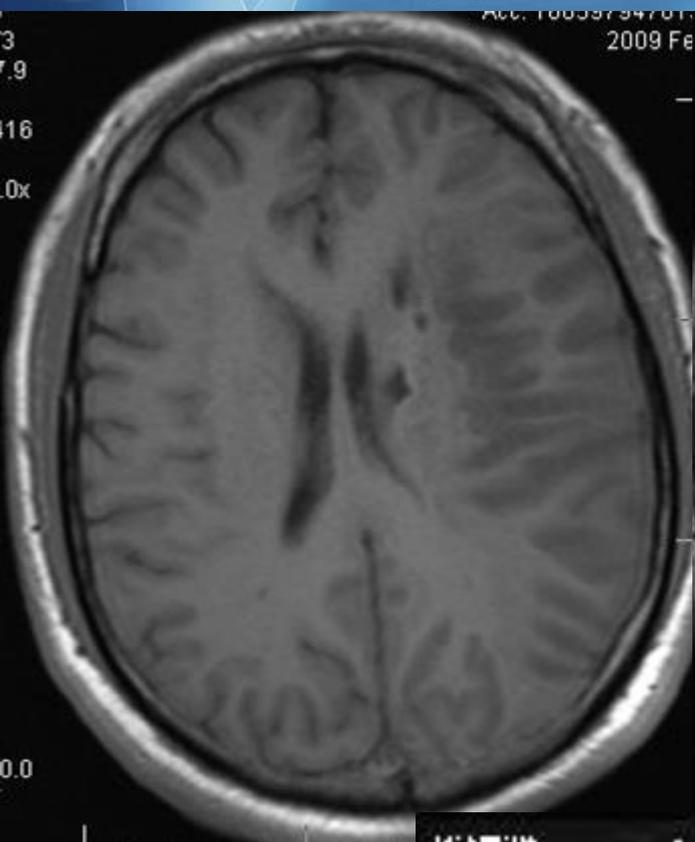


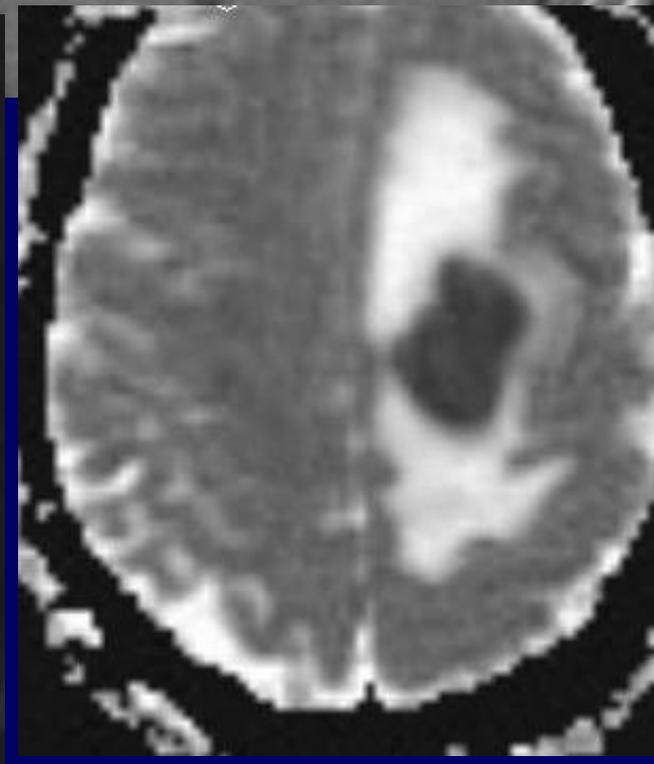
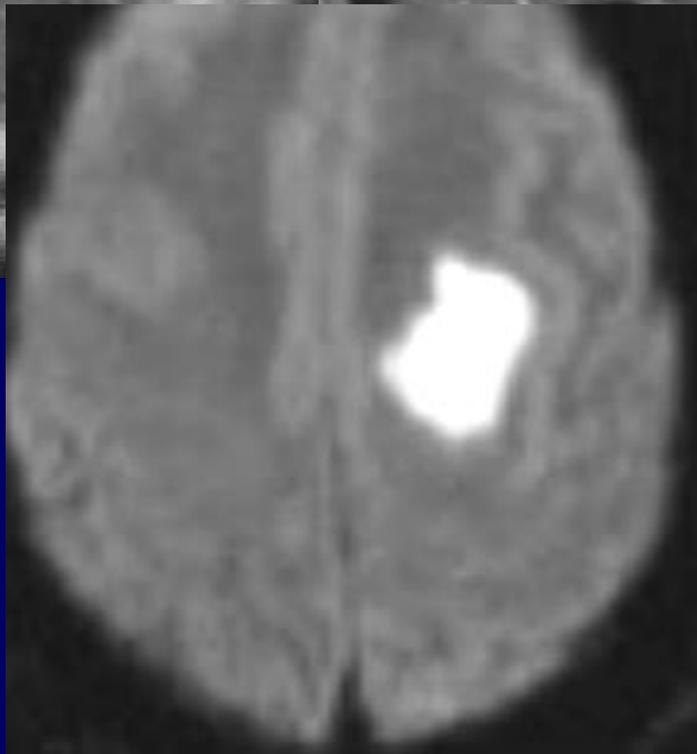
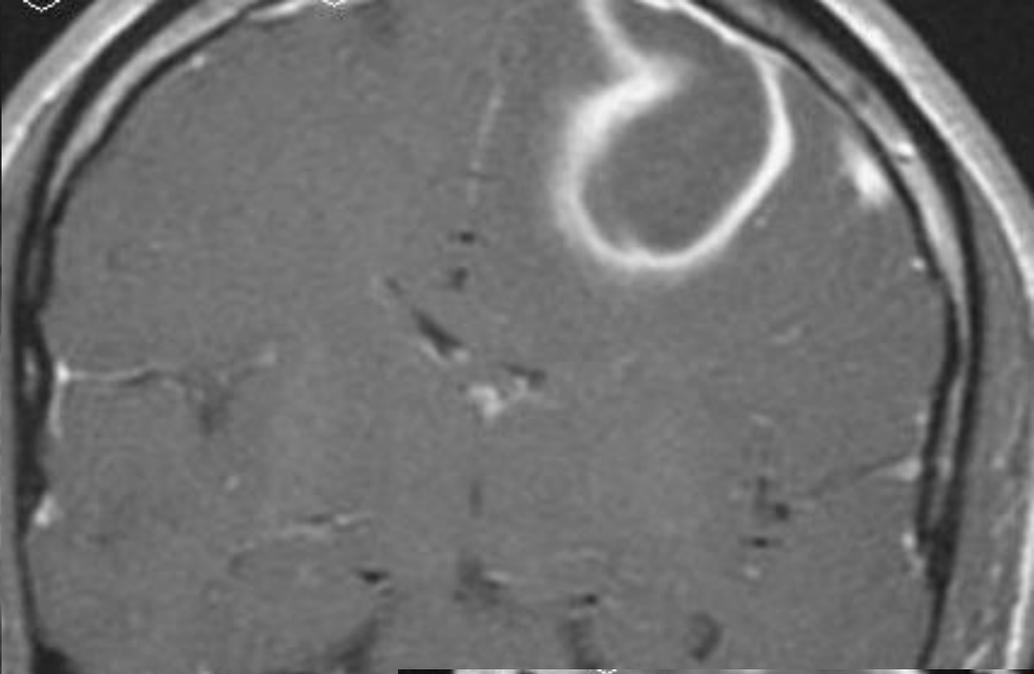
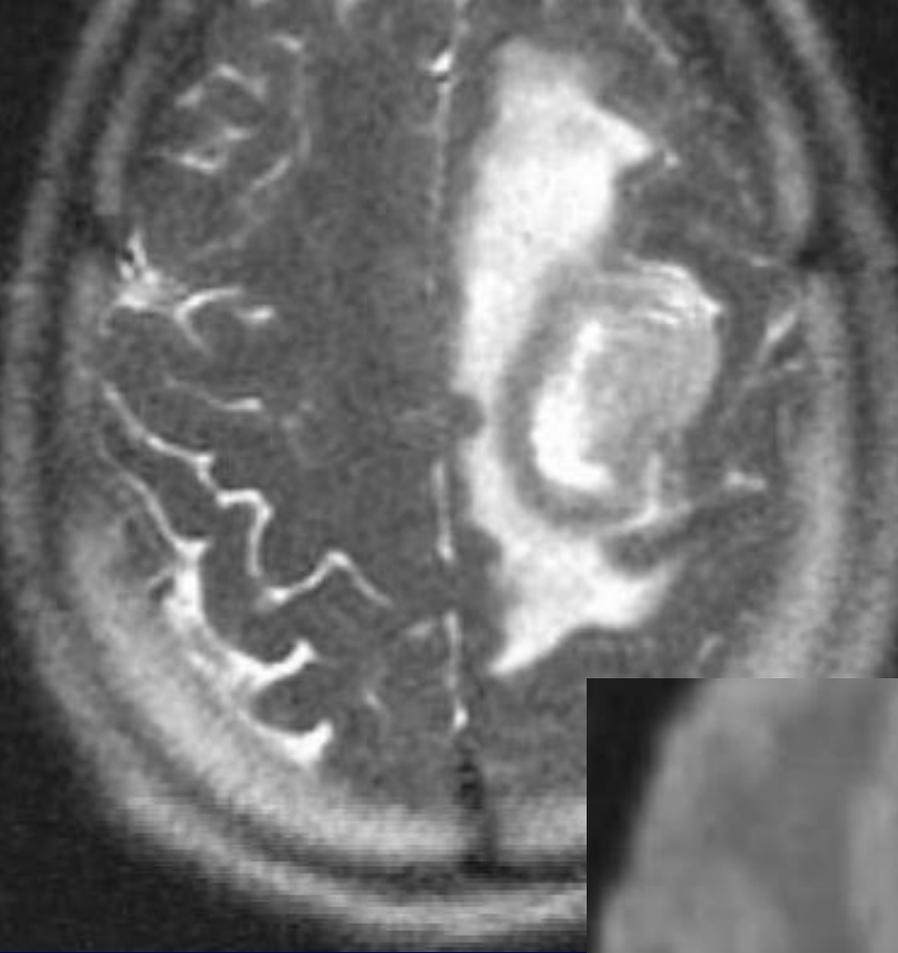
$b=50 \text{ sec/mm}^2$

$b=500 \text{ sec/mm}^2$   $b=1,000 \text{ sec/mm}^2$

ADC map

细胞毒性水肿

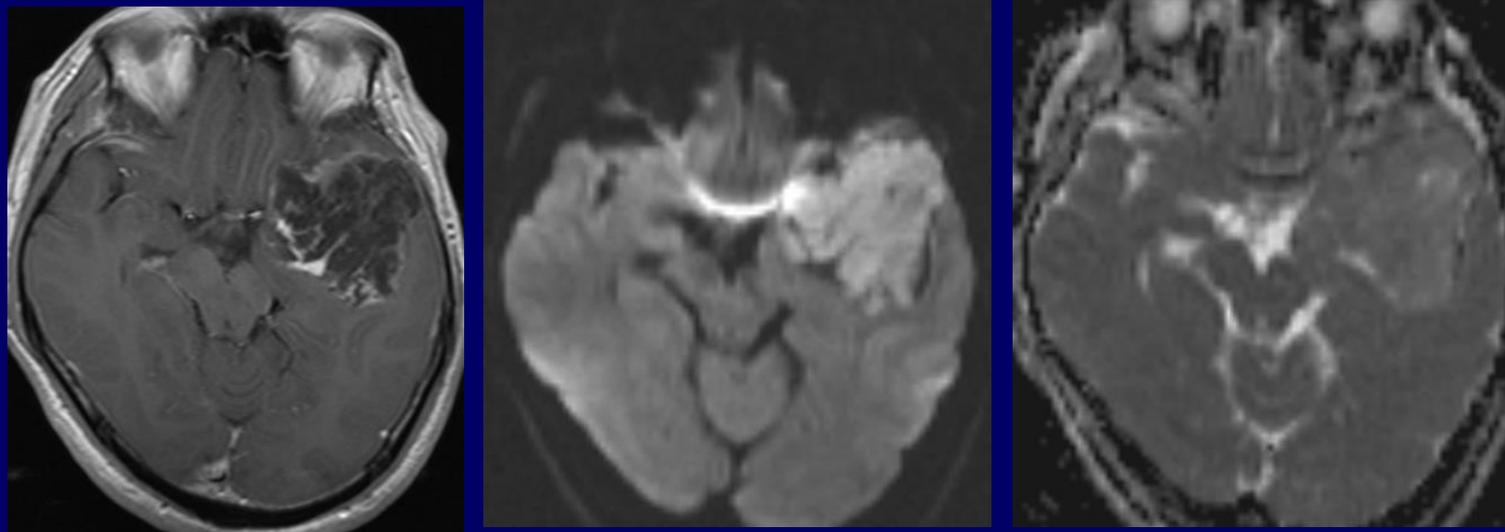
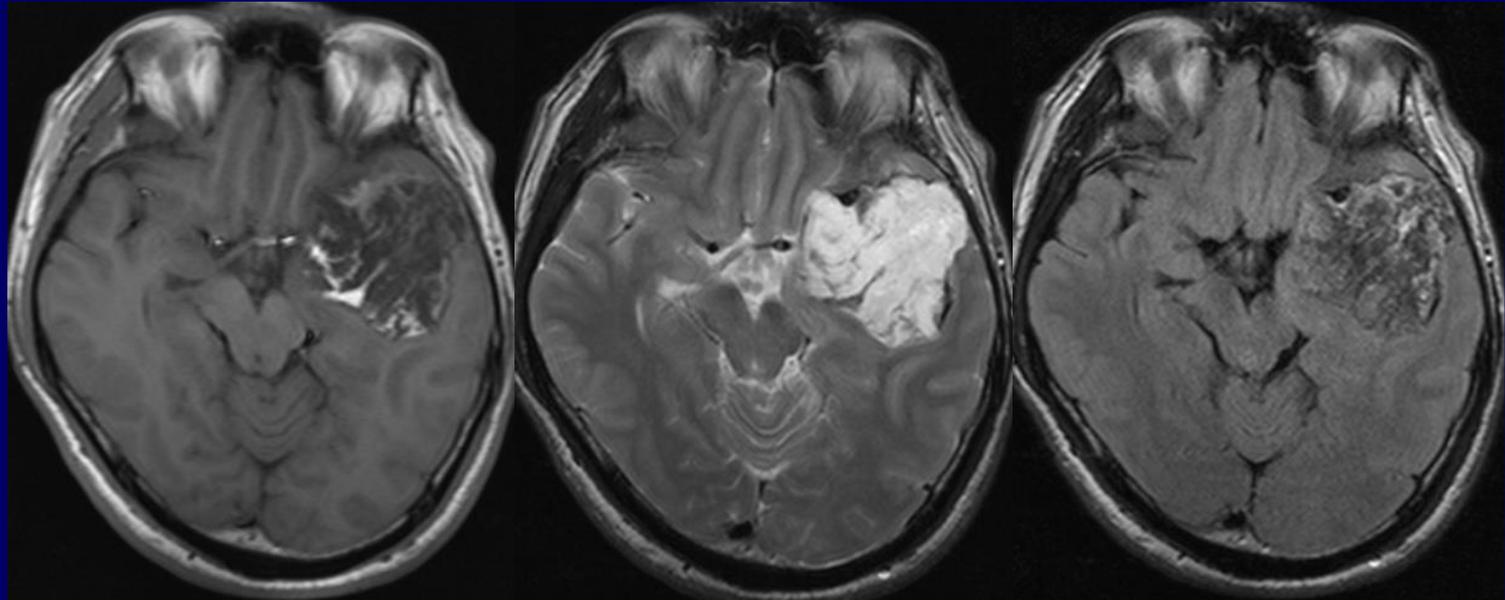




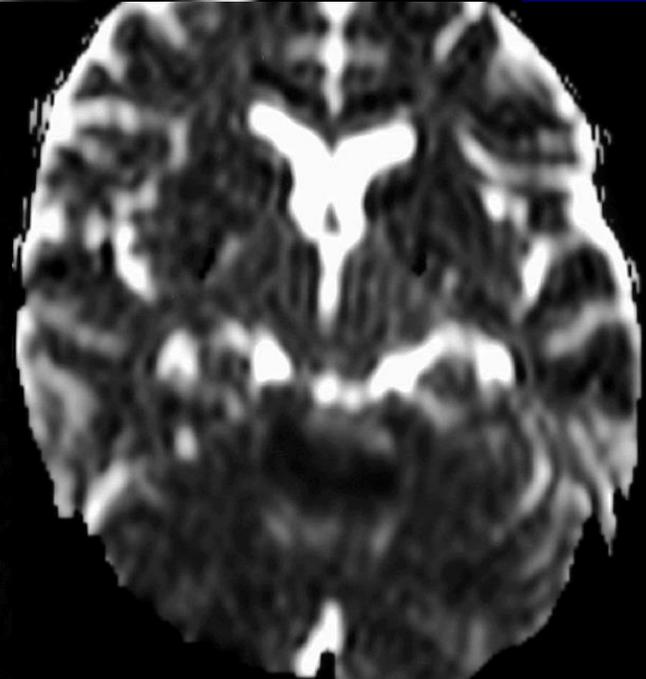
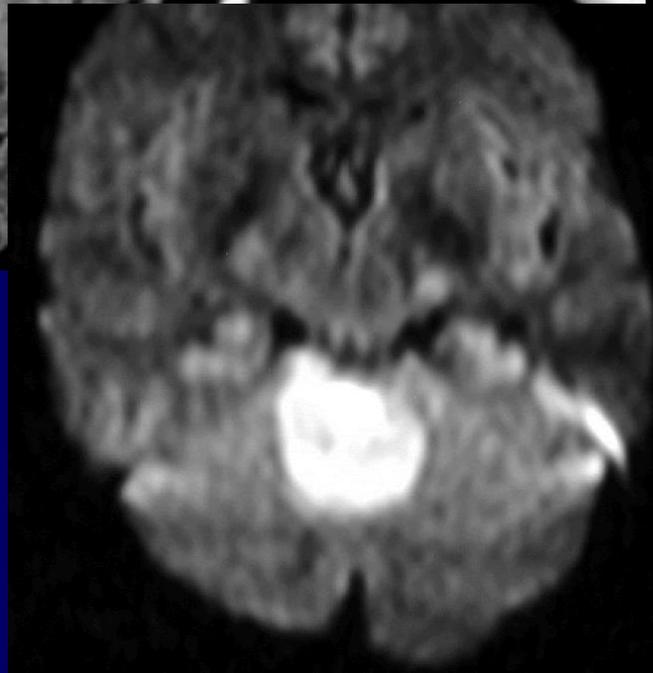
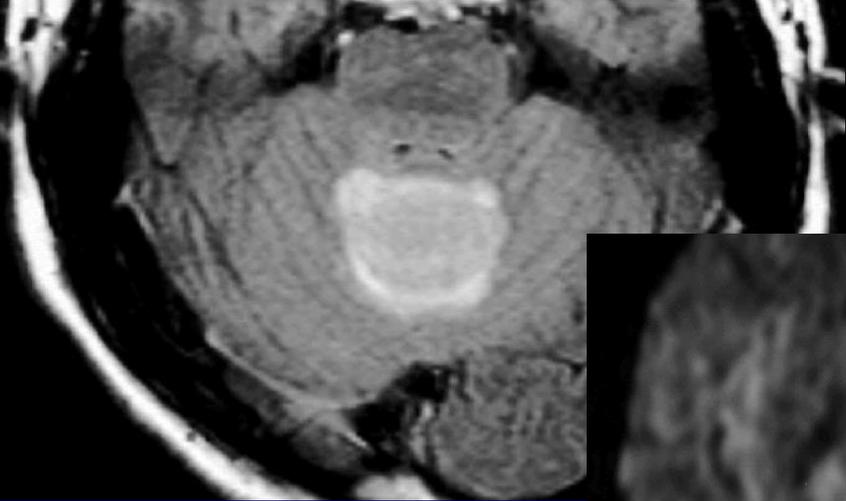
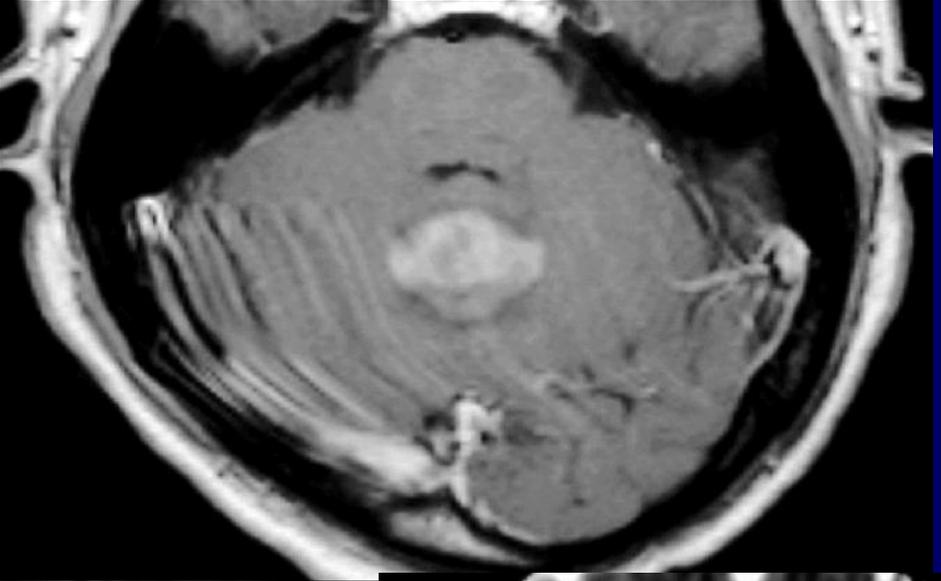
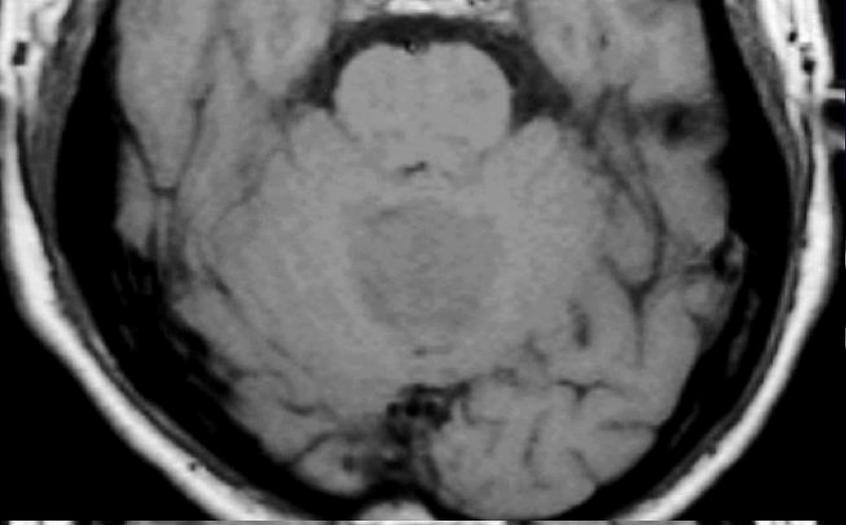
高粘度组织  
致信号增高



# 胆脂瘤



除胆脂瘤外，淋巴瘤、髓母细胞瘤等可弥散明显受限

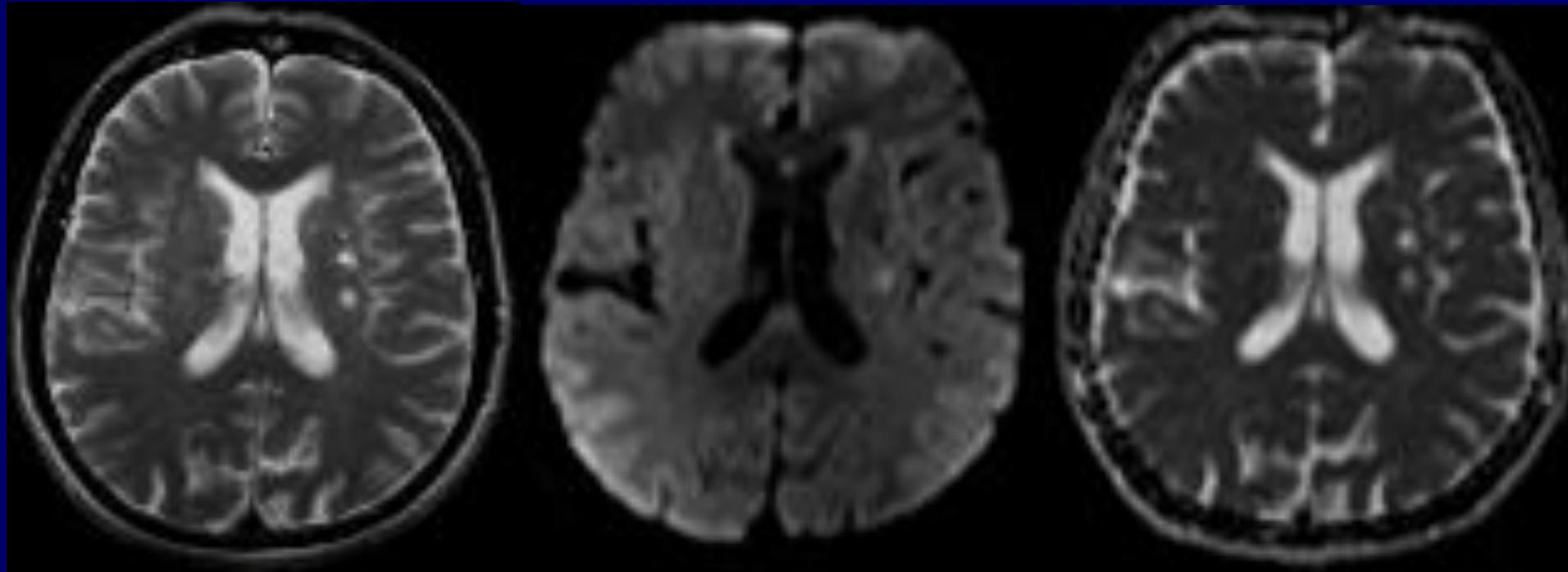


## 髓母细胞瘤

细胞密度高或/和细胞外间隙小导致信号增高



长T2组织：T2滤过效应  
**T2 Shine Through**



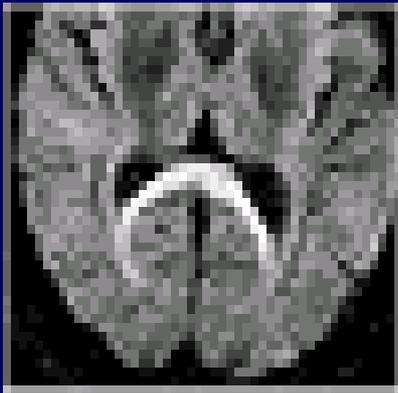
**T2WI**

**DWI**

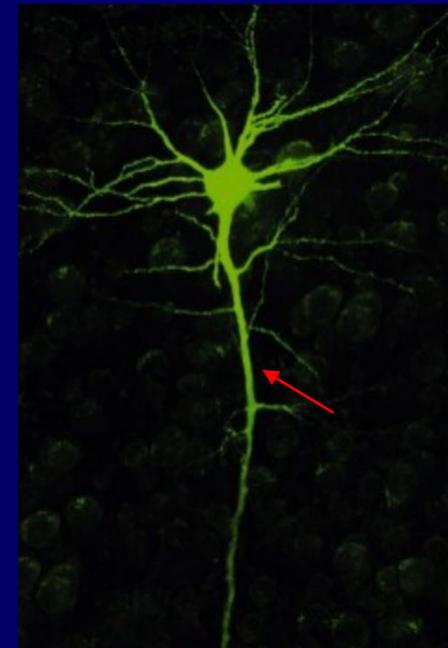
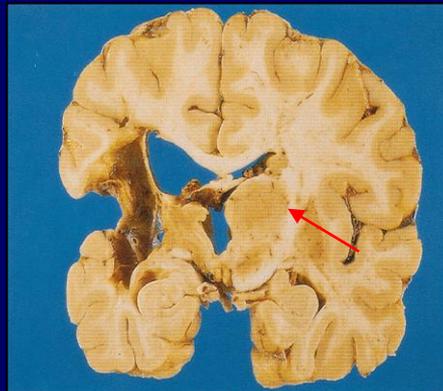
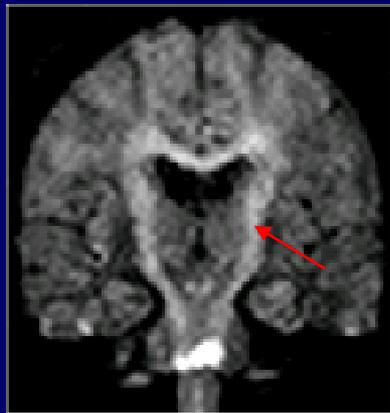
**ADC**



# 弥散加权成像上生理性信号升高



生理性屏障(例如, 神经纤维) 对水分子弥散运动会产生不同的限制作用。**该限制作用是非病理性的, 而是与方向相关的信号增加**

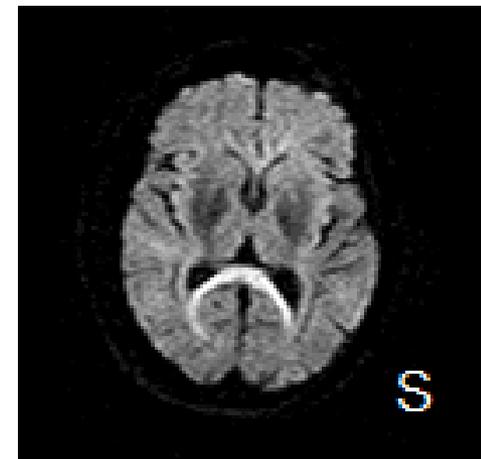
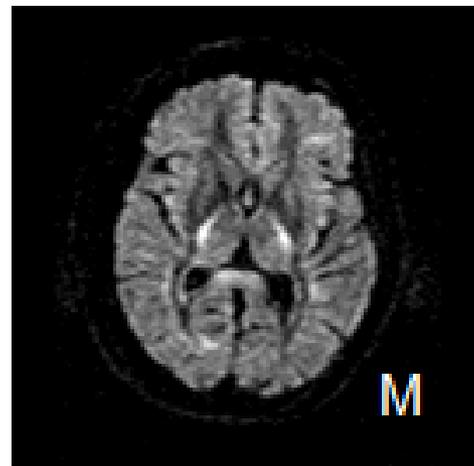
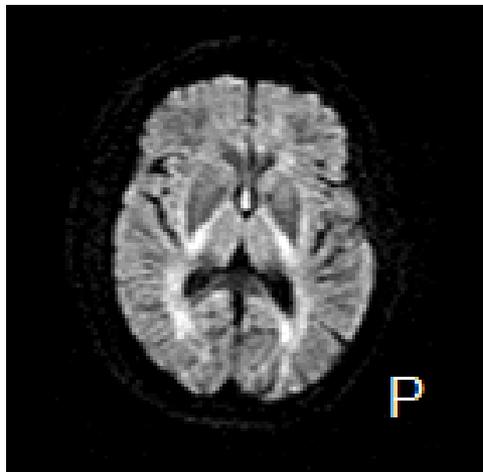


courtesy: Paul-Flechsig-Institut für Hirnforschung, Universität Leipzig

## PHILIPS

### Direction orientation of the motion

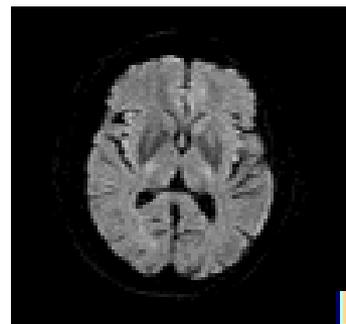
direction	
1	M
2	P
3	S



## PHILIPS

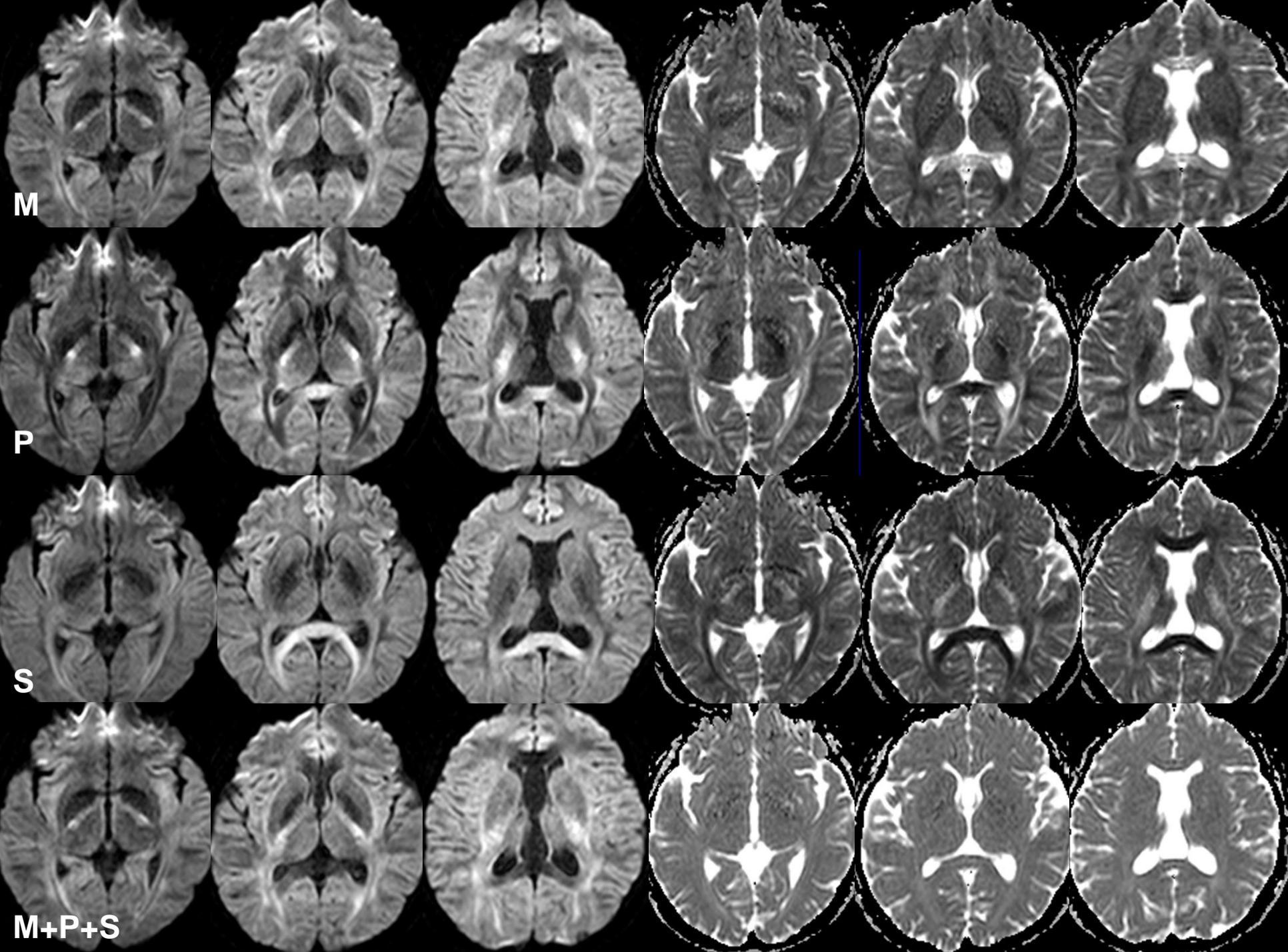
### DWI: "isotropic" or "Trace" image

- Independent of patient orientation



$$I = \sqrt[3]{|P| * |M| * |S|}$$

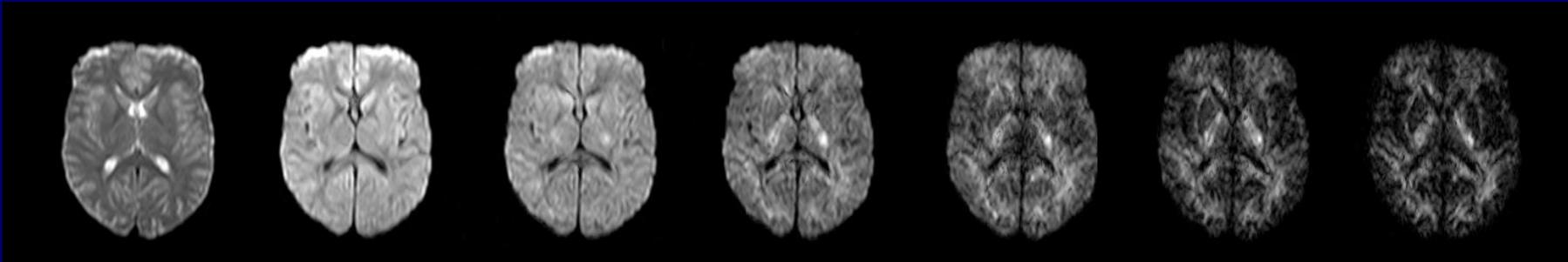
- Geometric mean of the three signals calculated per pixel
- Display of the magnitude per voxel



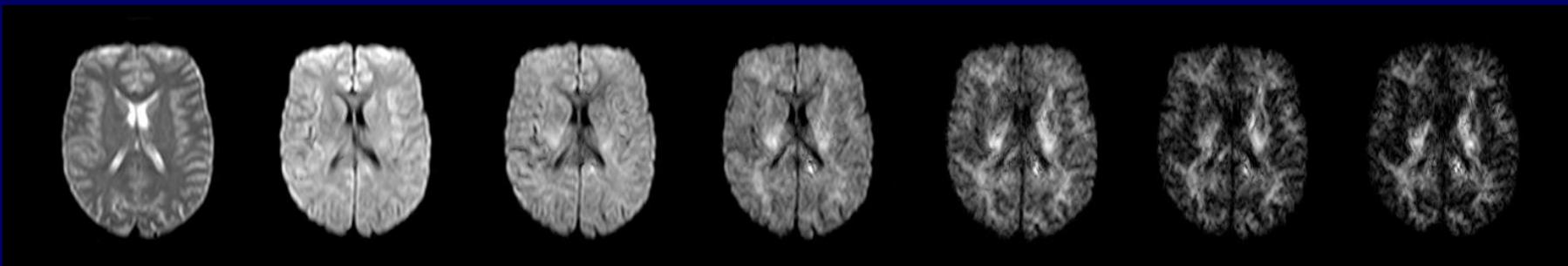


# DWI example: High b-values

Slice 1



Slice 2



b0

b1000

b2000

b3000

b4000

b5000

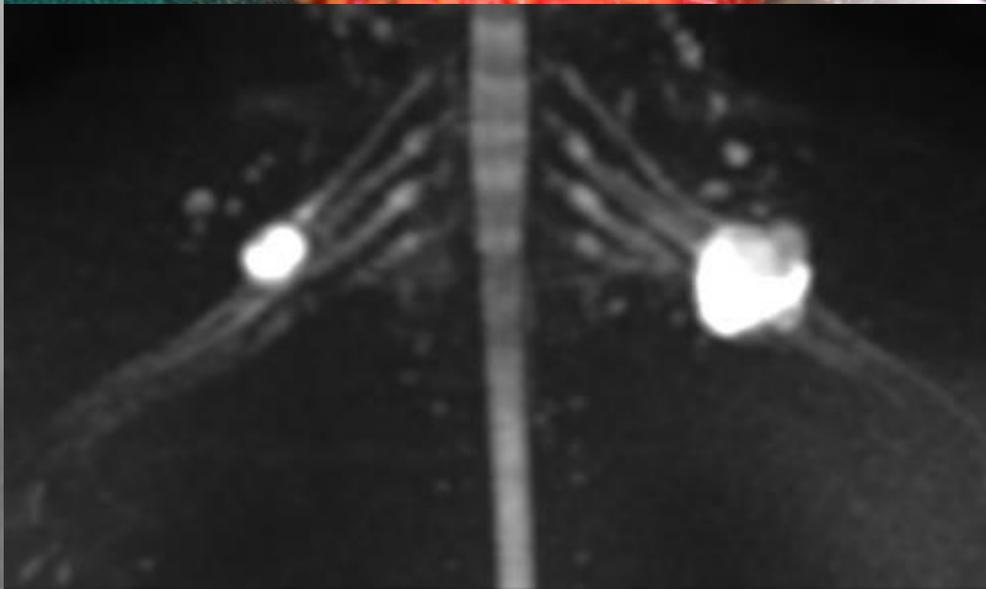
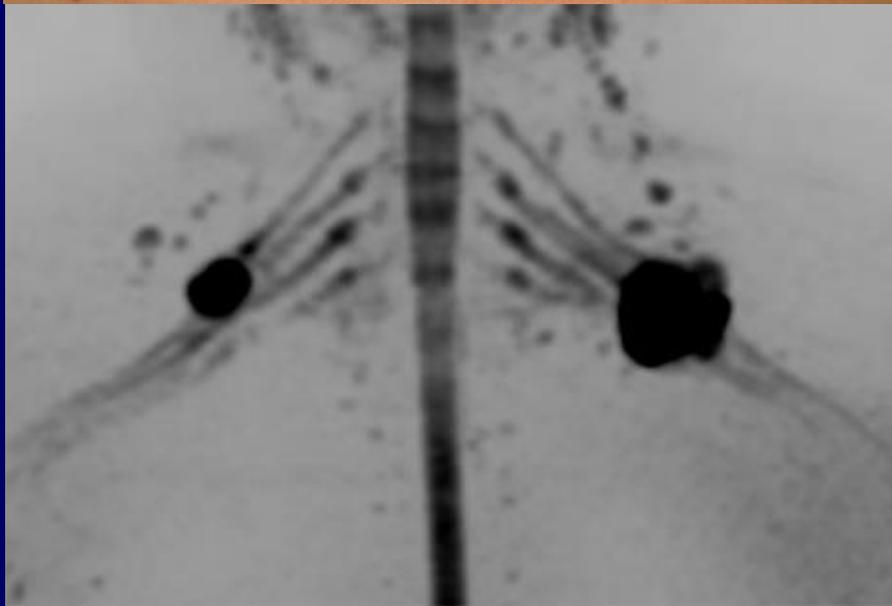
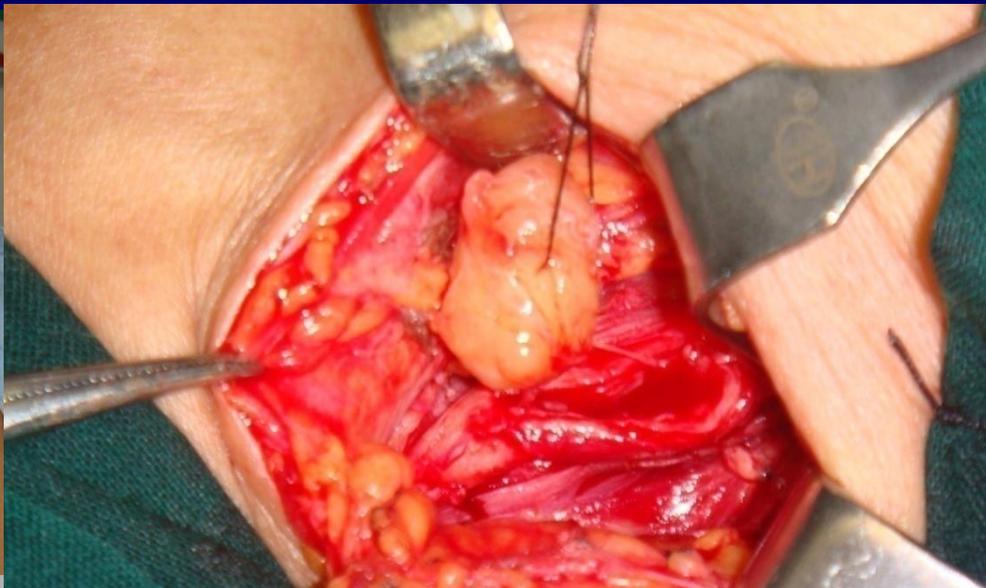
b6000

Single Shot DWI, 30 mT/m (gradient overplus)



# 双侧颈部肿块

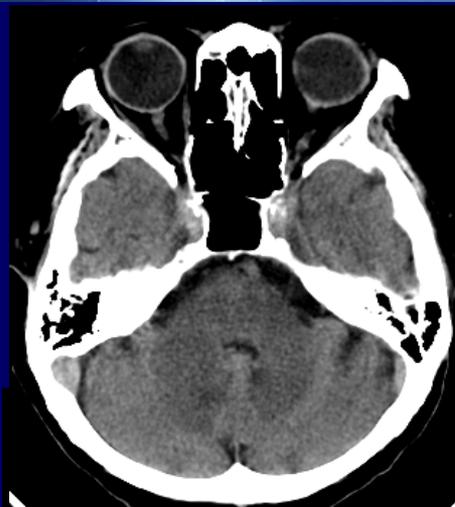
病理：神经鞘瘤



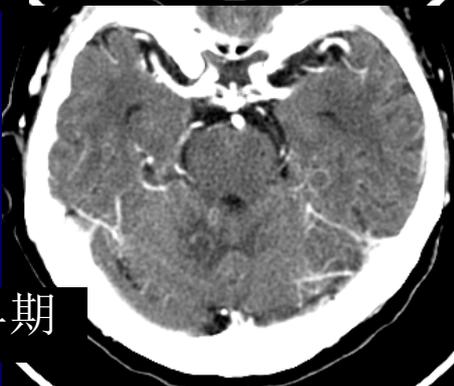
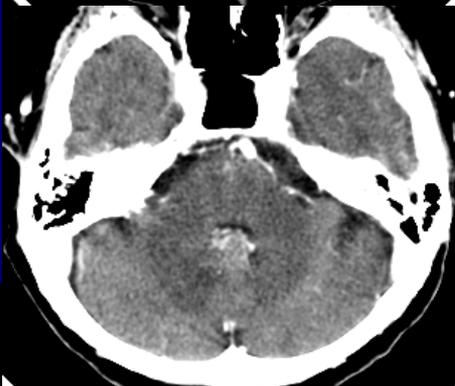


# 病例

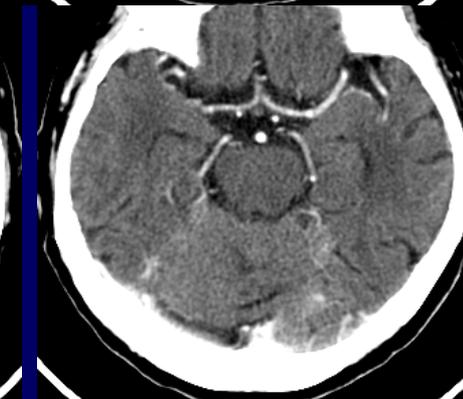
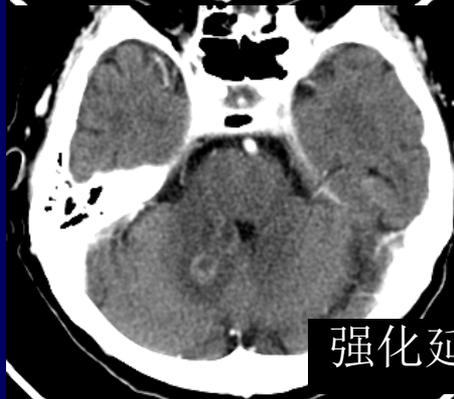
- 患者女，75岁
- 主诉：头晕半月
- 患者无发热、头痛，无肢体症状
- 既往无高血压和恶性病病史



平扫



强化早期

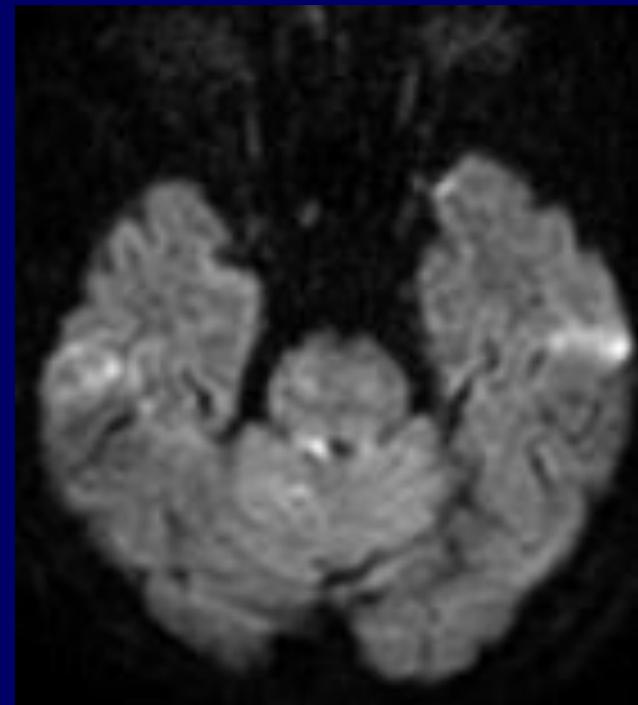
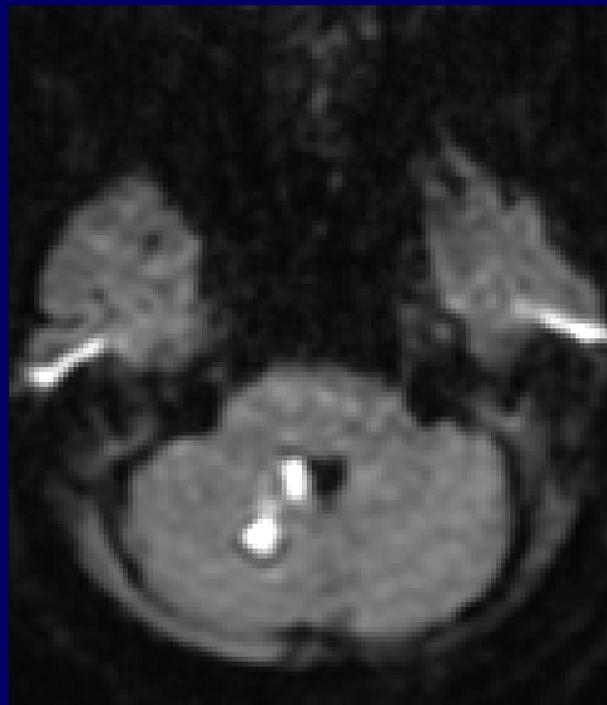
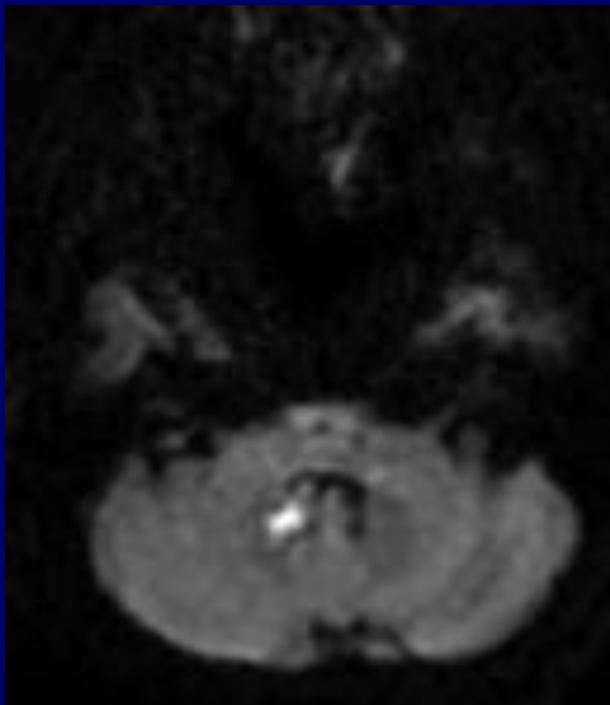


强化延迟期



# 可能的诊断

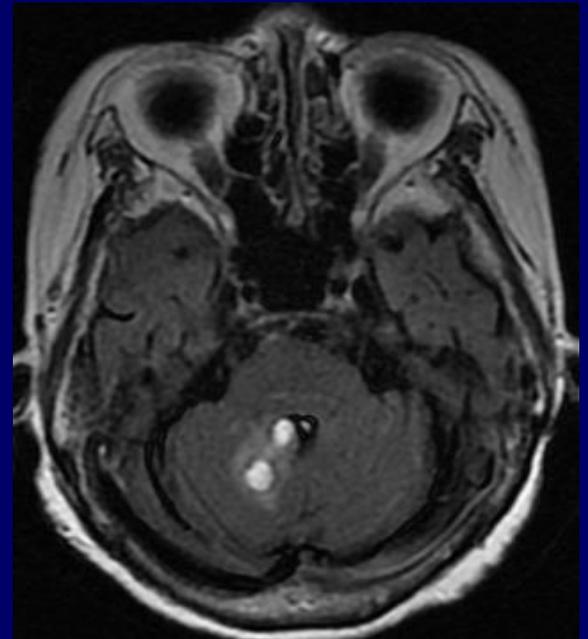
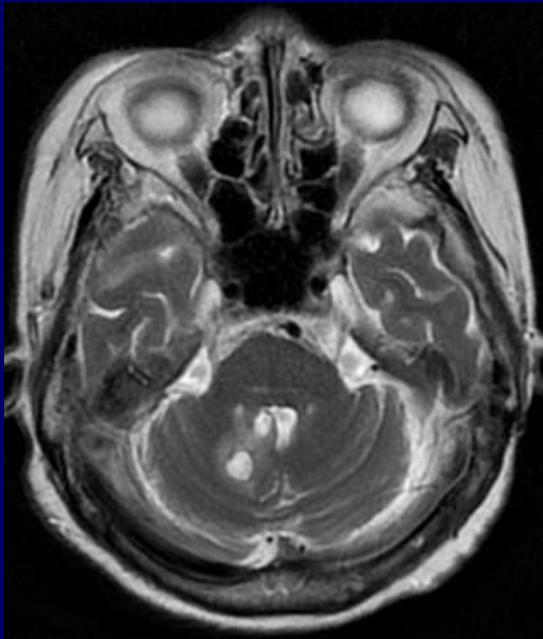
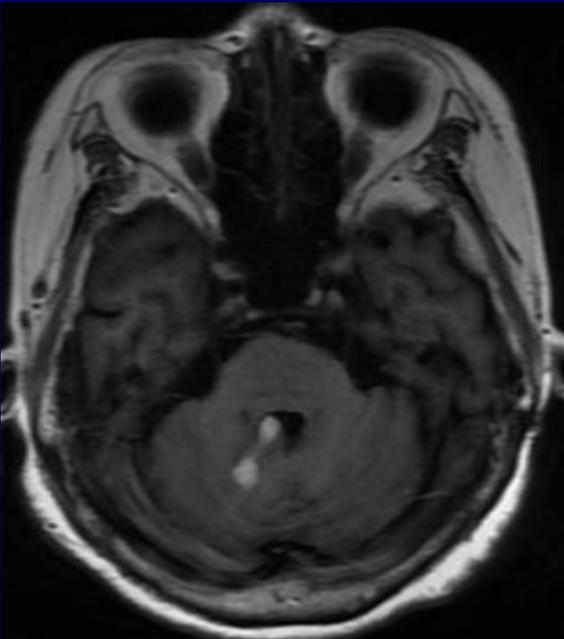
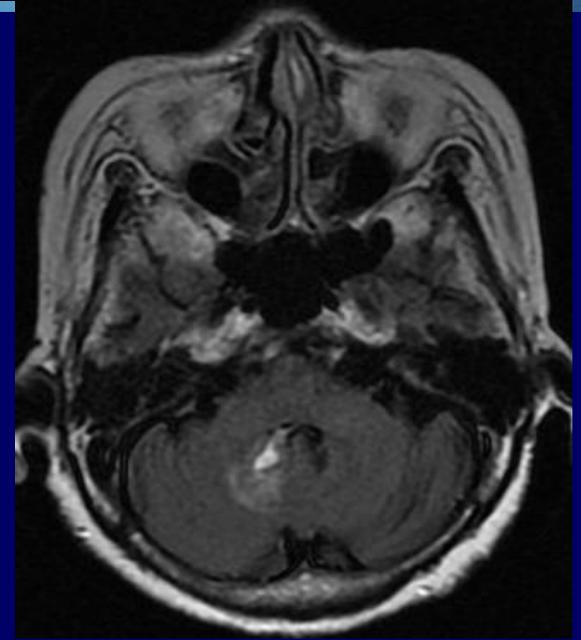
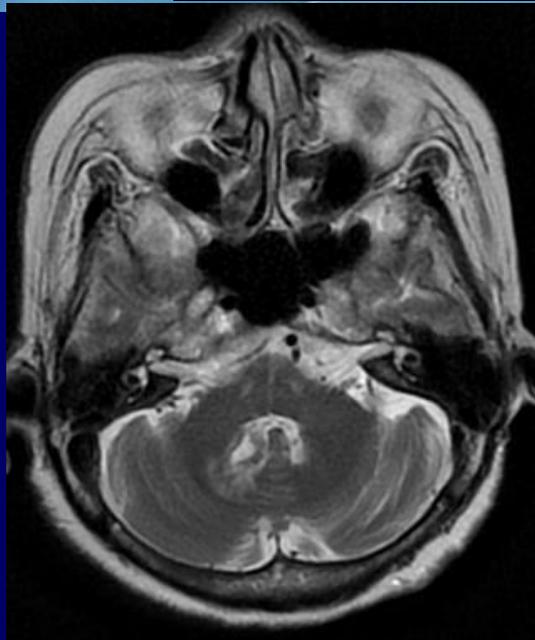
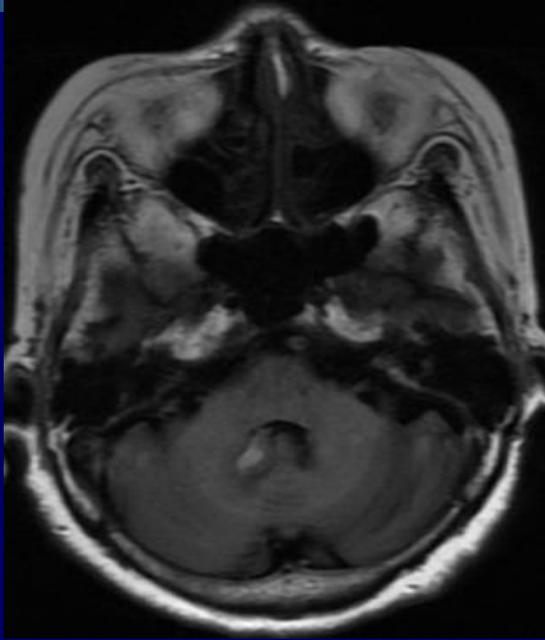
- 脑转移瘤
- 脑胶质瘤
- 脑脓肿
- 脑出血
- 脑梗死
- 脑囊虫
- 脑结核
- 脑非特异性肉芽肿



DWI ( $b=1000s/mm^2$ )

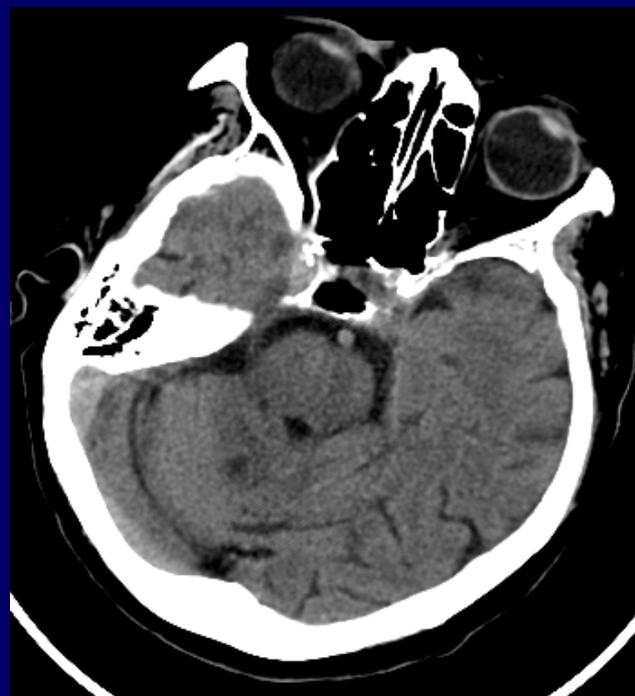
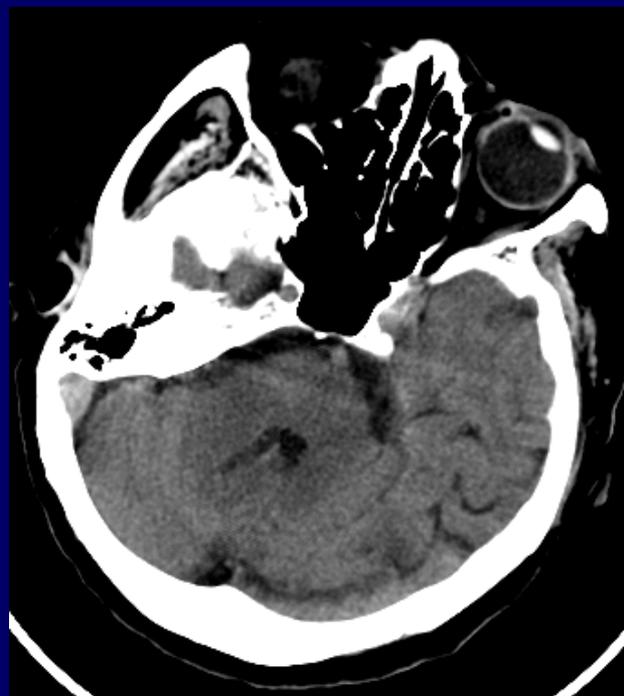
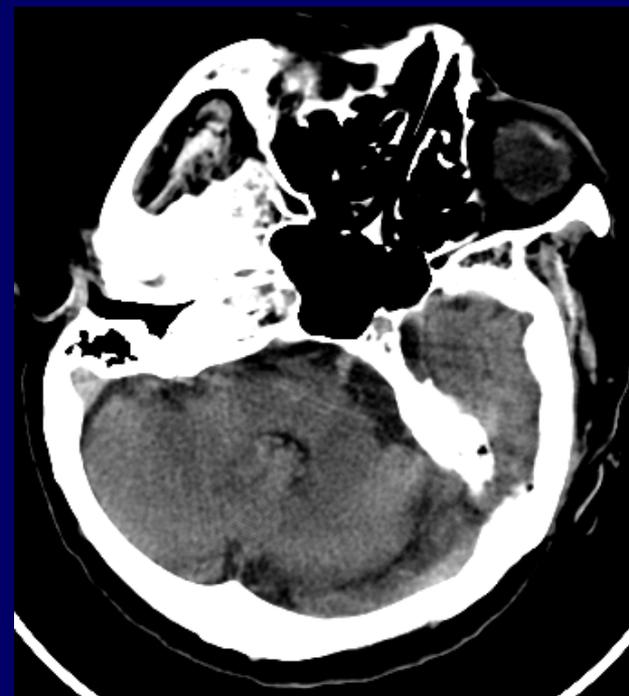


# 再行常规MRI检查





# 脑出血治疗1月后复查





- 6小时：红细胞完整，血肿周围血浆蛋白、少量单核细胞和中性粒细胞渗出，水肿较轻，神经细胞肿胀
- 12小时：周围炎性细胞增多，水肿略微明显，胶质细胞开始增生
- 24小时：周围炎性渗出及水肿进一步增加，神经细胞出现轻度缺血性改变
- 2-3天：血肿边缘红细胞开始破坏，炎性渗出和水肿等高峰，胶质细胞增生明显，神经细胞明显缺血性改变
- 4-7天：血肿边缘红细胞明显破坏并与周围脑组织界限不清，吞噬细胞出现，毛细血管增生，胶质细胞增生明显
- 2-3周：血肿红细胞破裂并逐渐吸收，出血灶缩小，毛细血管大量增生，水肿减退
- 1-2月：血肿吸收，内见大量含铁血黄素的吞噬细胞存在，周围组织疏松，并可出现囊变
- 6个月：囊肿形成，囊壁主要由胶质纤维组成，随时间延长囊壁逐渐变厚，局部仍可见吞噬有含铁血黄素吞噬细胞，胶质细胞增生明显，神经细胞不同程度坏死



## 病例小结

- 患者处于血肿约2周时进行的CT检查
- 血肿病理表现正处于密度开始降低，边缘模糊，边缘毛细血管增生导致的环状强化
- 易与脑脓肿、脑转移瘤等疾病相混淆
- 而此时血肿正处在MRI短T1长T2信号改变的亚急性期，与脑脓肿、脑转移瘤等疾病易于鉴别



# DWI小结

- 弥散受限：DWI高信号，ADC图低信号  
(三种因素，多种疾病)
- T2滤过效应：DWI高信号，ADC图高信号
- DWI生理性信号增高



# 脑血管分布与缺血性脑血管病



# 脑血液循环调节及病理生理特点

- 重量：正常成人脑1500g，占体重2%-3%
- 流经血液：750-1000ml/min，占每分心搏出量的20%
- 脑耗氧量：占全身耗氧量的20%-30%
- 能量：主要来自糖的有氧代谢，**几乎无能量储备**
- 对缺血、缺氧性损害十分敏感
- 血供中断，2分钟内脑电活动停止，5分钟现不可逆损伤



# 脑血液循环调节及病理生理特点

- 血流量分布不一，灰质  $>$  白质  
(**大脑皮层最丰富**，其次为基底核和小脑皮质)
- 大脑皮层缺血易发生出血性脑梗死
- 白质缺血易为缺血性脑梗死



# 脑动脉血管的特点

- 脑的血供与颅骨和硬脑膜的血供彼此无关，前者来自颈内动脉和椎动脉，后者来自颈外动脉
- 入颅动脉极度弯曲，是脑动脉无搏动的主要原因
- 脑动脉壁很薄，类似颅外同等大小的静脉  
(相对而言易破裂出血)
- 大脑的动脉分类：
  - 皮质支cortex branches**：营养皮质和浅层髓质
  - 中央支central branches**：（基底核、内囊及间脑）二者均自成体系，互不吻合



# 脑血管病

(cerebrovascular disease, CVD)

- 由各种原因导致的急慢性脑血管病变
- 人类死亡的三大主要疾病之一
- 脑卒中 (stroke) 指由于急性脑循环障碍导致的局限或全面性脑功能缺损综合征或称急性脑血管病事件



# 脑血管病分类（1995，中国）

- I, 短暂性脑缺血发作：颈内动脉系统、椎-基底动脉系统
- II, 脑卒中：
  - 1, 蛛网膜下腔出血（动脉瘤、血管畸形等）
  - 2, 脑出血（高血压、梗死后、肿瘤、血液病等）
  - 3, 脑梗死：
    - 动脉粥样硬化性血栓性脑梗死
    - 脑栓塞（心源性、动脉源性、其他）
    - 腔隙性脑梗死
    - 出血性脑梗死
    - 无症状性脑梗死
    - 其他
    - 原因不明
- III, 椎-基底动脉供血不足
- IV, 脑血管性痴呆
- V, 高血压脑病
- VI, 颅内动脉瘤
- VII, 颅内血管畸形
- VIII, 脑动脉炎
- IX, 其他动脉疾病
- X, 颅内静脉病、静脉窦及脑部静脉血栓形成



# 脑卒中（1986-1990流调） (stroke)

- 发病率：109.7-217/10万
- 患病率：719-745.6/10万
- 死亡率：116-141.8/10万
- 存活者中50%-70%遗留严重残疾
- 男：女约为（1.3-1.7）：1



# 脑血管病的病因

- 1, 血管壁病变： 高血压性动脉硬化、动脉粥样硬化最常见  
其次动脉炎（结核、梅毒、结缔组织病和钩端螺旋体等）  
再次先天性血管病、外伤、药物、肿瘤等
- 2, 心脏病和血流动力学改变： 高血压、低血压、血压波动、  
心律失常
- 3, 血液成分和血液流变学改变： 脱水、凝血机制异常
- 4, 其他病因： 空气、脂肪、癌细胞栓子  
脑血管受压、外伤、痉挛



# 一、动脉粥样硬化性血栓性脑梗死

- ✓ 脑梗死最常见类型，占60%
- ✓ 主因：动脉硬化、动脉炎
- ✓ 脑动脉主干或（主要）分支管腔狭窄、闭塞或血栓形成（属于大血管病！！）
- ✓ 颈内动脉占80%，椎-基底动脉占20%
- ✓ 顺序：颈内动脉、MCA、PCA、ACA、椎-基底动脉
- ✓ 影像学特点：病灶按照供血动脉分布

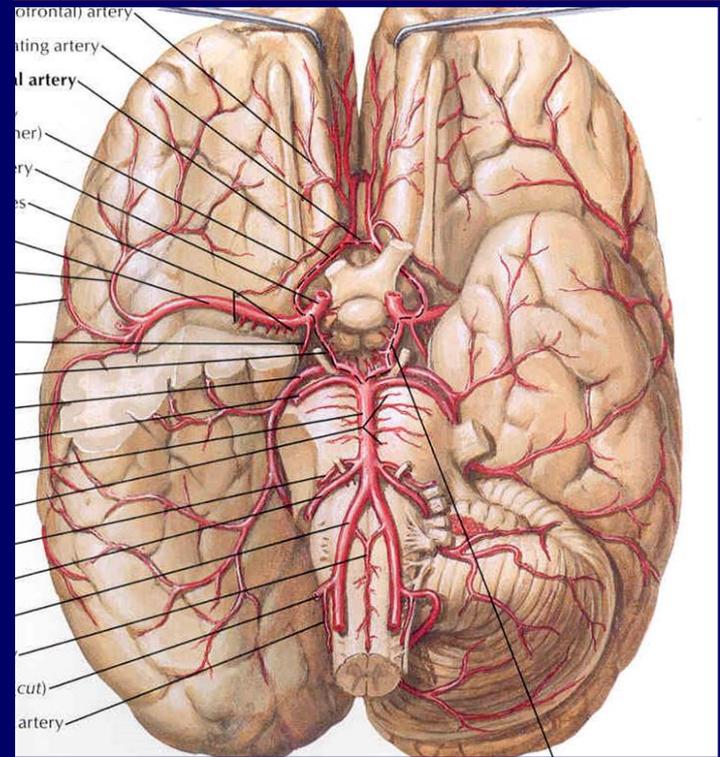


# 脑的供血动脉

## 颈内动脉、椎-基底动脉

- 大脑：ACA、MCA、PCA
- 小脑：PICA、AICA、SCA
- 脑干：BA、VA

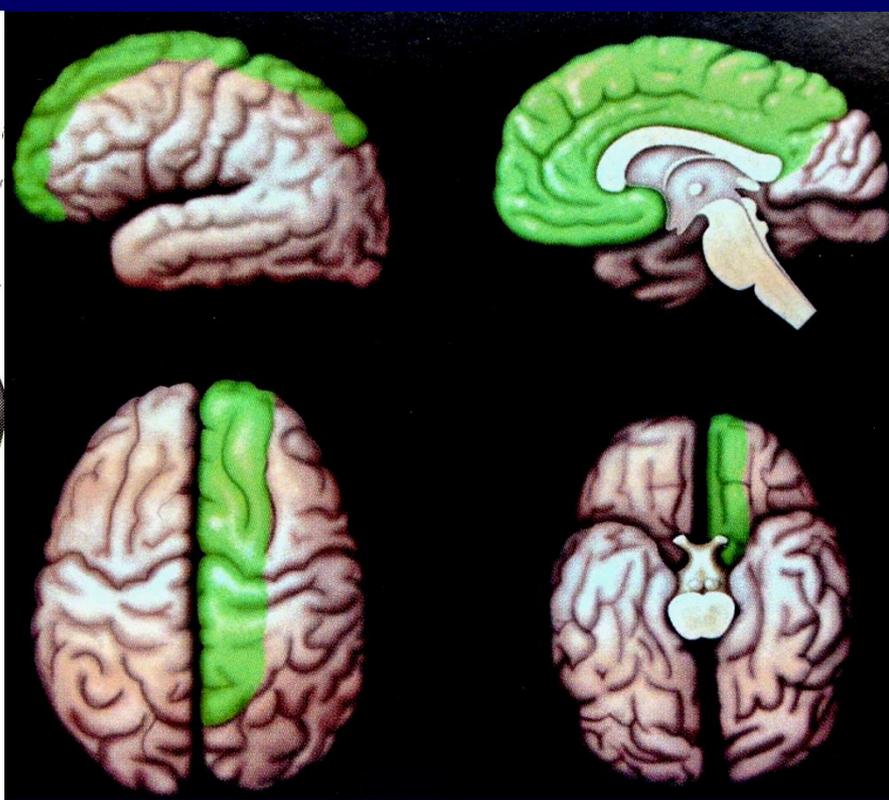
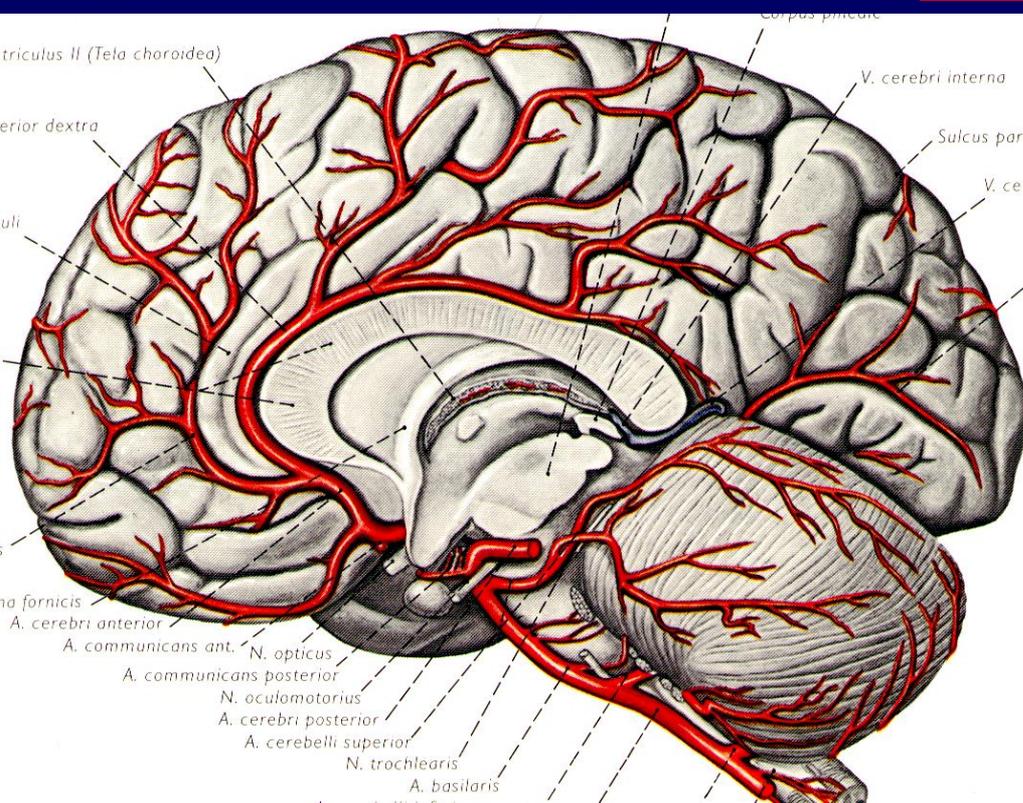
- 皮质支、中央支（穿支）
- 各自有不同的供血区域
- 鉴别诊断

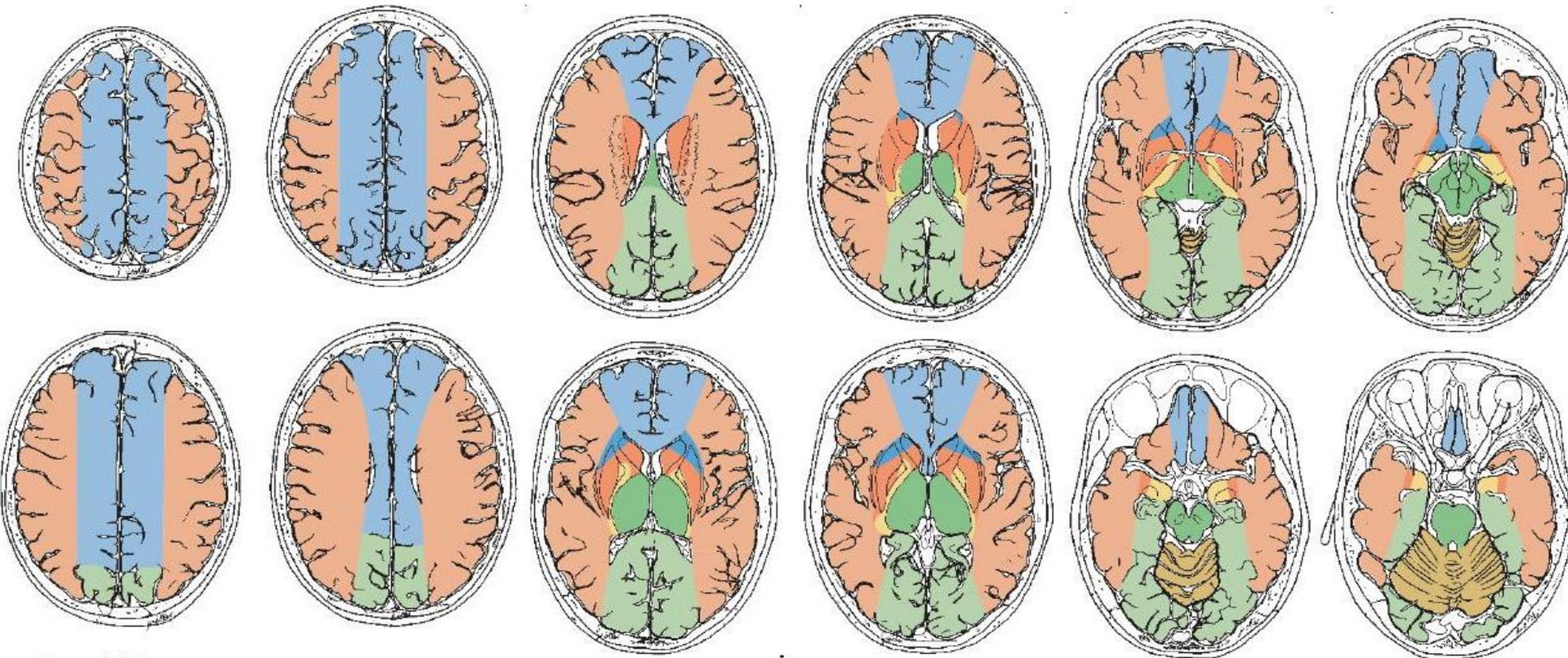




# 大脑前动脉 供血范围

- 皮质支：
  - 额叶下内侧部
  - 大脑半球内侧面的前2/3  
(顶枕沟以前半球内侧面)
  - 大脑凸面中线外1-2cm处





### Anterior cerebral artery

Terminal branches

### Middle cerebral artery

Terminal branches

### Posterior cerebral artery

Terminal branches

### Anterior cerebral artery

Terminal branches

Central branches (striated branches arteries and Huebner's recurrent including distal medial striate artery)

### Middle cerebral artery

Terminal branches

Central branches (striated branches)

### Posterior cerebral artery

Terminal branches

Central branches (including the posterior communicating artery)

### Anterior choroidal artery

### Anterior cerebral artery

Terminal branches

Central branches (striated branches)

### Middle cerebral artery

Terminal branches

Central branches (striated branches)

### Posterior cerebral artery

Terminal branches

Central branches (including the posterior communicating artery)

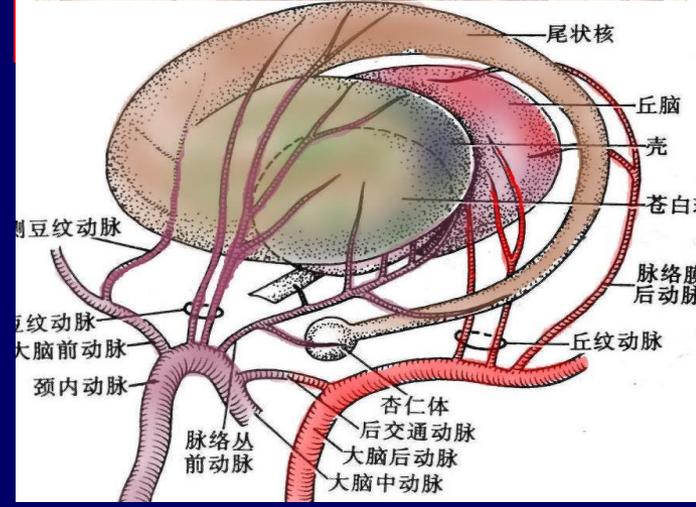
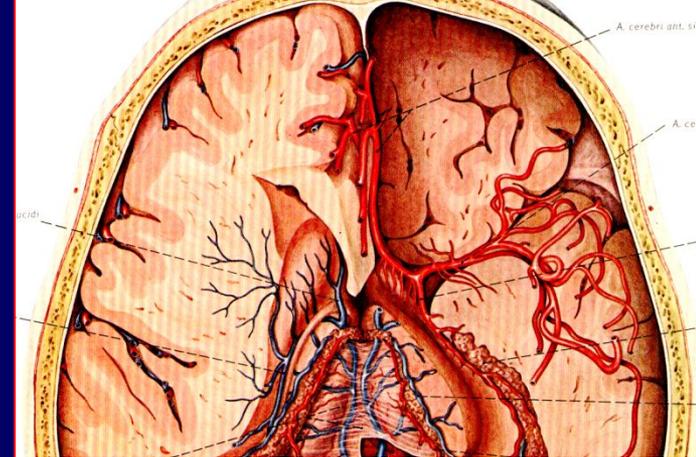
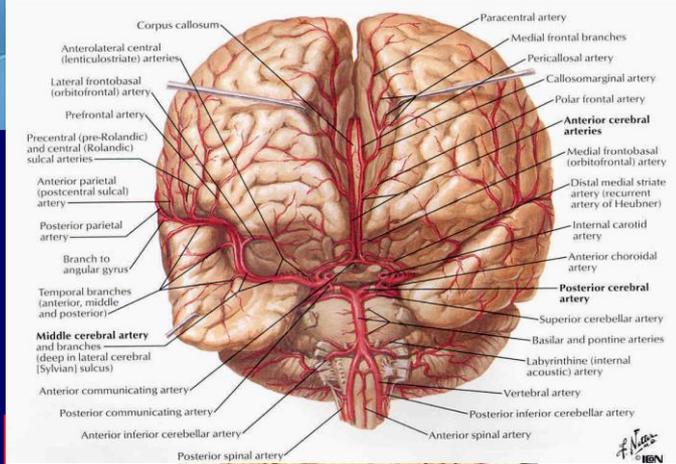
### Anterior choroidal artery

Superior cerebellar artery



# 大脑前动脉供血范围

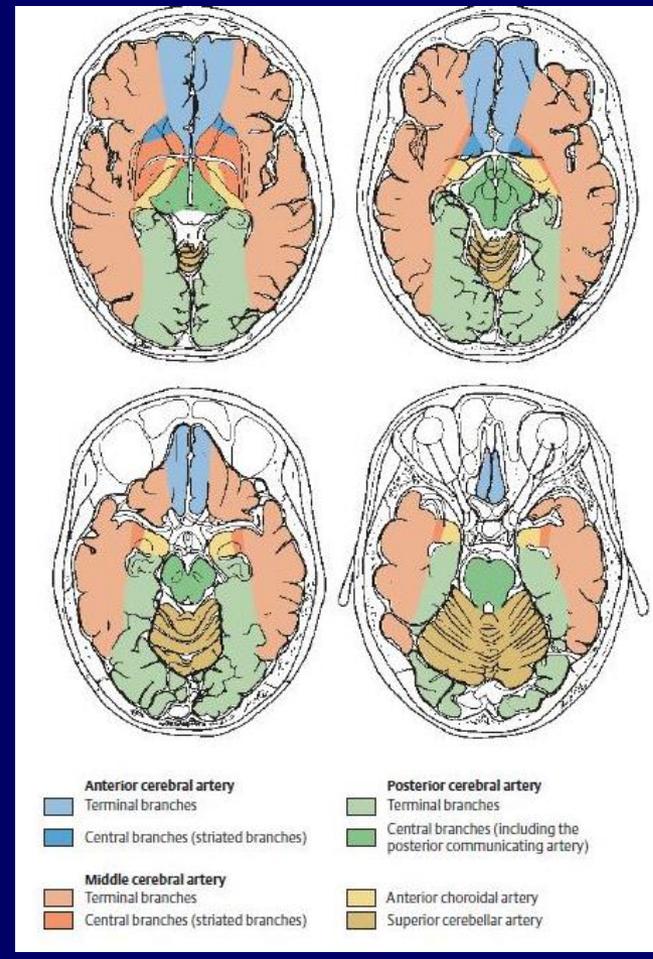
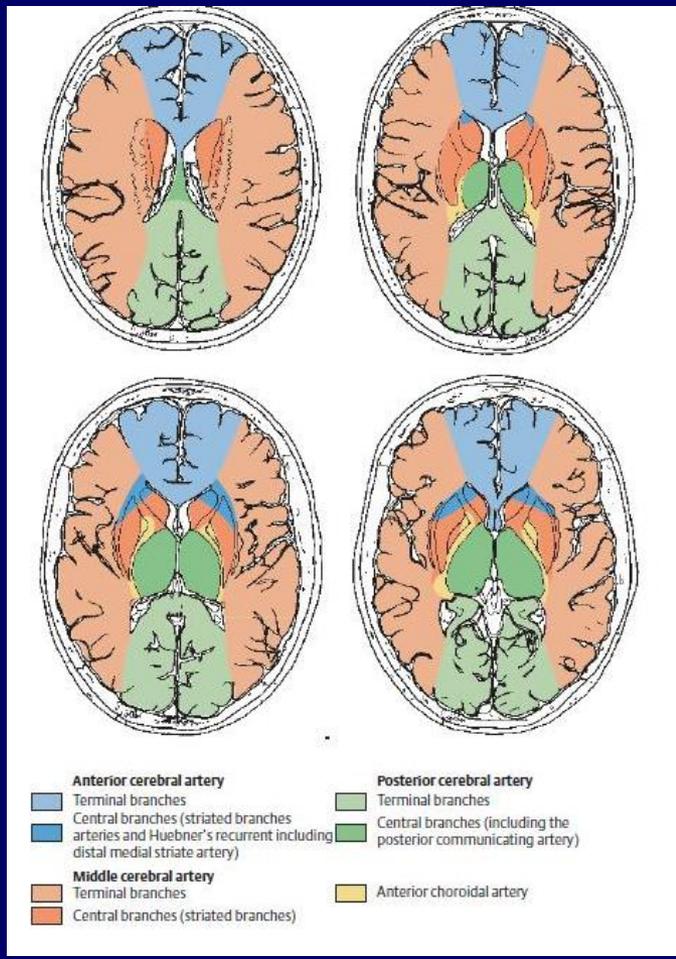
- 中央支（内侧豆纹动脉）
- A. 返支（Heubner 动脉）：  
营养壳、尾状核头及  
内囊前下部；
- B. 基底支：  
供应视交叉和下丘脑

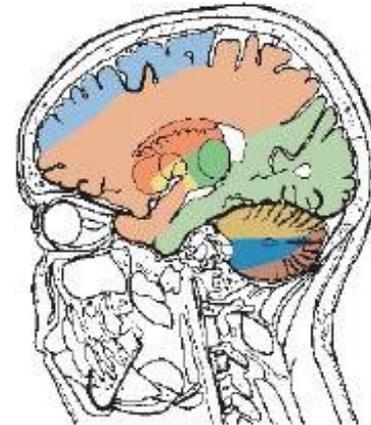
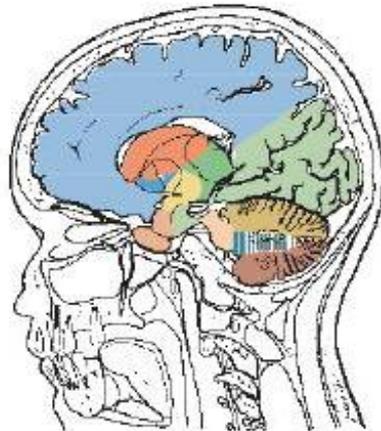
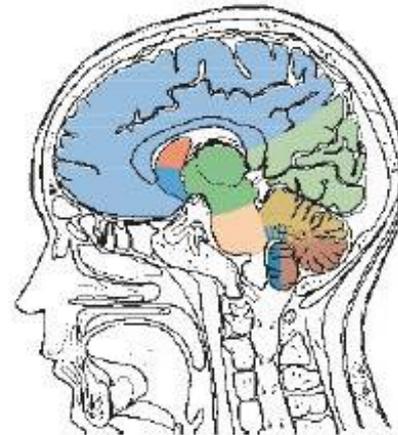
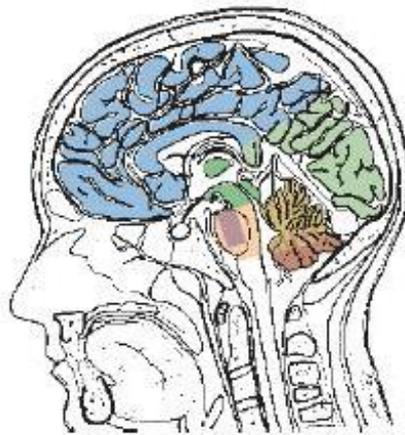




# 大脑前动脉供血范围

- 中央支：胼胝体嘴部，尾状核头，前联合  
壳核前1/3、苍白球外侧部尖端、内囊前肢  
(Recurrent artery of Heubner)



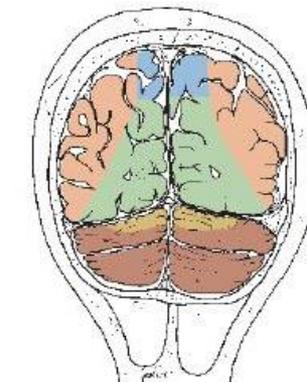
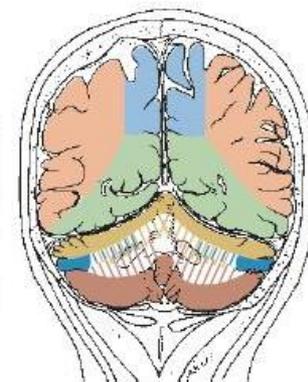
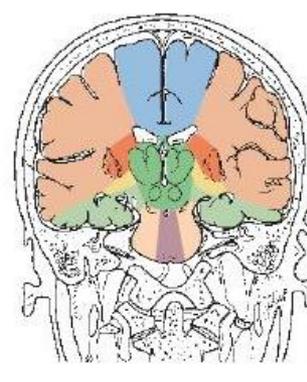
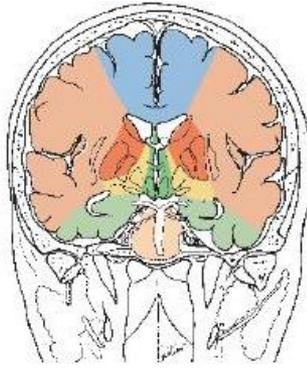
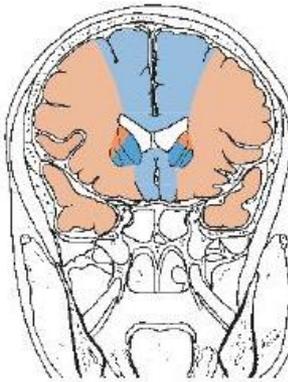
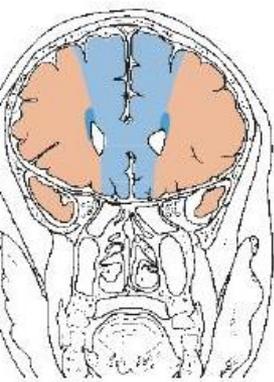
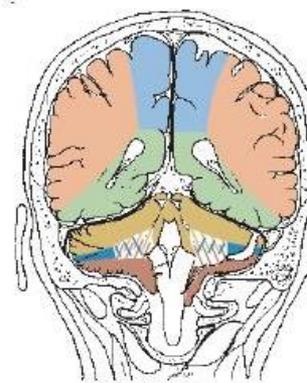
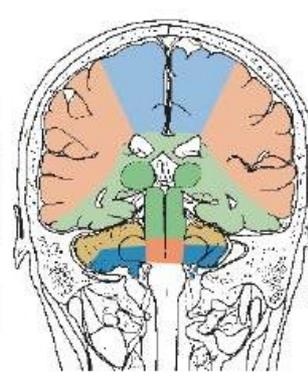
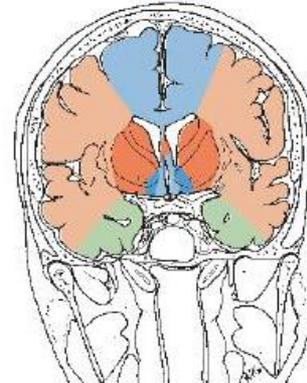
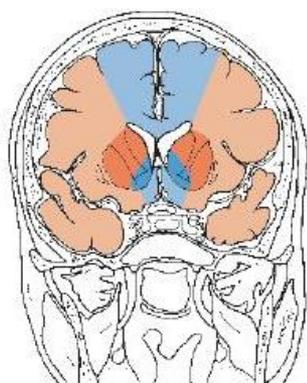
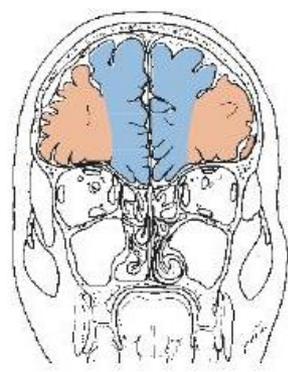
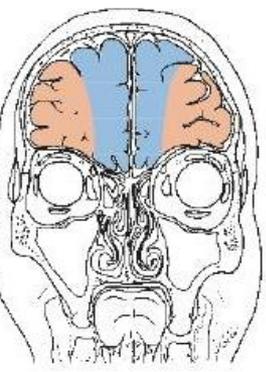


- Anterior cerebral artery**
- Terminal branches
  - Central branches (striate arteries including distal medial striate artery)

- Middle cerebral artery**
- Terminal branches
  - Central branches (striate branches)

- Posterior cerebral artery**
- Terminal branches
  - Central branches (including the posterior communicating artery)

- Basilar artery**
- Anteromedial and anterolateral paramedian branches
  - Circumferential arteries and lateral and dorsal paramedian branches
  - Superior cerebellar artery
  - Anterior superior cerebellar artery
  - Boundary region
  - Posterior inferior cerebellar artery



**Anterior cerebral artery**  
 Terminal branches  
 Central branches

**Middle cerebral artery**  
 Terminal branches  
 Central branches

**Anterior cerebral artery**  
 Terminal branches  
 Central branches (striate arteries including distal medial striate artery)

**Middle cerebral artery**  
 Terminal branches  
 Central branches (striate branches)

**Posterior cerebral artery**  
 Terminal branches  
 Central branches (including posterior communicating artery)  
 Anterior choroidal artery

**Basilar artery**  
 Anteromedial and anterolateral paramedian branches  
 Circumferential arteries and lateral and dorsal paramedian branches

**Anterior cerebral artery**  
 Terminal branches

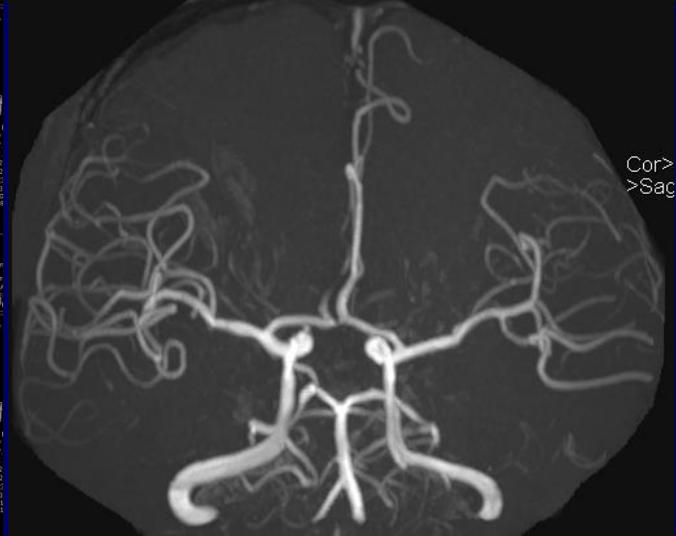
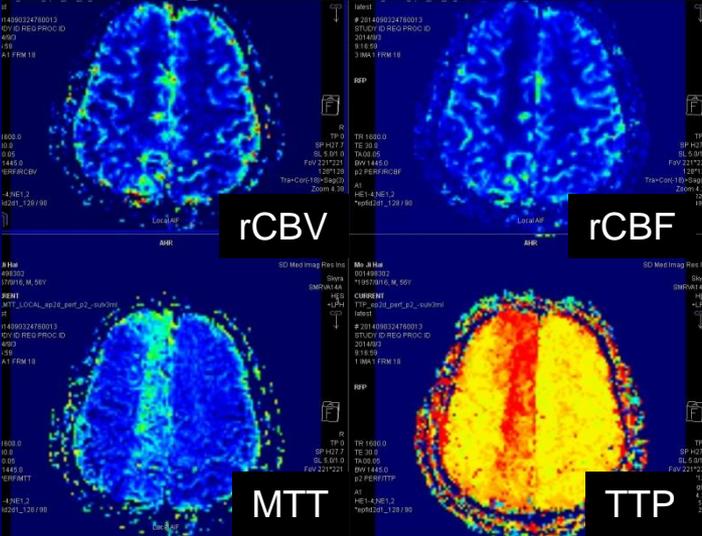
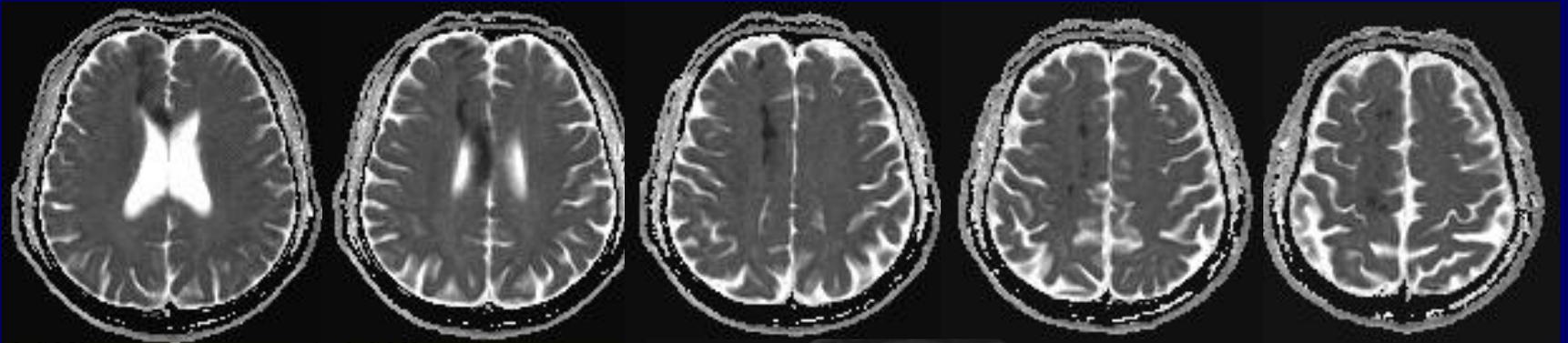
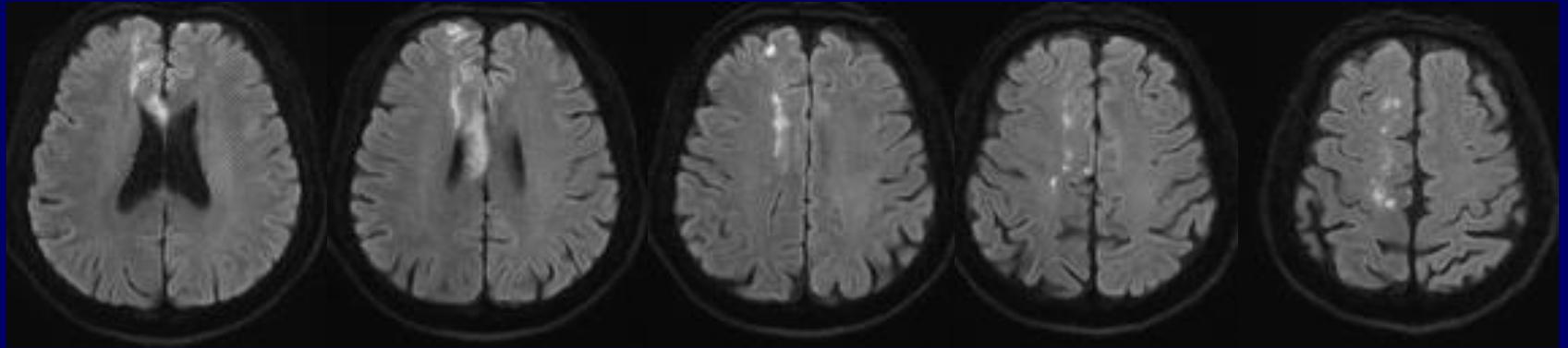
**Middle cerebral artery**  
 Terminal branches

**Posterior cerebral artery**  
 Terminal branches  
 Central branches (including posterior communicating artery)

Anterior choroidal artery

**Basilar artery**  
 Circumferential arteries and lateral and dorsal paramedian branches

Superior cerebellar artery  
 Anterior inferior cerebellar artery  
 Border area  
 Posterior inferior cerebellar artery

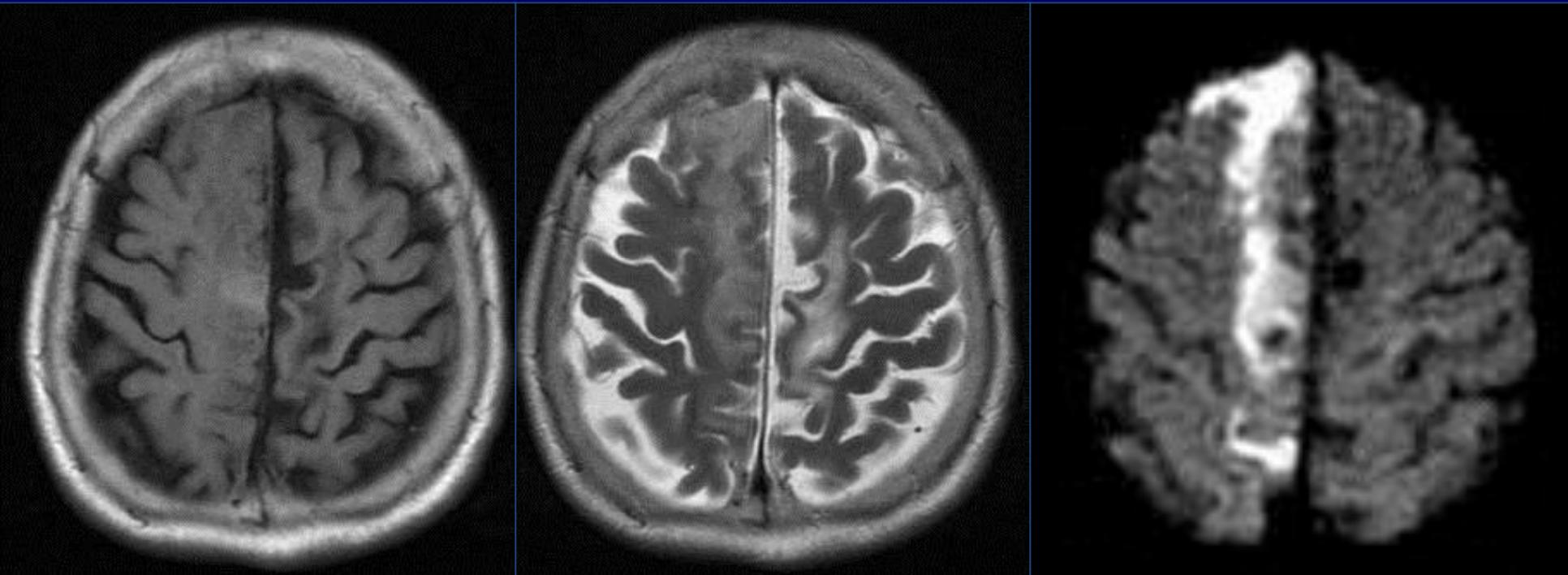


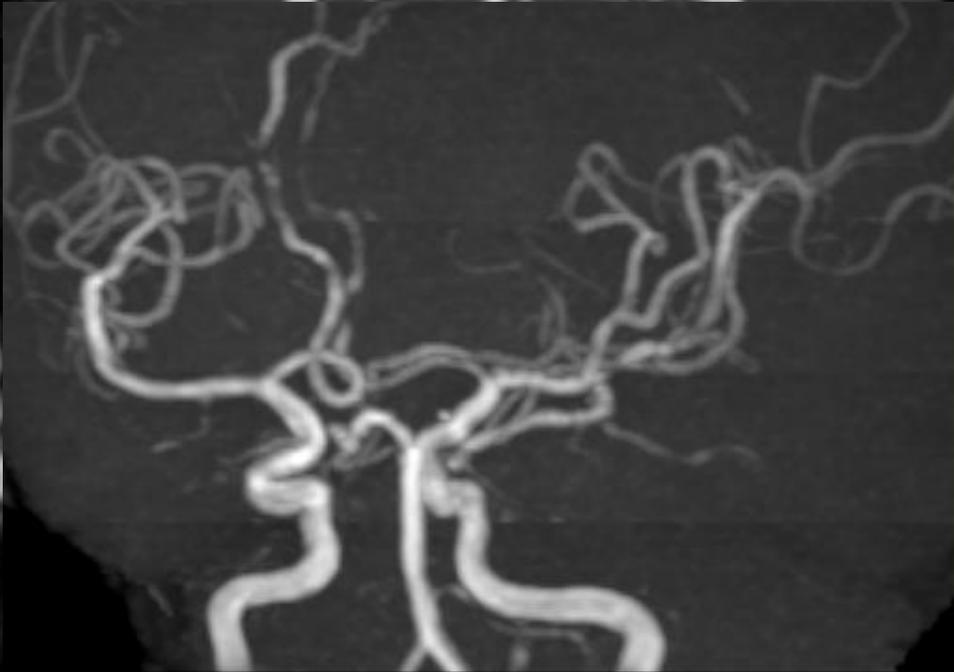
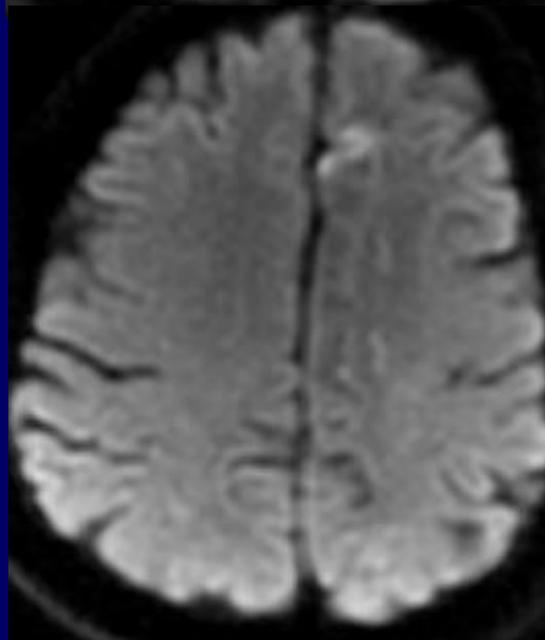
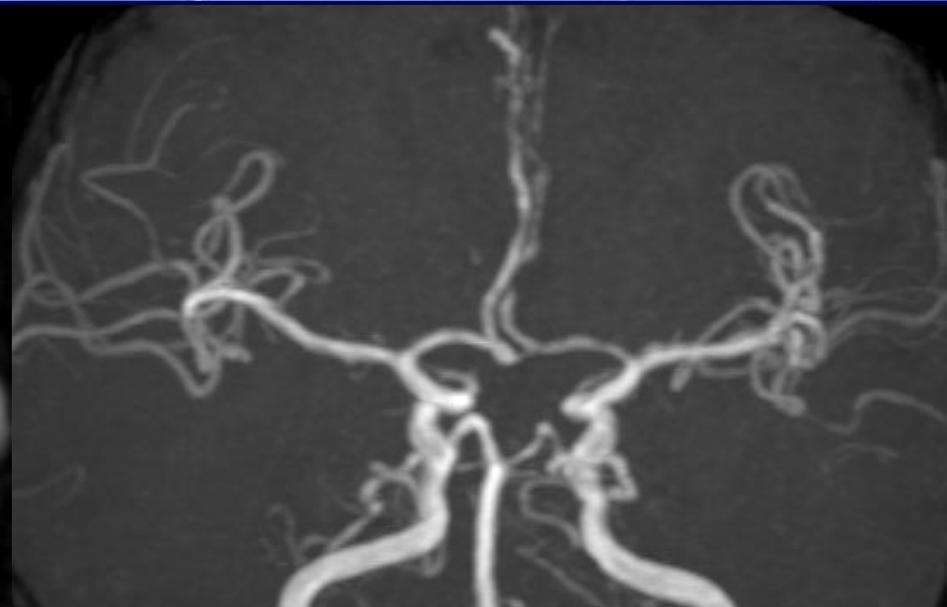
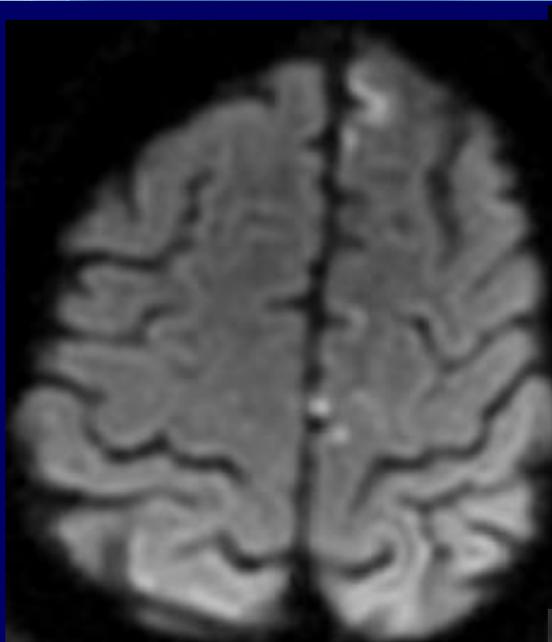
男，57岁，  
左下肢无力2  
天，加重伴  
左上肢无力4  
小时

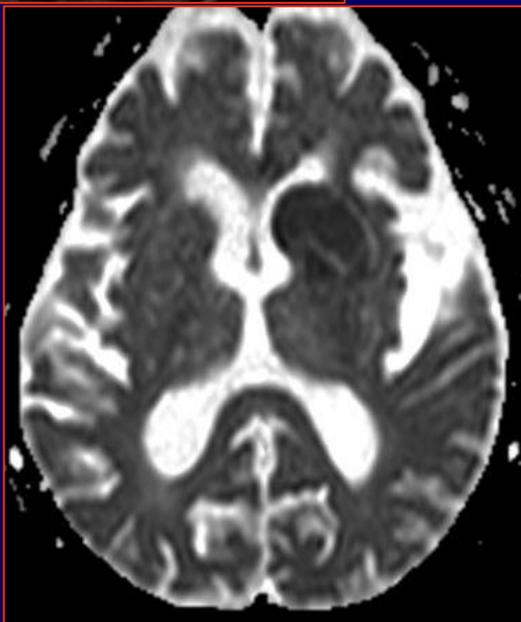
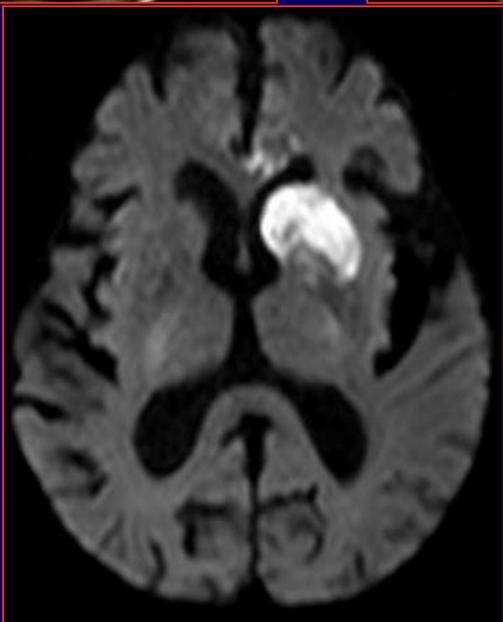
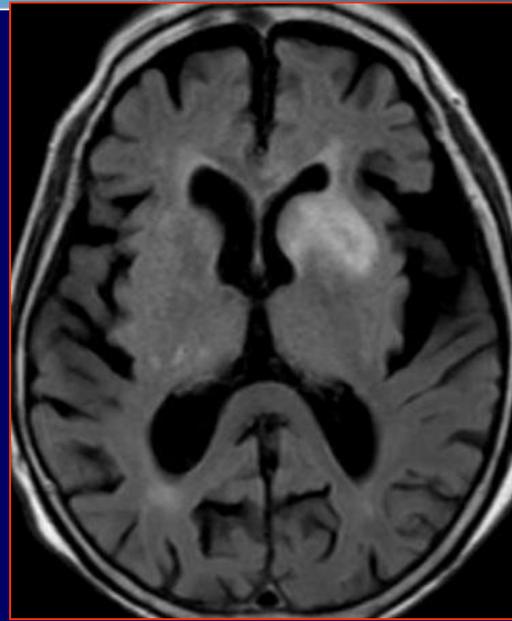
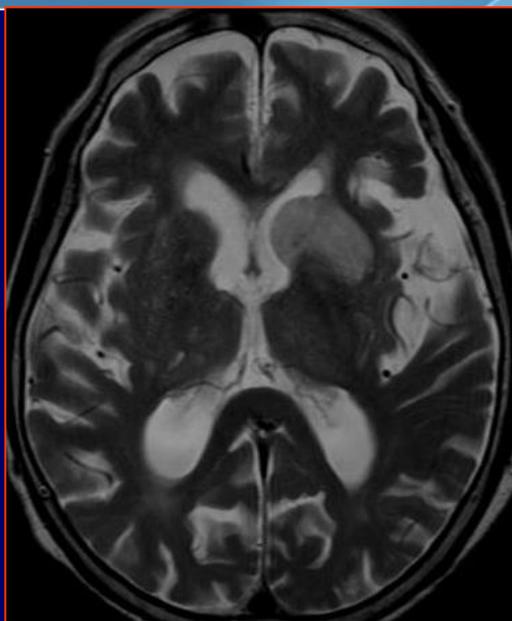
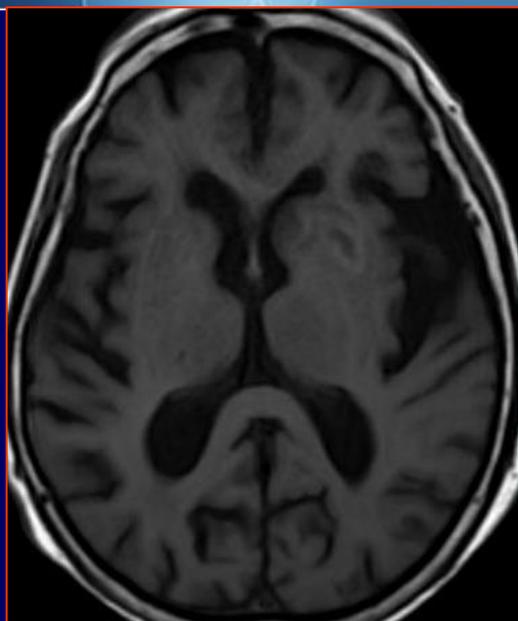
前交通发育不良



# 大脑前动脉供血区脑梗死





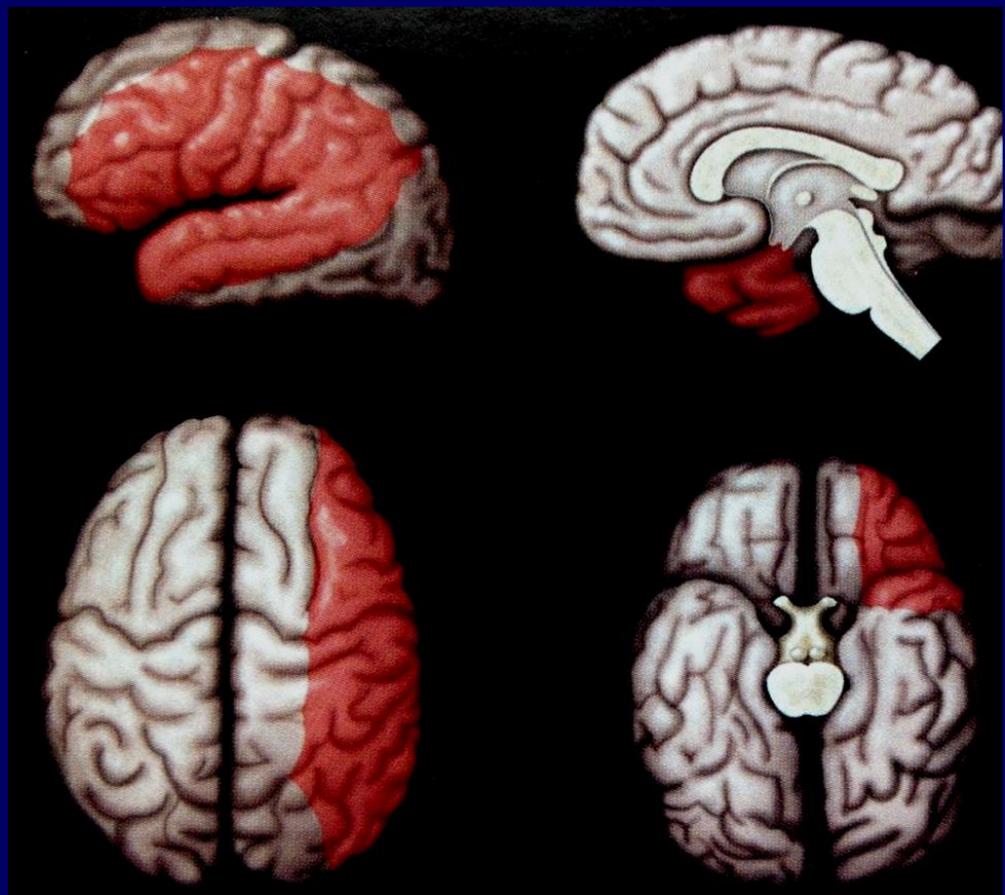
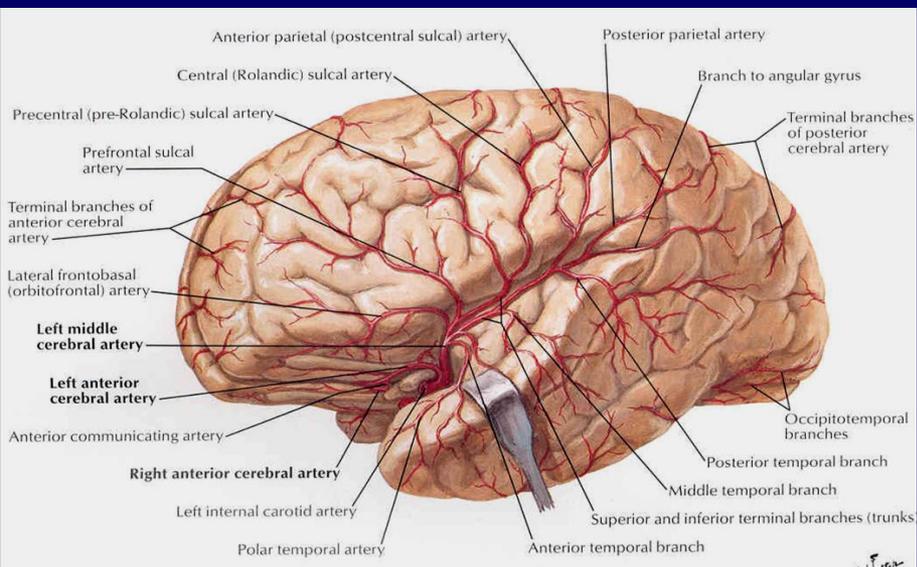


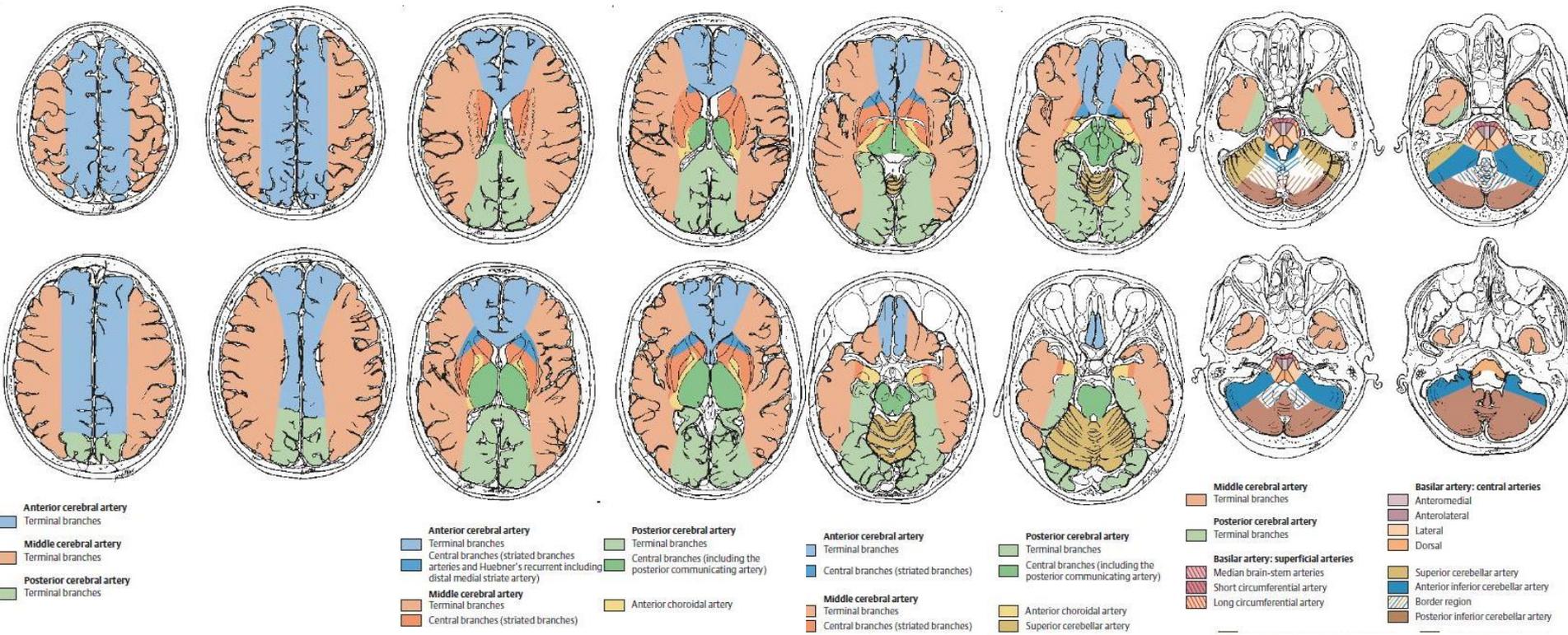
ACA中央支



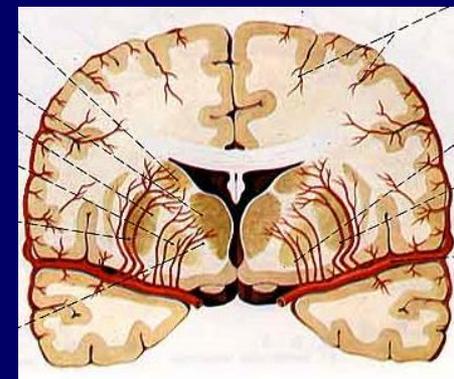
# 大脑中动脉供血范围

- 皮质支： 大脑半球外侧面的大部  
颞叶前极  
脑岛表面  
额叶下外侧面

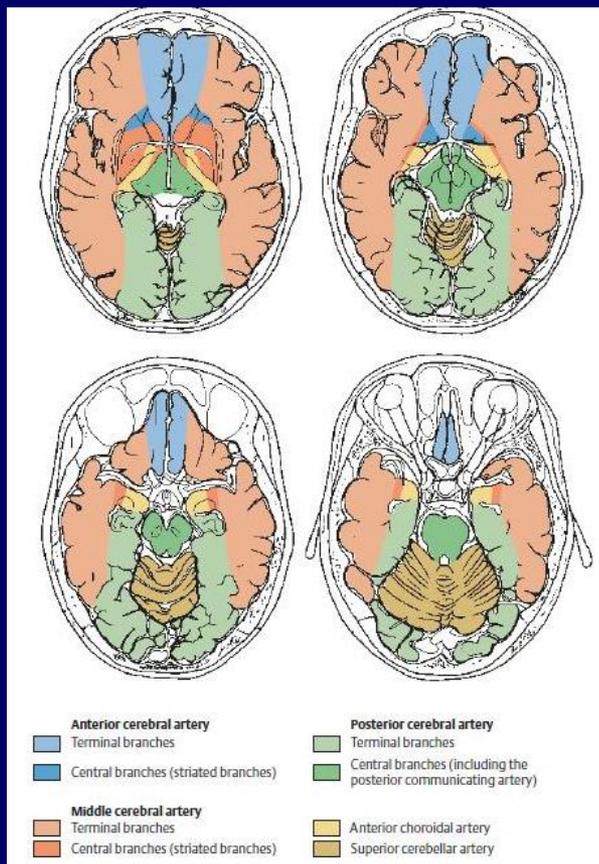
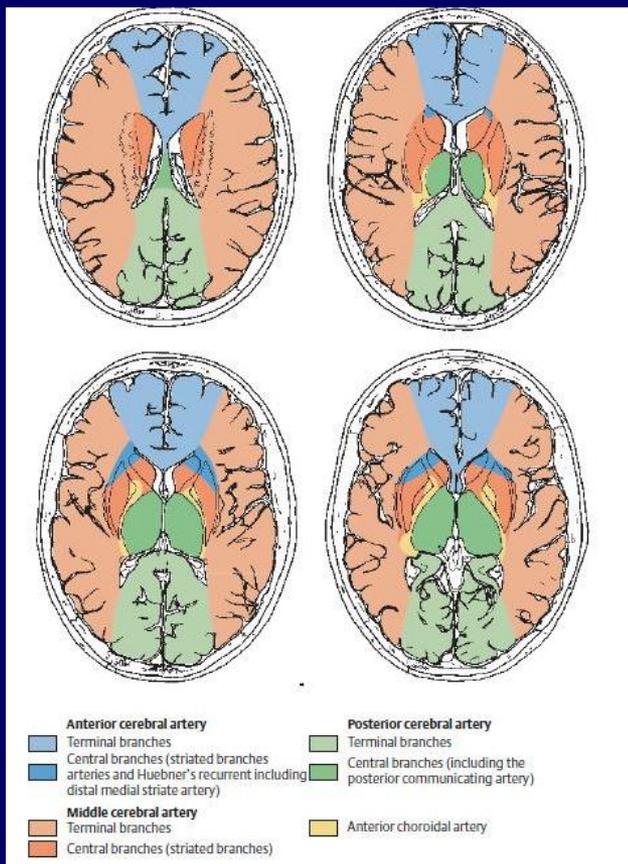




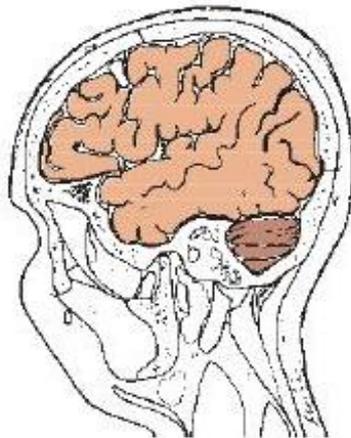
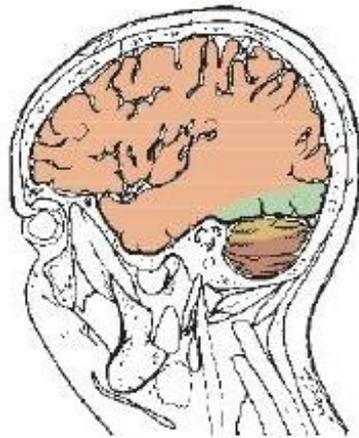
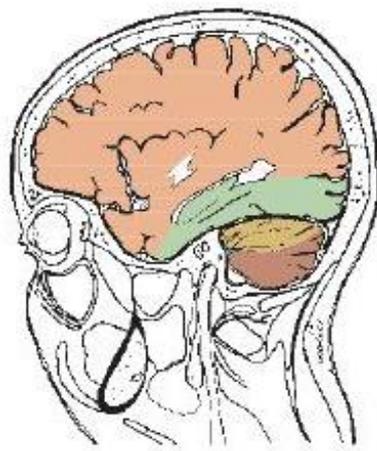
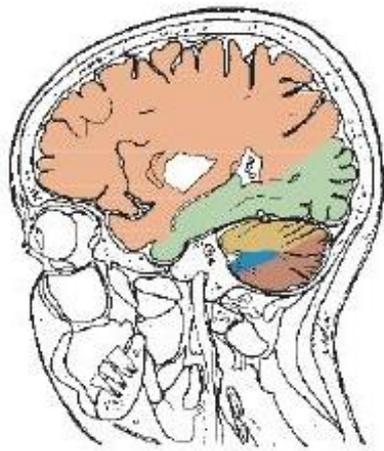
# 大脑中动脉供血范围



➤ 中央支（外侧豆纹动脉）：  
前连合外侧部，壳的大部、苍白球的大部分  
内囊上半部及附近辐射冠；尾状核的大部分  
部分深部白质

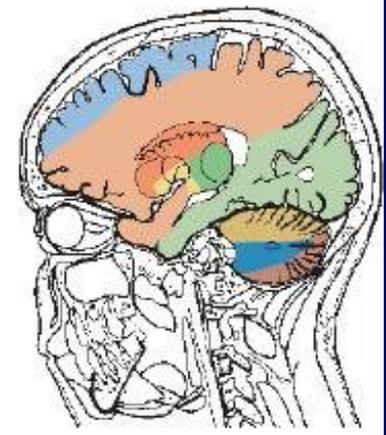
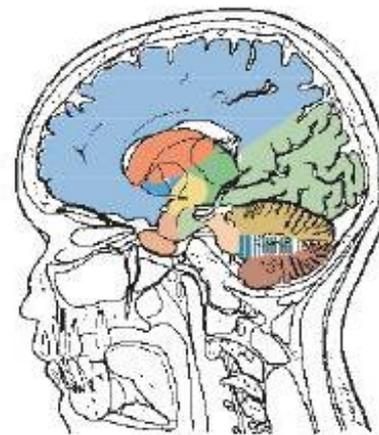
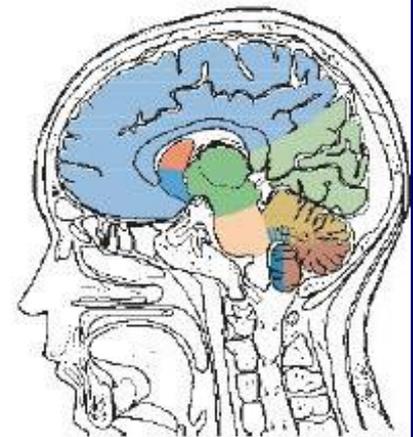
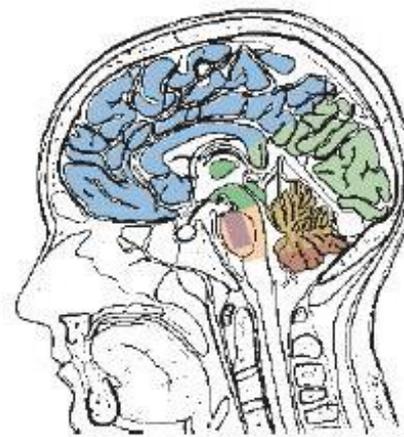


此是状囊动脉纹内主要内容出血  
组供体的脉破，裂故出血  
动脉



- Middle cerebral artery**
  - Terminal branches
  - Central branches (striate branches)
- Posterior cerebral artery**
  - Terminal branches
- Anterior choroidal artery

- Superior cerebellar artery
- Anterior superior cerebellar artery
- Posterior inferior cerebellar artery

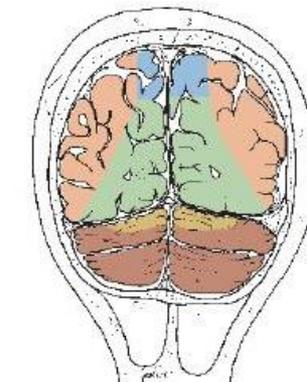
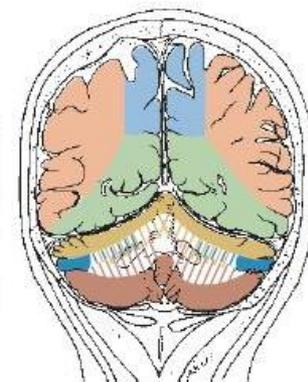
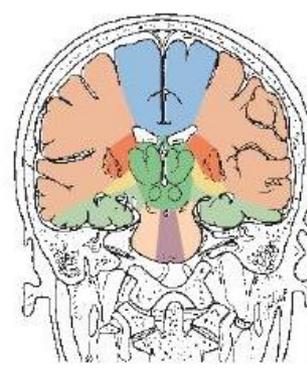
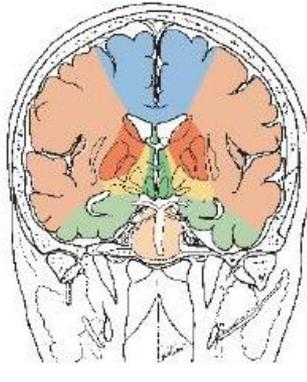
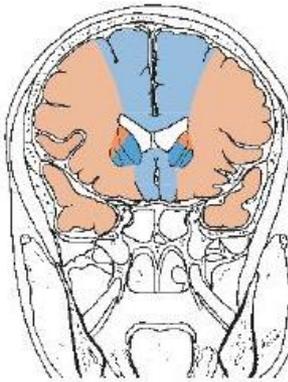
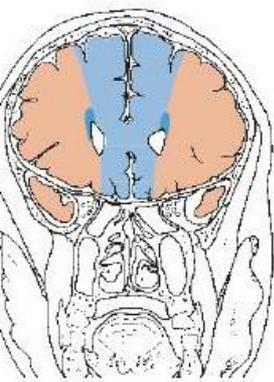
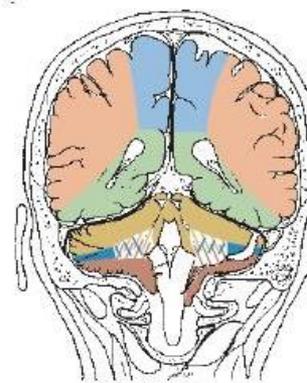
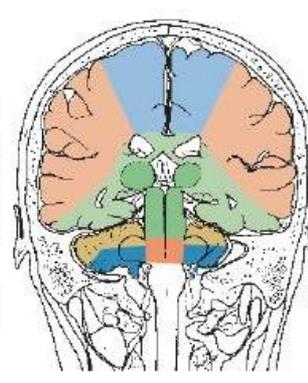
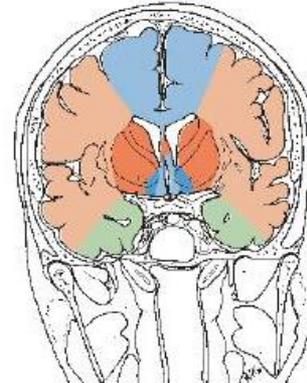
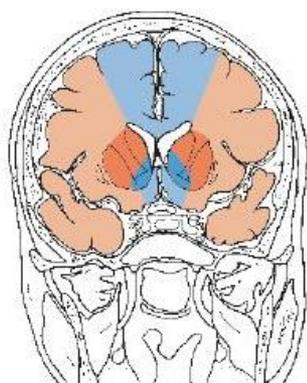
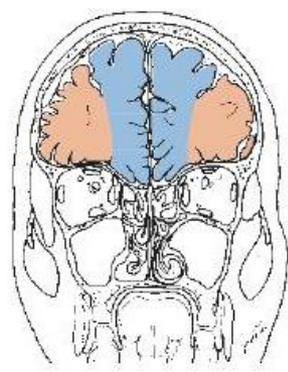
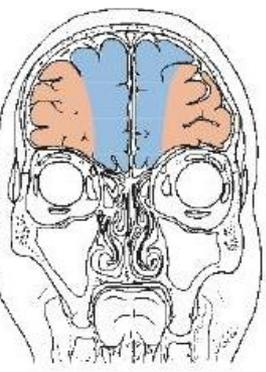


- Anterior cerebral artery**
  - Terminal branches
  - Central branches (striate arteries including distal medial striate artery)

- Middle cerebral artery**
  - Terminal branches
  - Central branches (striate branches)

- Posterior cerebral artery**
  - Terminal branches
  - Central branches (including the posterior communicating artery)

- Basilar artery**
  - Anteromedial and anterolateral paramedian branches
  - Circumferential arteries and lateral and dorsal paramedian branches
  - Superior cerebellar artery
  - Anterior superior cerebellar artery
  - Boundary region
  - Posterior inferior cerebellar artery



**Anterior cerebral artery**  
 Terminal branches  
 Central branches

**Middle cerebral artery**  
 Terminal branches  
 Central branches

**Anterior cerebral artery**  
 Terminal branches  
 Central branches (striate arteries including distal medial striate artery)

**Middle cerebral artery**  
 Terminal branches  
 Central branches (striate branches)

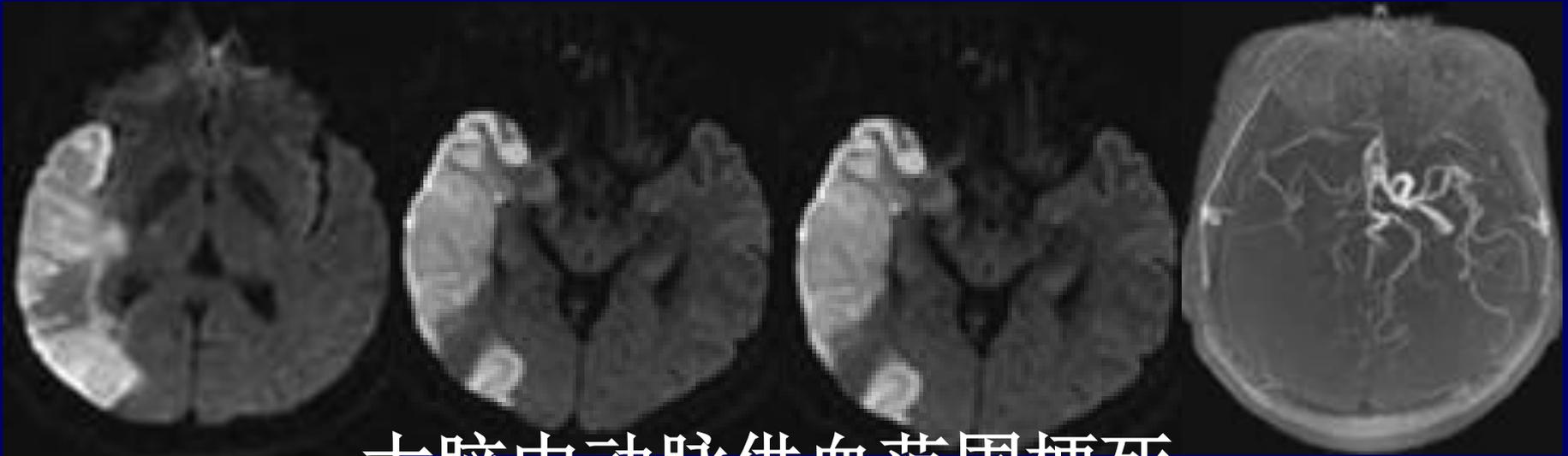
**Posterior cerebral artery**  
 Terminal branches  
 Central branches (including posterior communicating artery)  
 Anterior choroidal artery

**Basilar artery**  
 Anteromedial and anterolateral paramedian branches  
 Circumferential arteries and lateral and dorsal paramedian branches

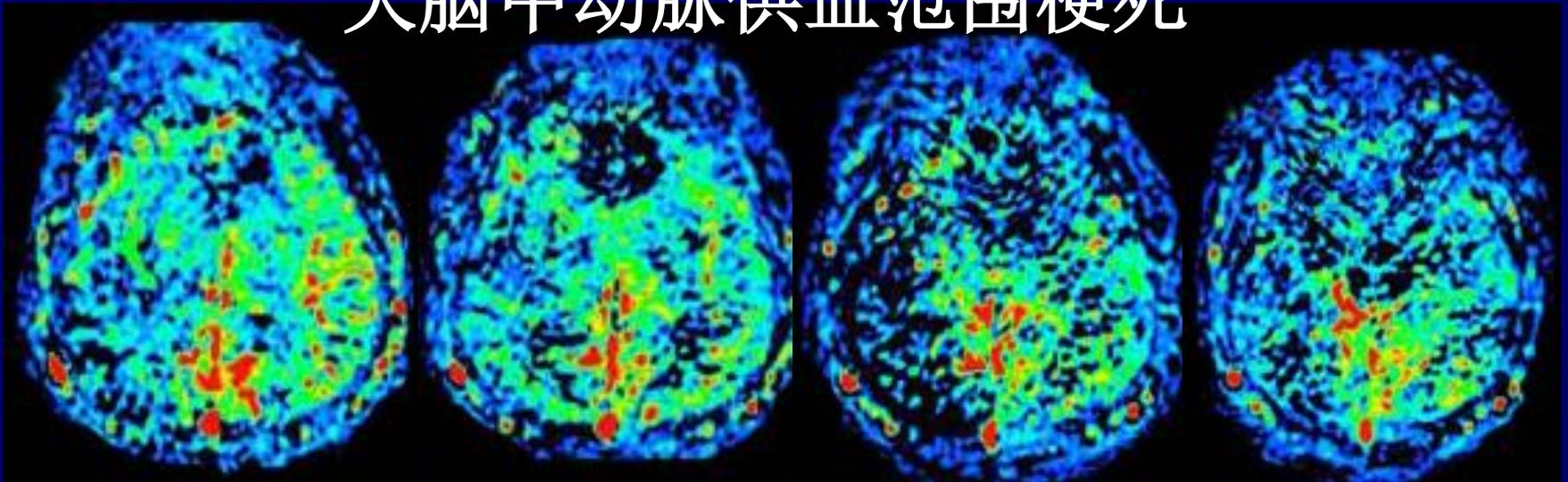
**Anterior cerebral artery**  
 Terminal branches  
**Middle cerebral artery**  
 Terminal branches

**Posterior cerebral artery**  
 Terminal branches  
 Central branches (including posterior communicating artery)

Anterior choroidal artery  
**Basilar artery**  
 Circumferential arteries and lateral and dorsal paramedian branches  
 Superior cerebellar artery  
 Anterior inferior cerebellar artery  
 Border area  
 Posterior inferior cerebellar artery



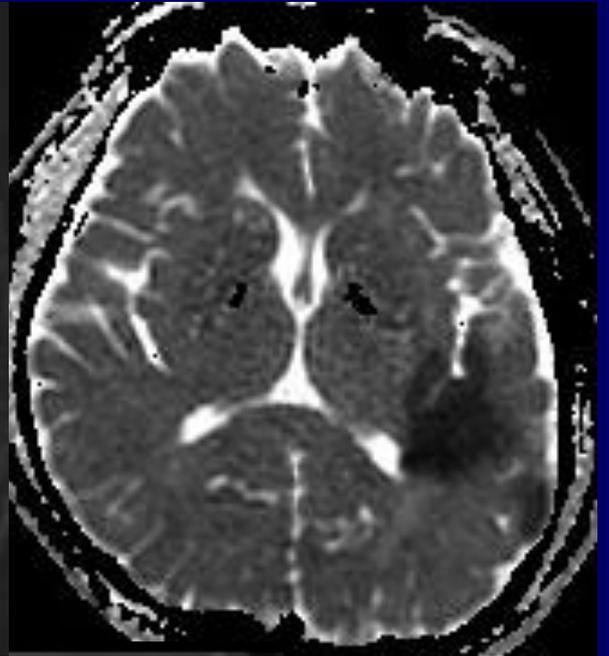
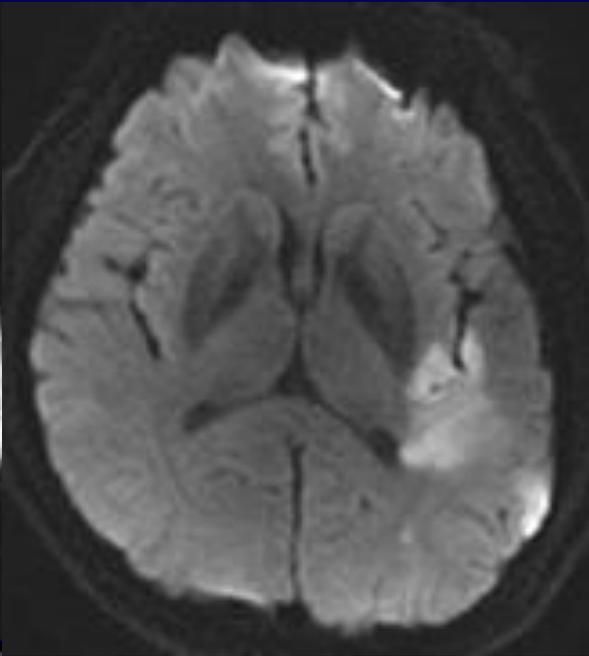
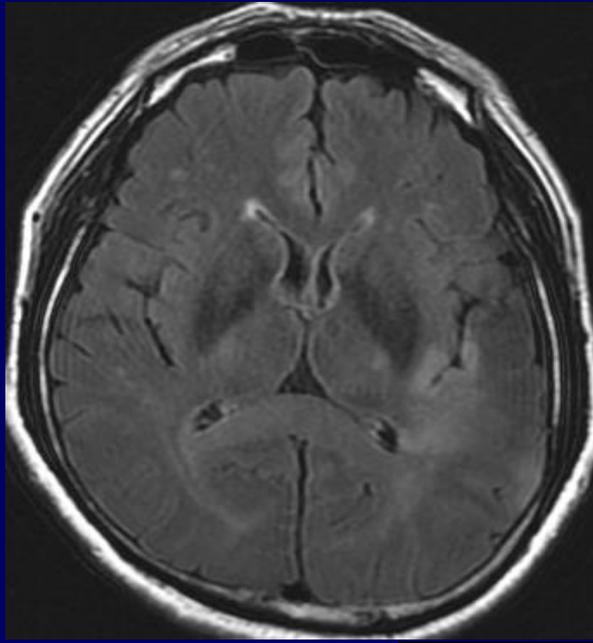
## 大脑中动脉供血范围梗死

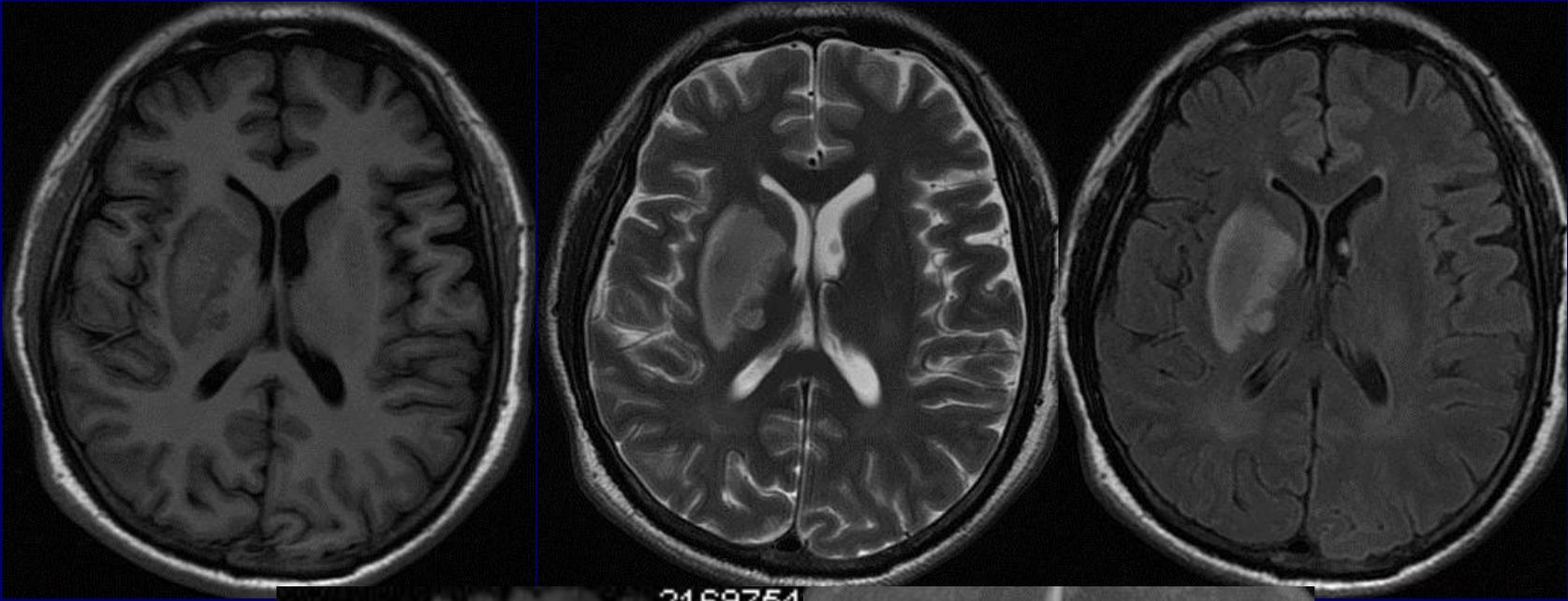


F, 58岁, 左侧肢体麻木2天, 瘫痪并伴有头痛、头晕、恶心、呕吐5小时

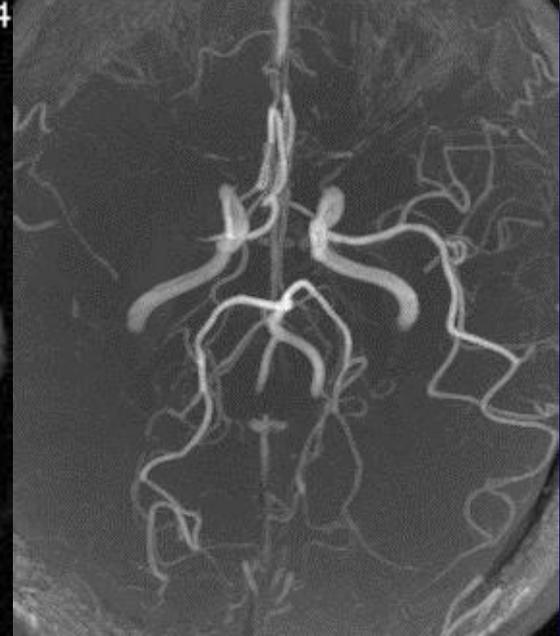
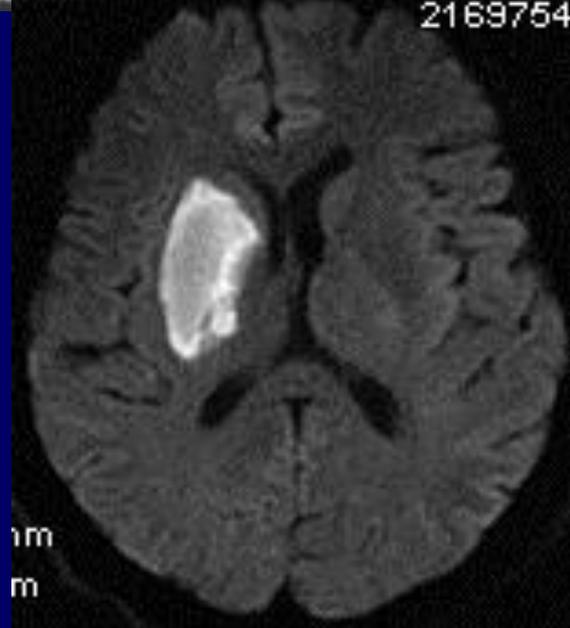


# 大脑中动脉供血范围梗死





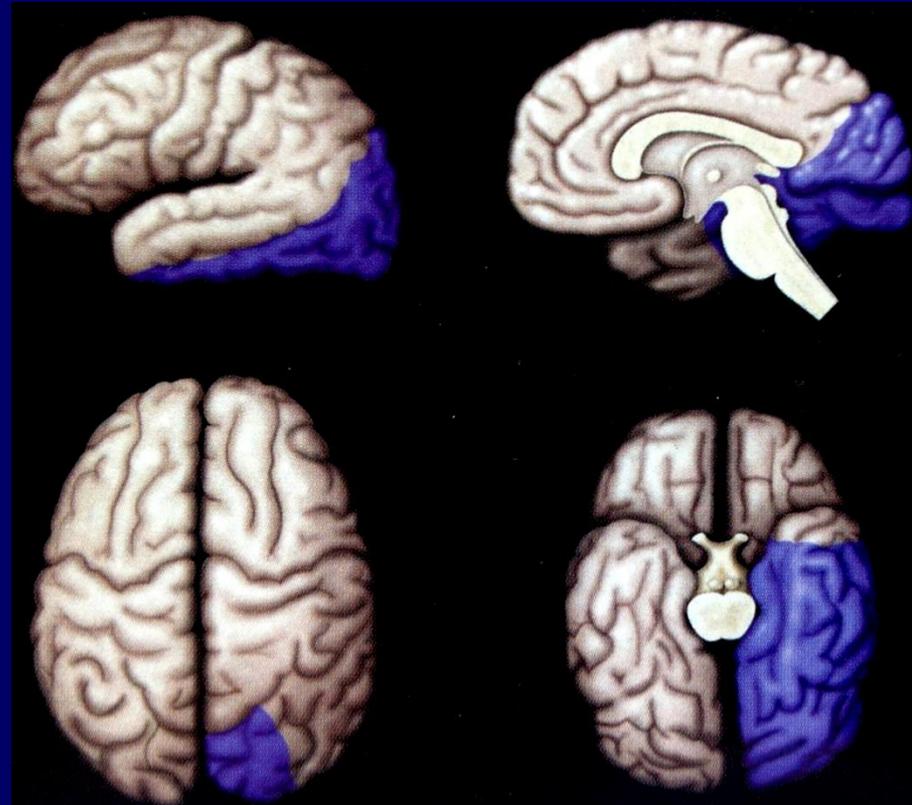
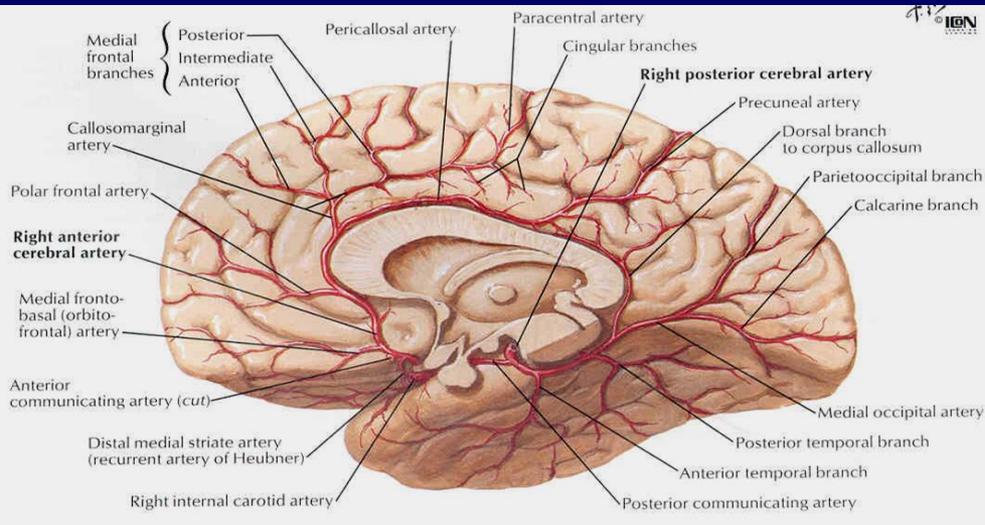
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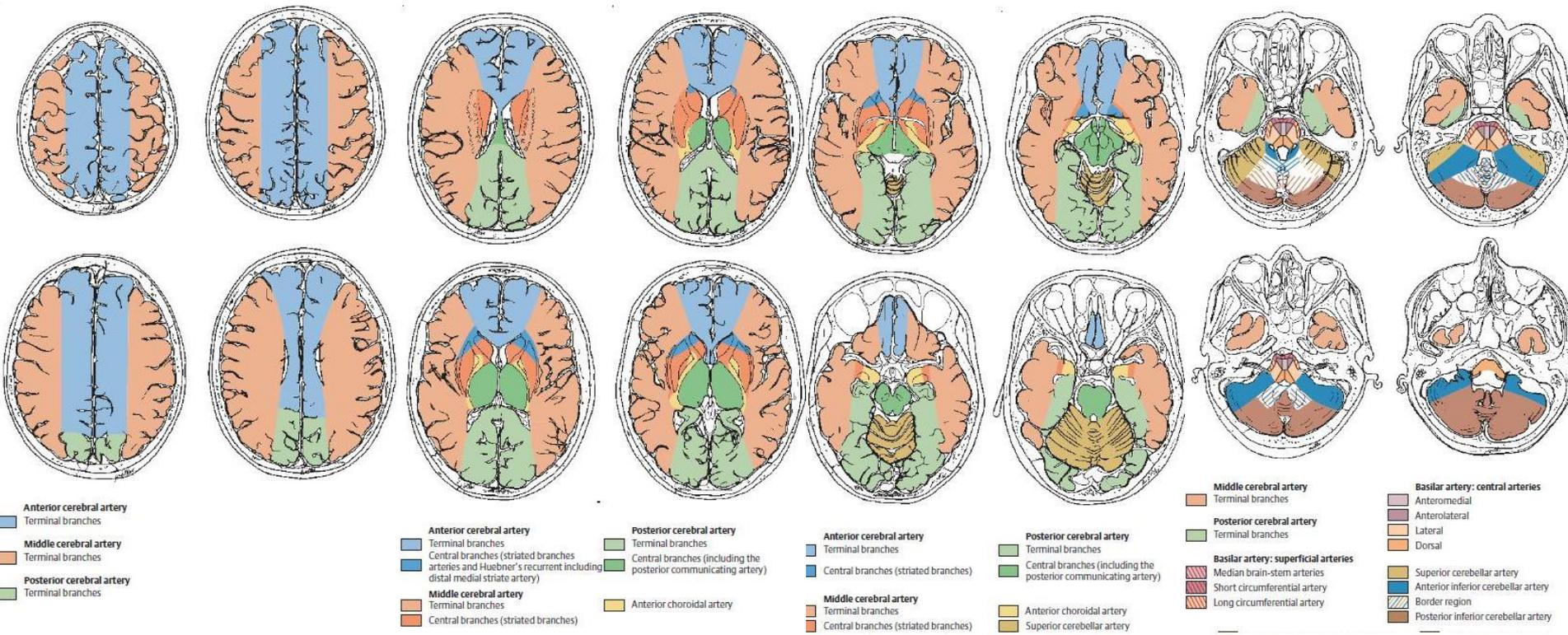




# 大脑后动脉供血范围

- 皮质支：部分颞叶表面下部及颞叶底面  
大脑内侧面的后1/3及枕叶  
大脑凸面后部一小部分



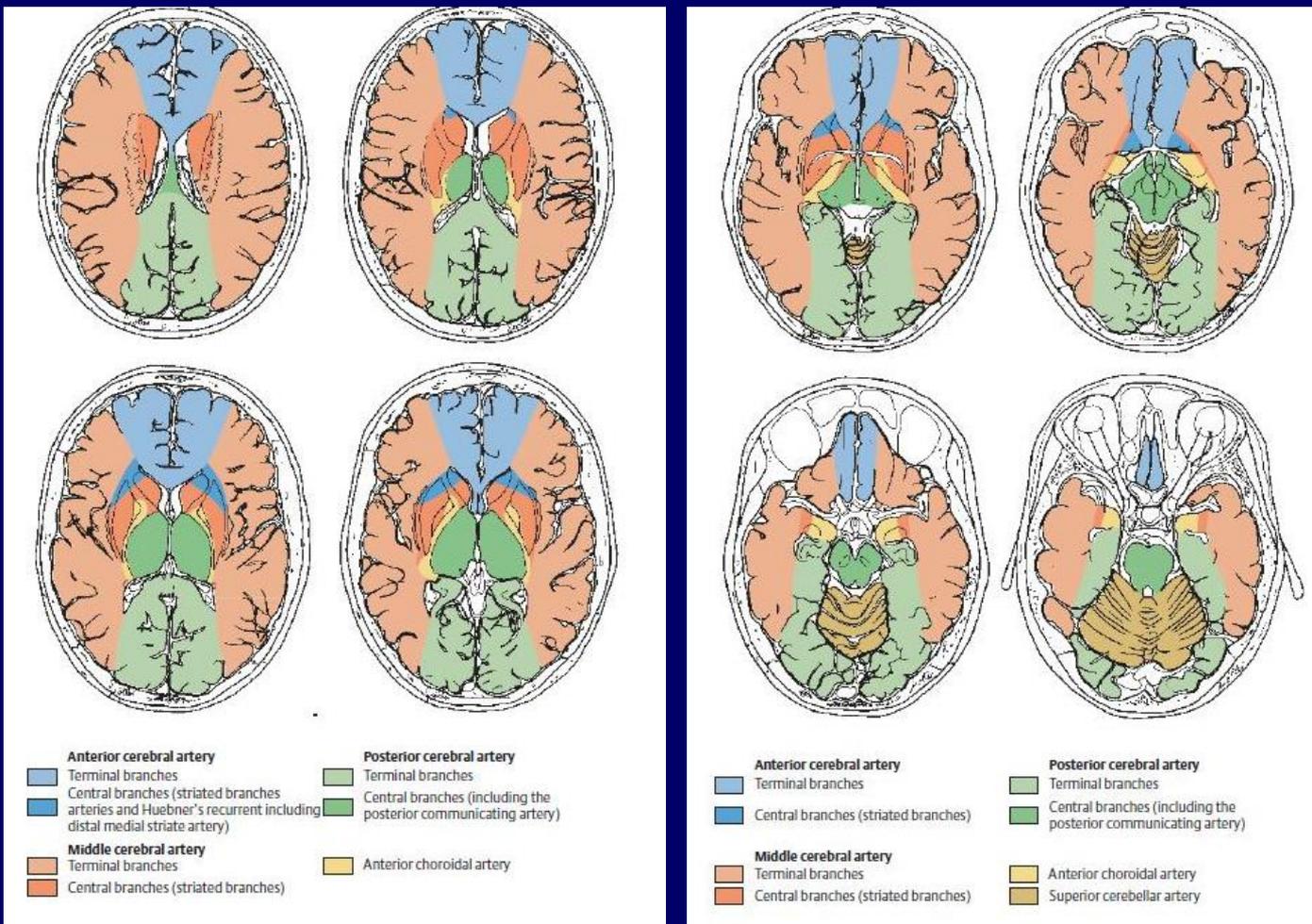


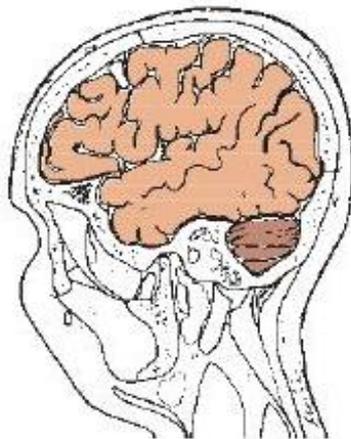
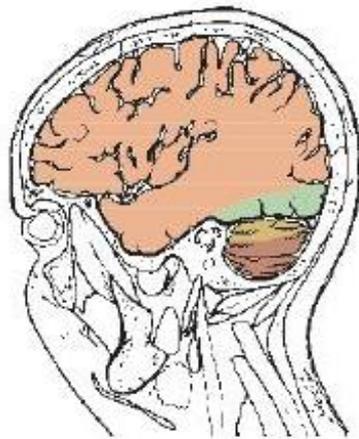
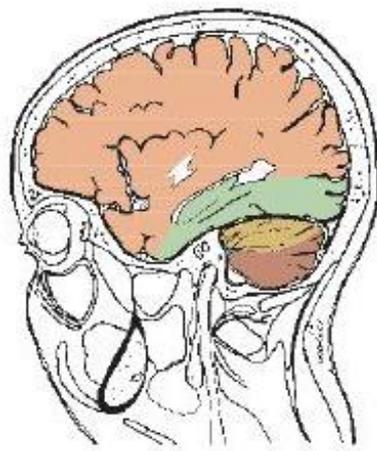
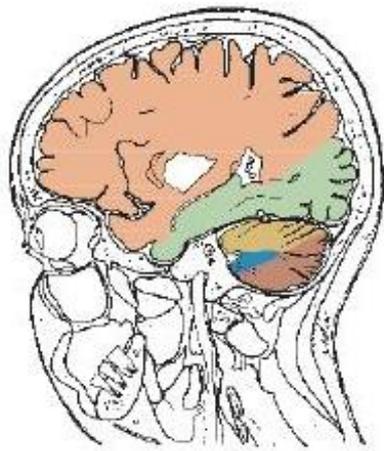


# 大脑后动脉供血范围



➤ 中央支：脑底部中心大部（背侧丘脑、下丘脑）  
中脑  
脉络丛





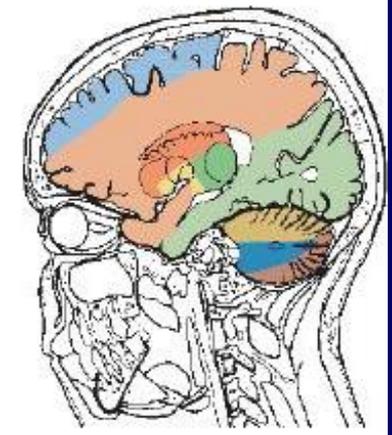
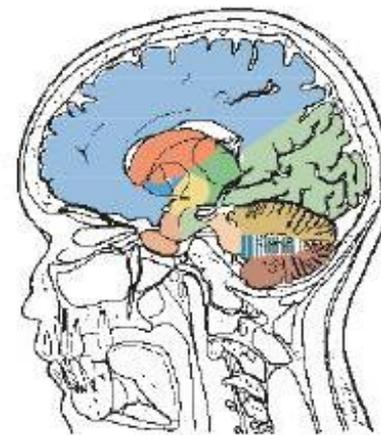
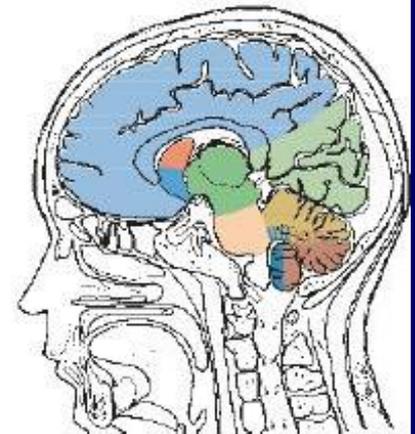
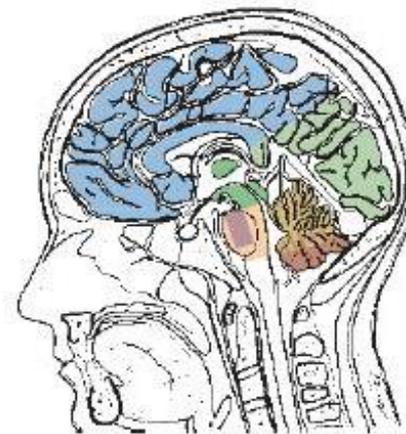
**Middle cerebral artery**

- Terminal branches
- Central branches (striate branches)

**Posterior cerebral artery**

- Terminal branches
- Anterior choroidal artery

- Superior cerebellar artery
- Anterior superior cerebellar artery
- Posterior inferior cerebellar artery



**Anterior cerebral artery**

- Terminal branches
- Central branches (striate arteries including distal medial striate artery)

**Middle cerebral artery**

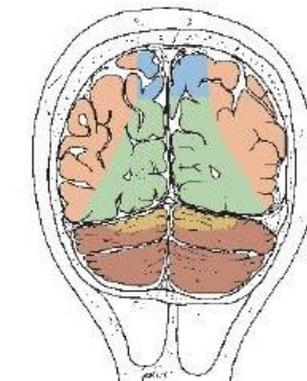
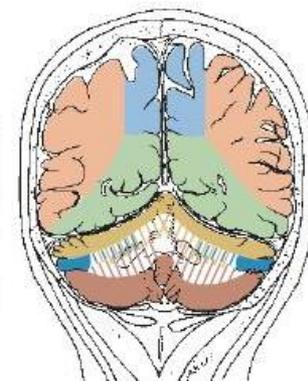
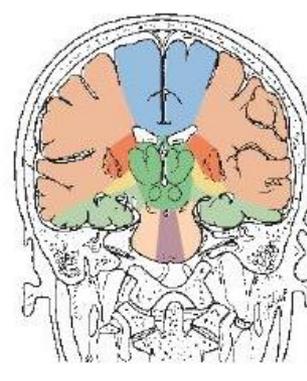
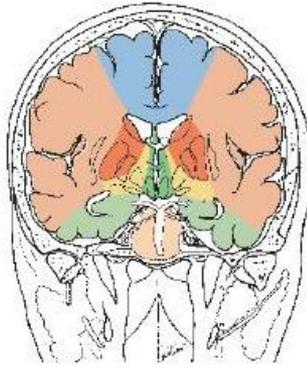
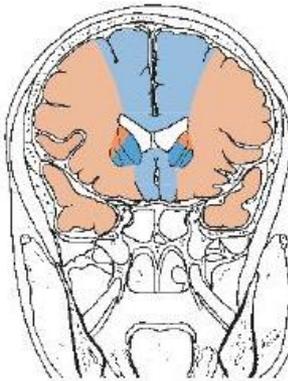
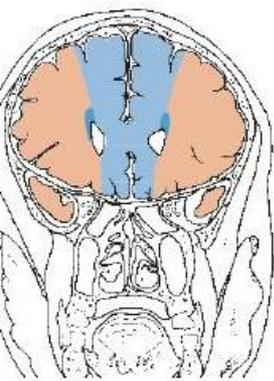
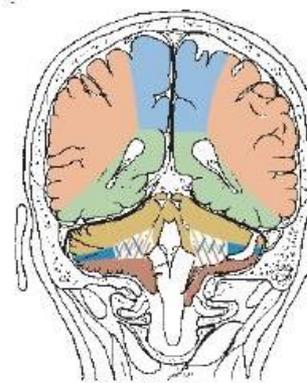
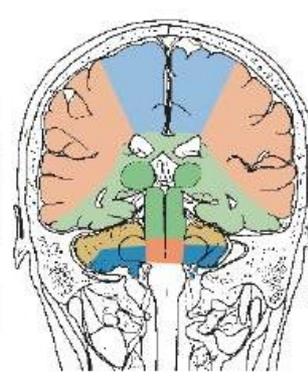
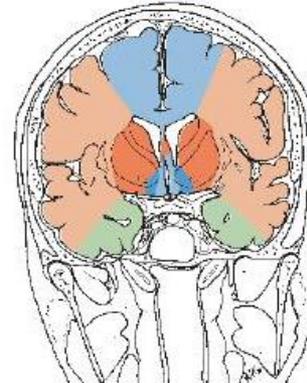
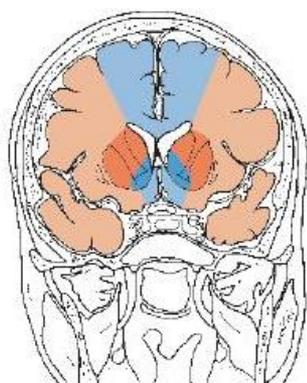
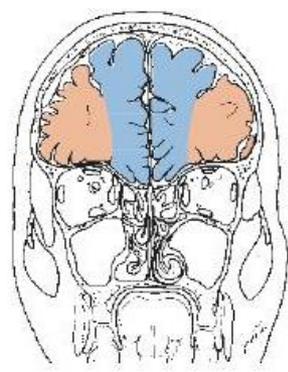
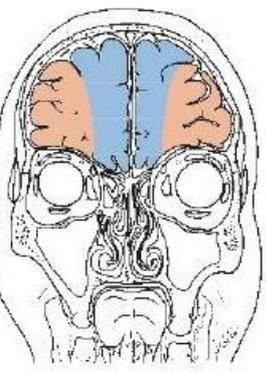
- Terminal branches
- Central branches (striate branches)

**Posterior cerebral artery**

- Terminal branches
- Central branches (including the posterior communicating artery)

**Basilar artery**

- Anteromedial and anterolateral paramedian branches
- Circumferential arteries and lateral and dorsal paramedian branches
- Superior cerebellar artery
- Anterior superior cerebellar artery
- Boundary region
- Posterior inferior cerebellar artery



**Anterior cerebral artery**  
 Terminal branches  
 Central branches

**Middle cerebral artery**  
 Terminal branches  
 Central branches

**Anterior cerebral artery**  
 Terminal branches  
 Central branches (striate arteries including distal medial striate artery)

**Middle cerebral artery**  
 Terminal branches  
 Central branches (striate branches)

**Posterior cerebral artery**  
 Terminal branches  
 Central branches (including posterior communicating artery)  
 Anterior choroidal artery

**Basilar artery**  
 Anteromedial and anterolateral paramedian branches  
 Circumferential arteries and lateral and dorsal paramedian branches

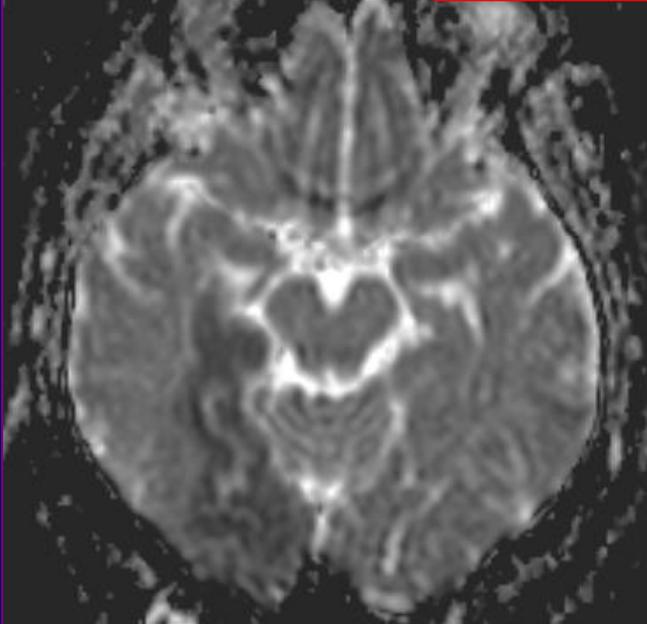
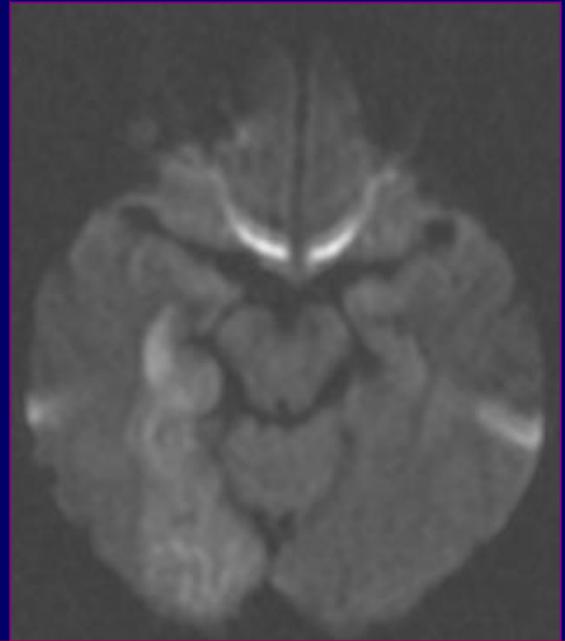
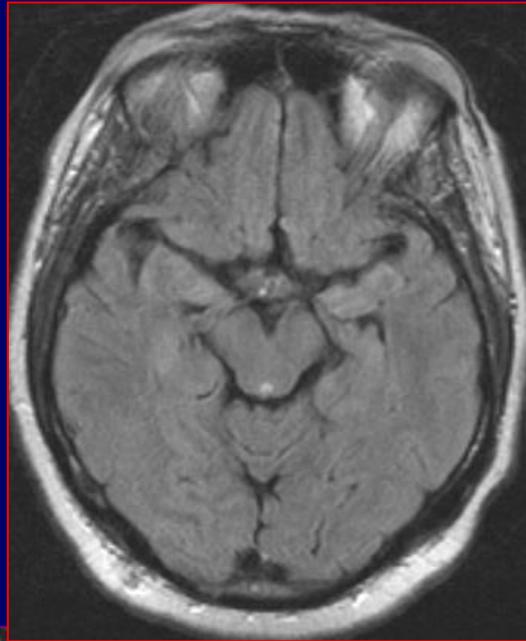
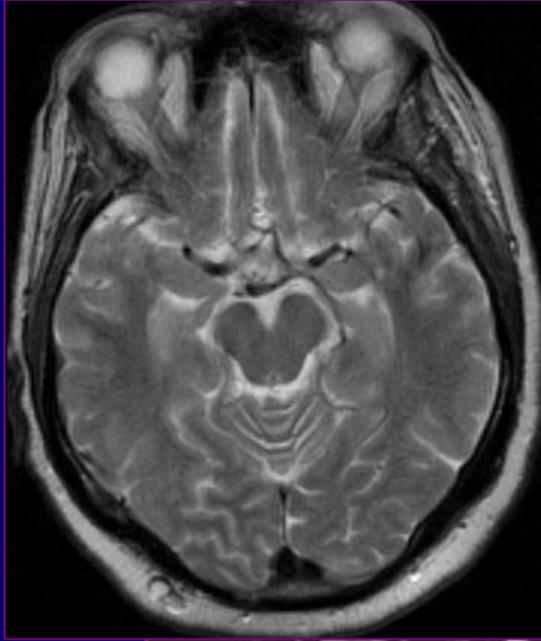
**Anterior cerebral artery**  
 Terminal branches  
**Middle cerebral artery**  
 Terminal branches

**Posterior cerebral artery**  
 Terminal branches  
 Central branches (including posterior communicating artery)

Anterior choroidal artery

**Basilar artery**  
 Circumferential arteries and lateral and dorsal paramedian branches

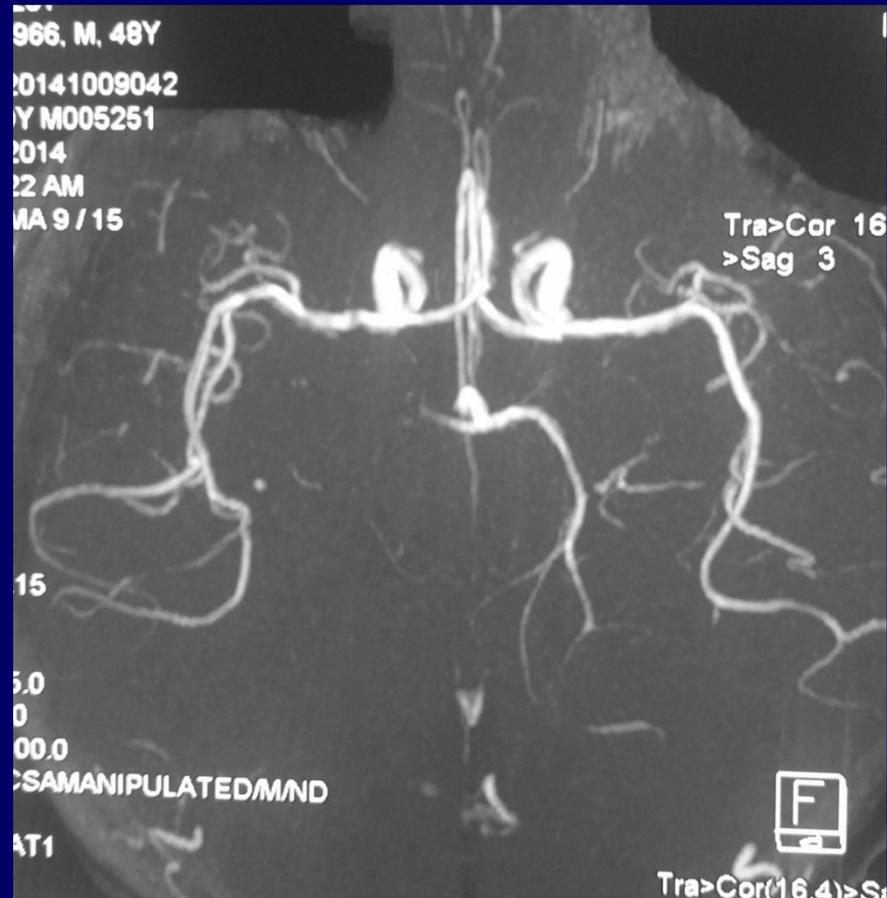
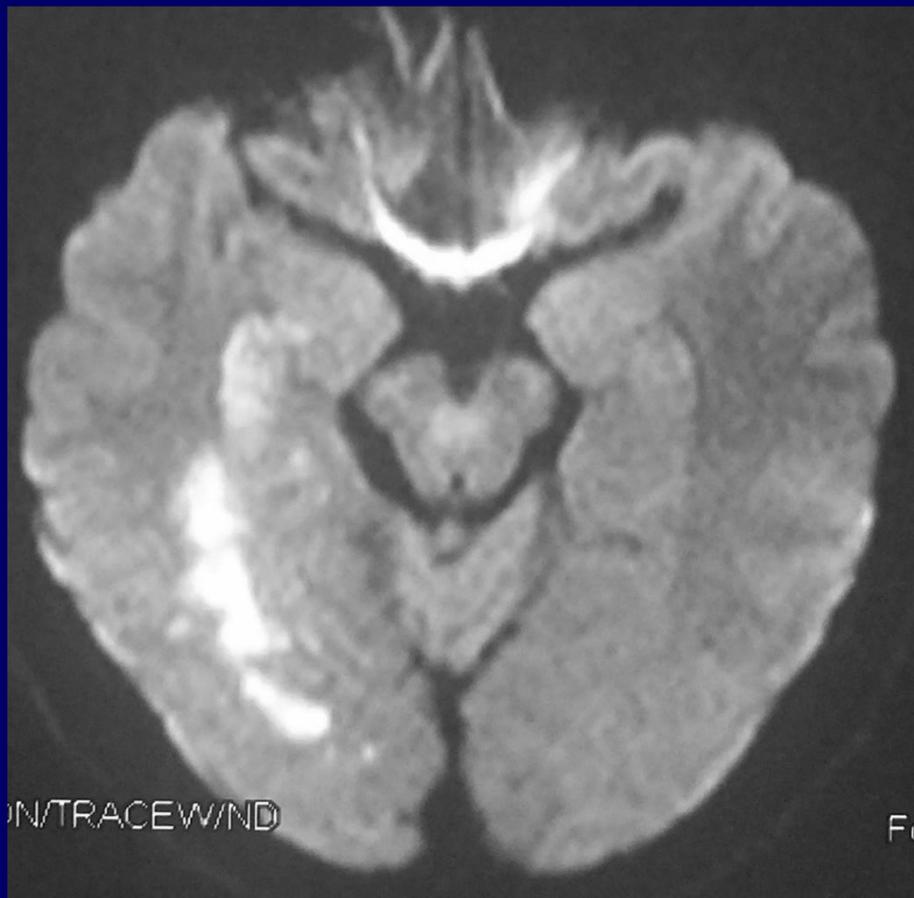
Superior cerebellar artery  
 Anterior inferior cerebellar artery  
 Border area  
 Posterior inferior cerebellar artery

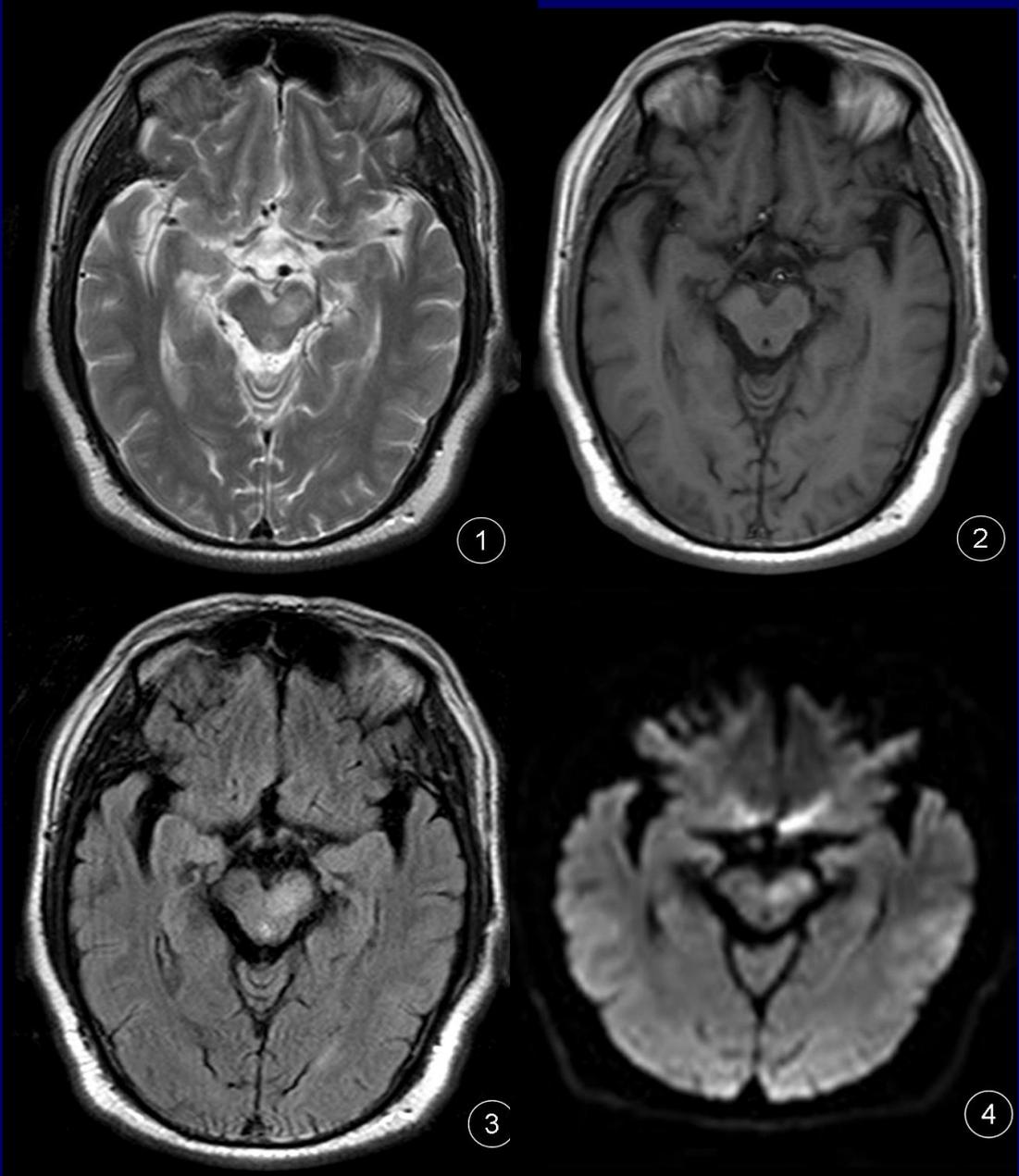


大脑后动脉供血范围梗死



## 大脑后动脉供血范围梗死



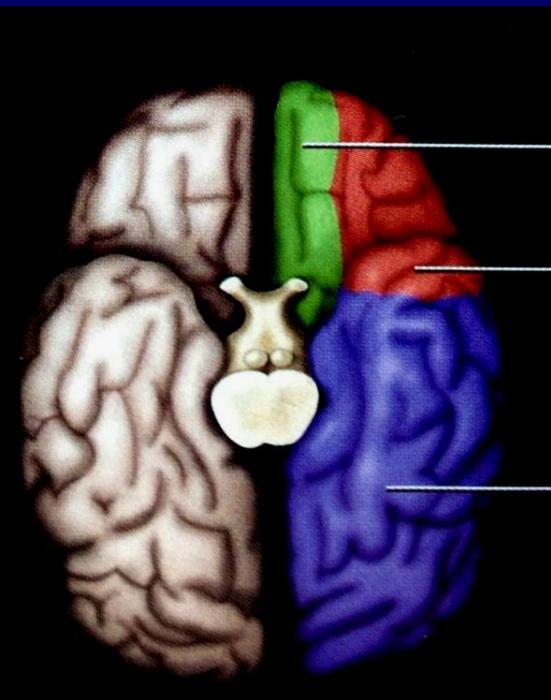
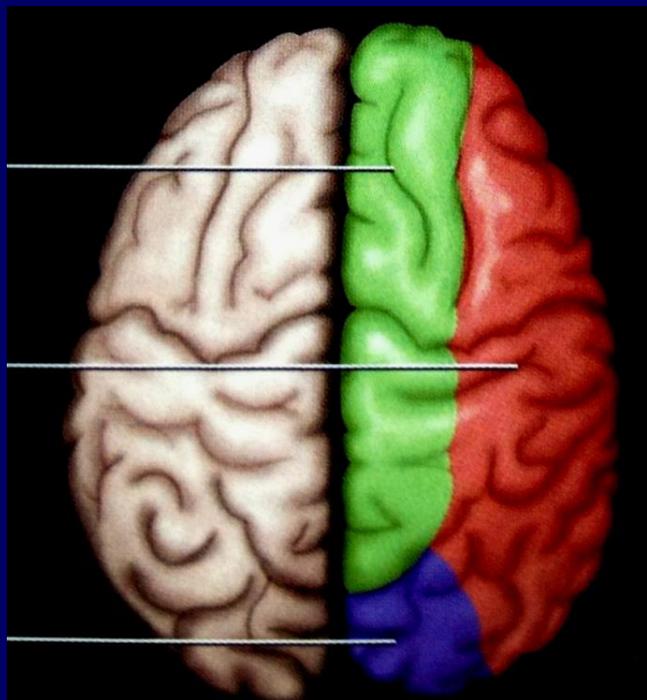
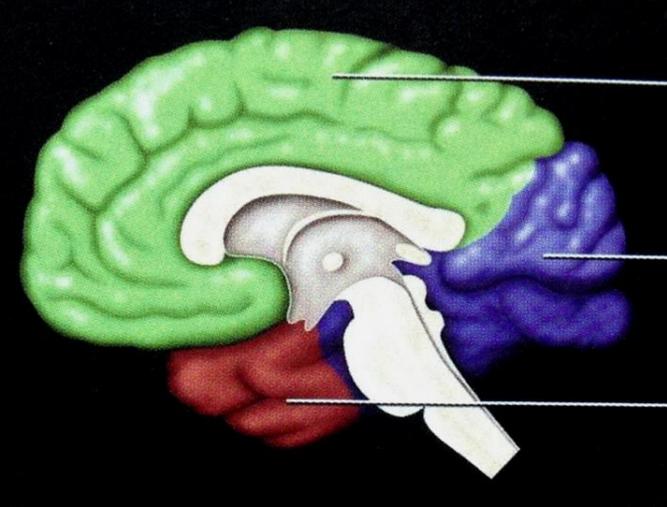
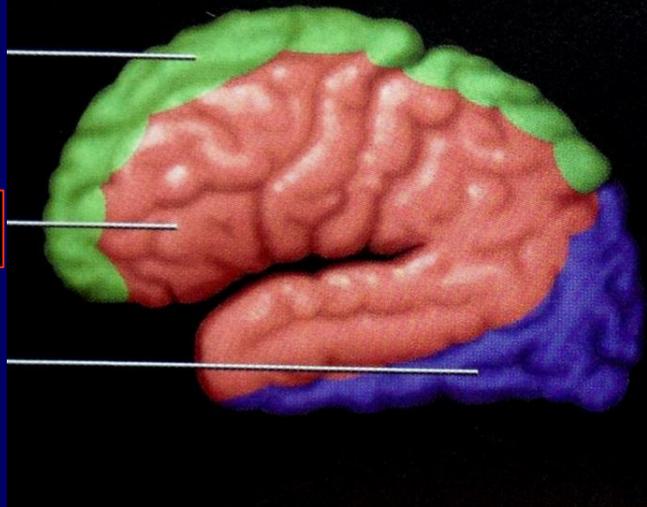




ACA

MCA

PCA

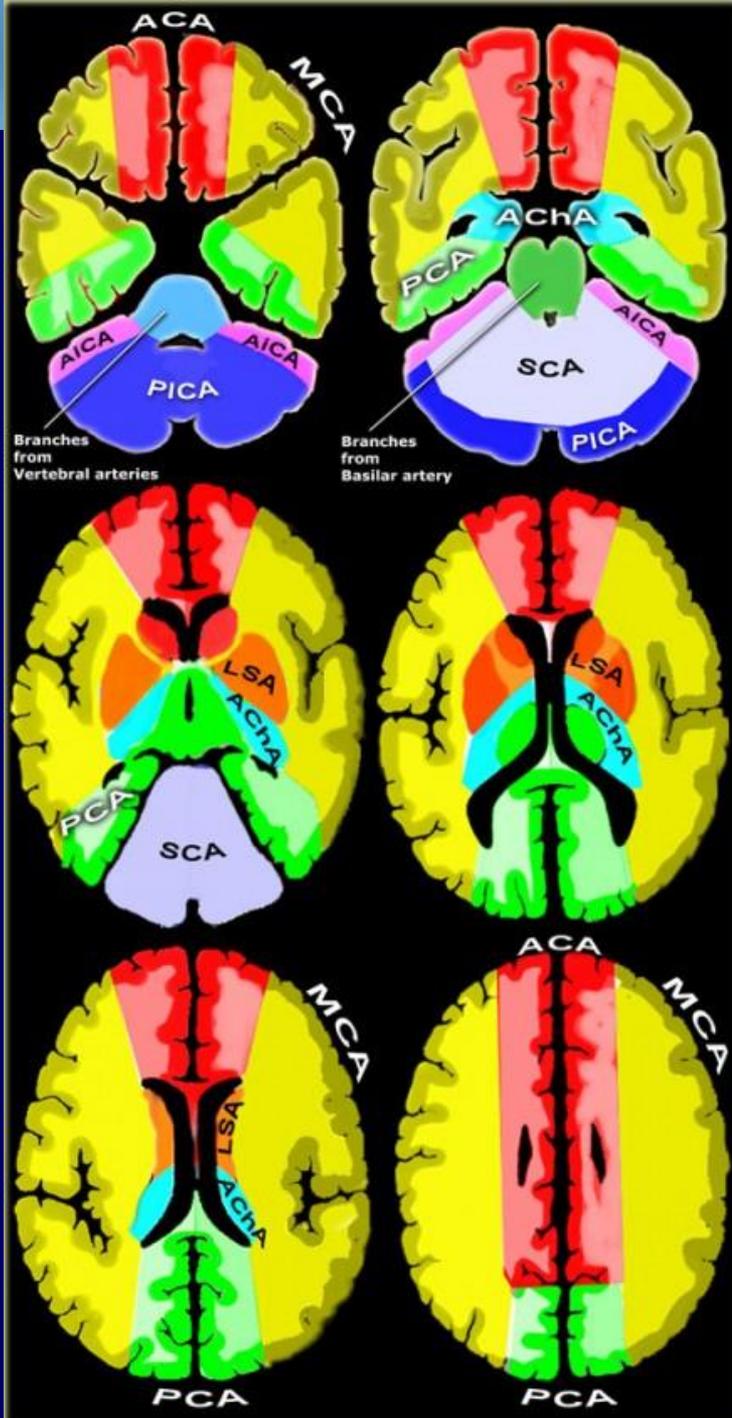


脑动脉供血范围示意图

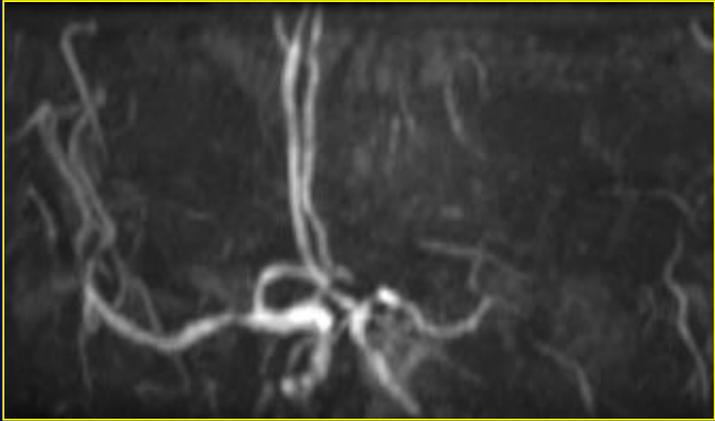
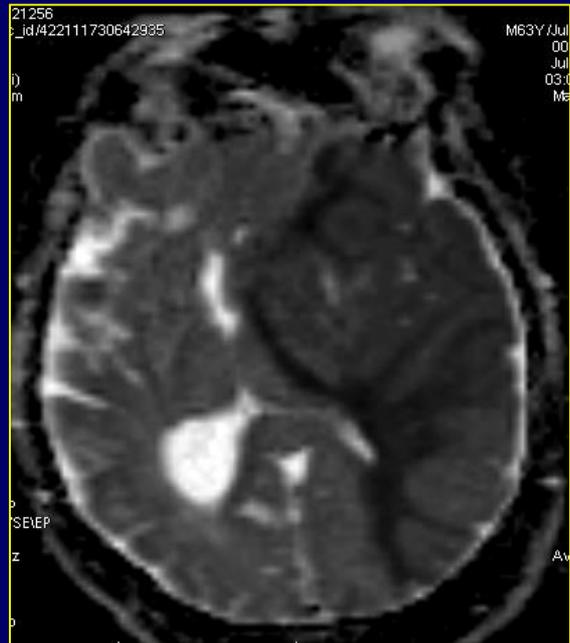
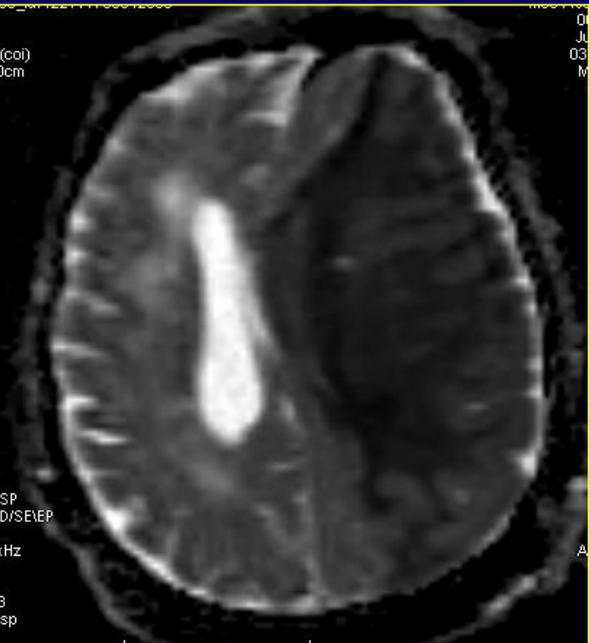
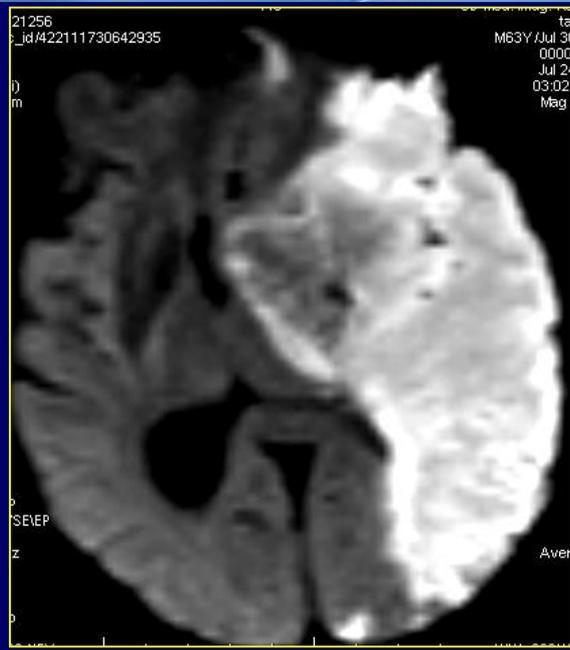


# 脑动脉供血范围示意图

- ACA (红色)
- MCA (黄色)
- PCA (绿色)



AChA 脉络膜前动脉  
LSA 豆纹动脉



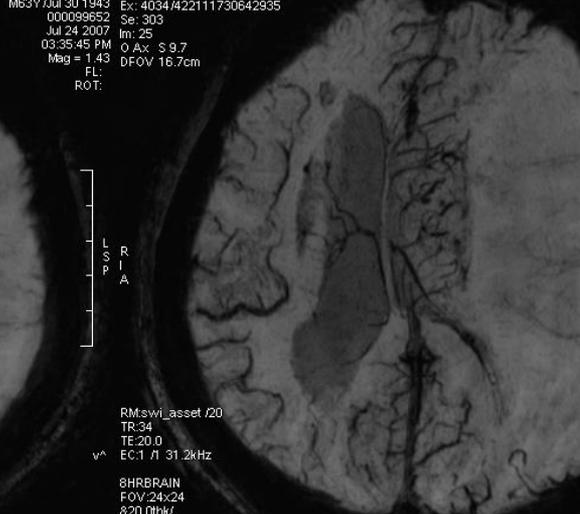


SIGNA EXCITE GEMSGEMS  
Ex: 4034/422111730642935  
Se: 303  
Im: 21  
O Ax: S 17.3  
DFOV: 16.7cm



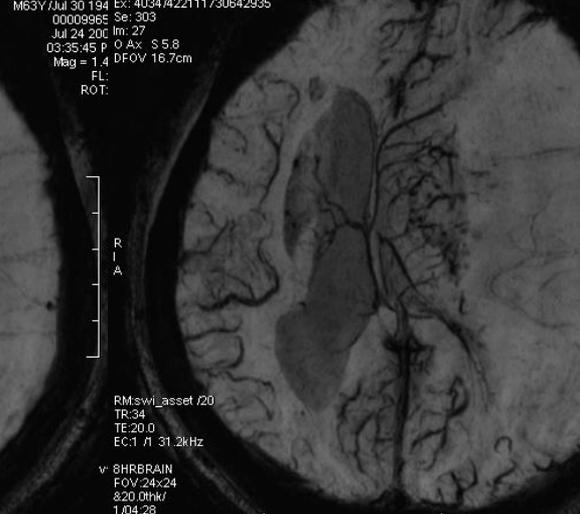
taolianyi  
M63Y /Jul 30 1943  
000099652  
Jul 24 2007  
03:35:45 PM  
Mag = 1.43  
FL:  
ROT:

SIGNA EXCITE GEMSGEMS  
Ex: 4034/422111730642935  
Se: 303  
Im: 25  
O Ax: S 9.7  
DFOV: 16.7cm



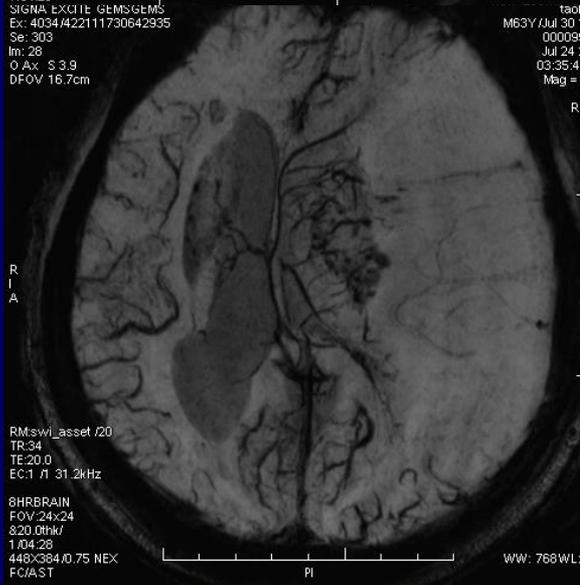
taolian  
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00009965  
Jul 24 2007  
03:35:45 P  
Mag = 1.4  
FL:  
ROT:

SIGNA EXCITE GEMSGEMS  
Ex: 4034/422111730642935  
Se: 303  
Im: 27  
O Ax: S 5.8  
DFOV: 16.7cm



taolianyi  
M63Y /Jul 30 1943  
000099652  
Jul 24 2007  
03:35:45 PM  
Mag = 1.43  
FL:  
ROT:

SIGNA EXCITE GEMSGEMS  
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Im: 28  
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DFOV: 16.7cm

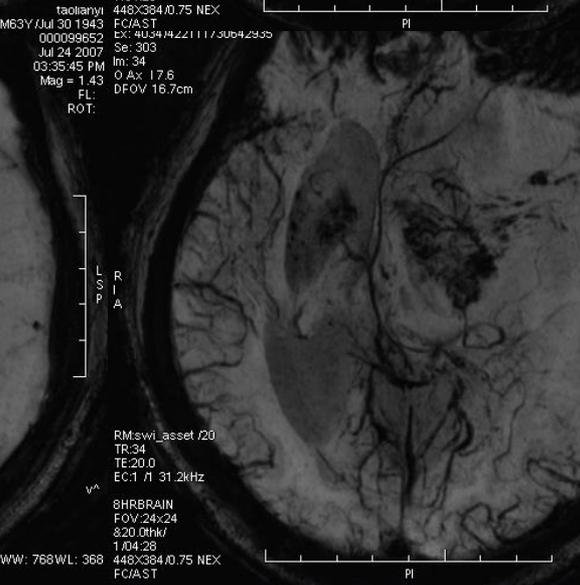


taoli  
M63Y /Jul 30 1  
000099652  
Jul 24 2007  
03:35:44  
Mag = 1.43  
FL:  
ROT:

SIGNA EXCITE GEMSGEMS  
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Se: 303  
Im: 30  
O Ax: S 0.1  
DFOV: 16.7cm

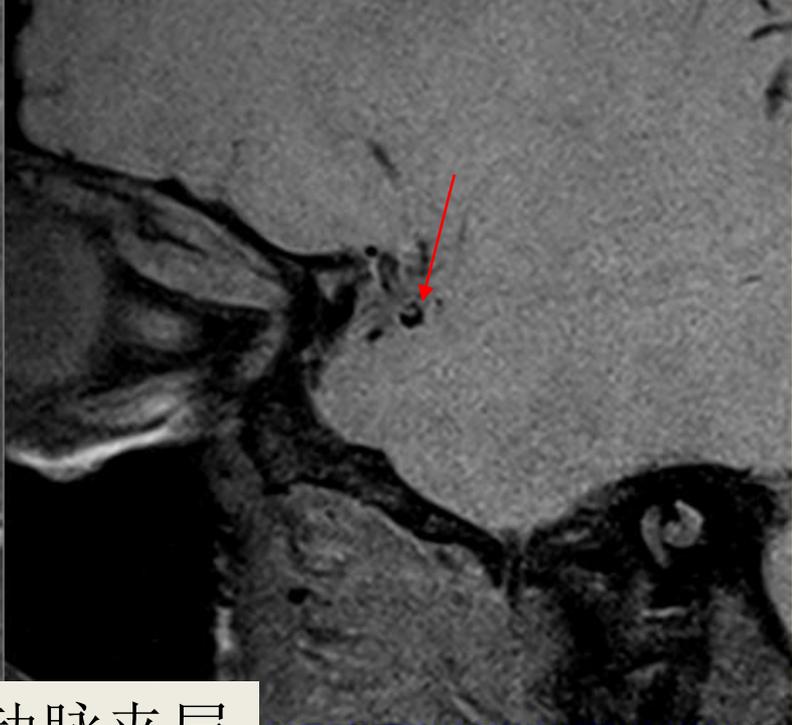
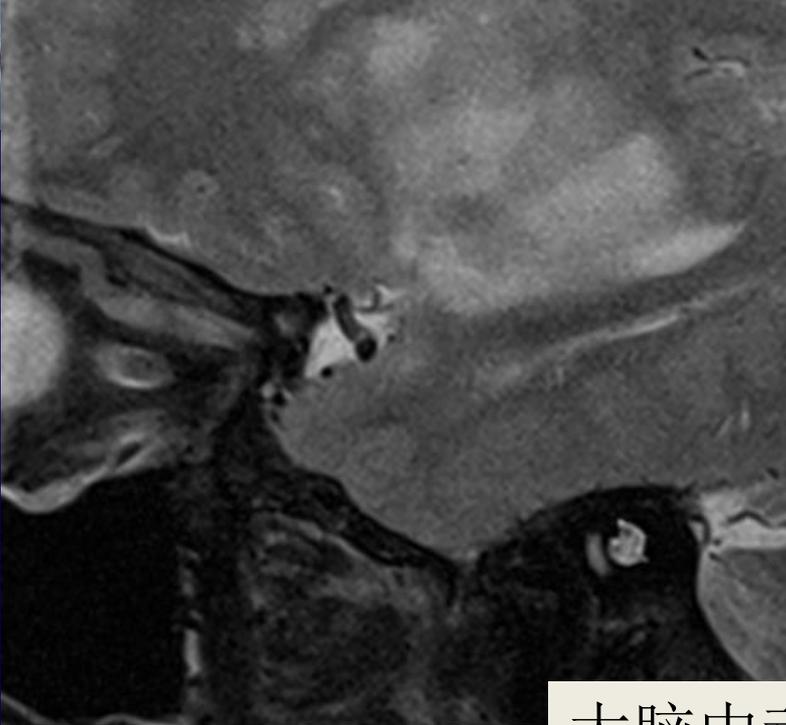


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Jul 24 2007  
03:35:45 PM  
Mag = 1.43  
FL:  
ROT:

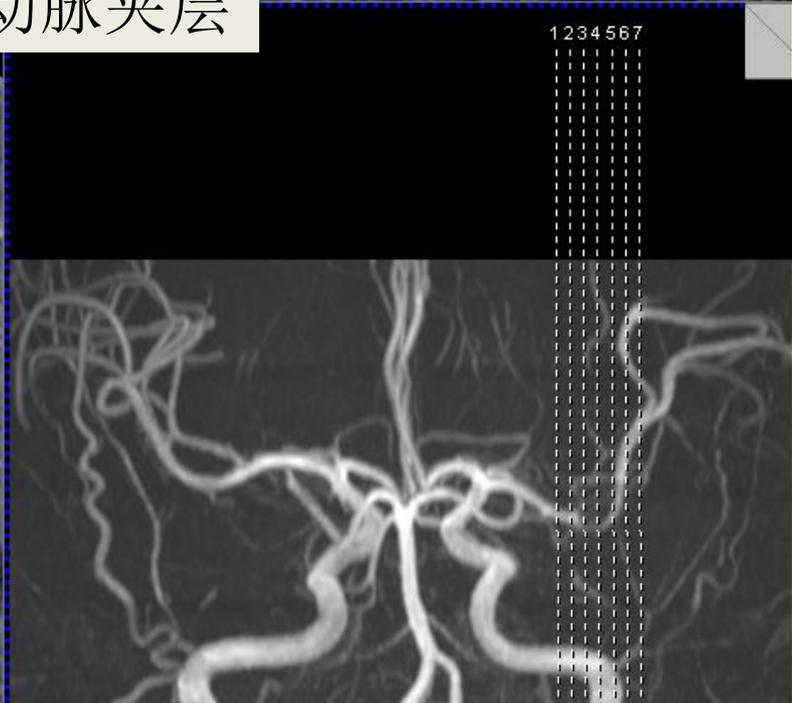
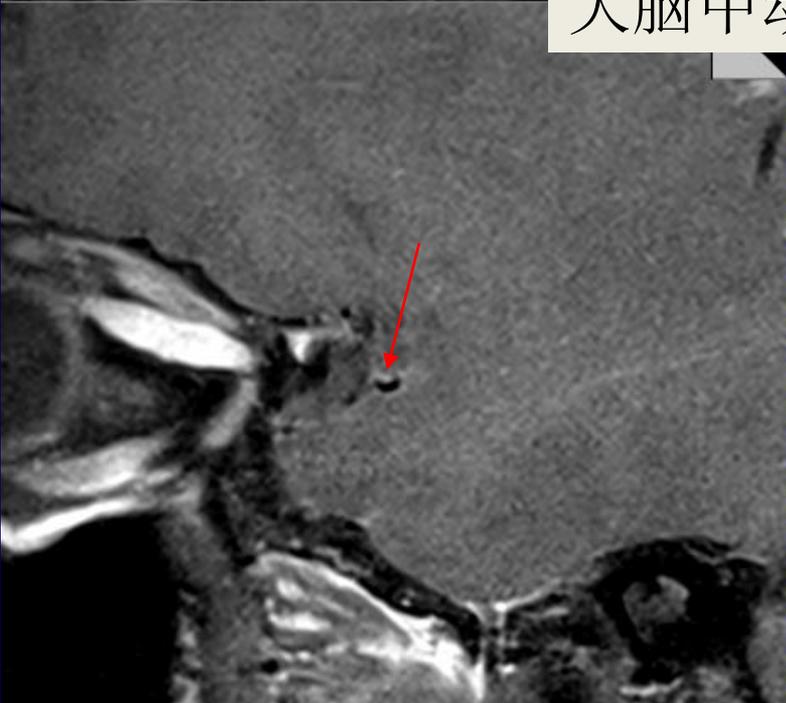


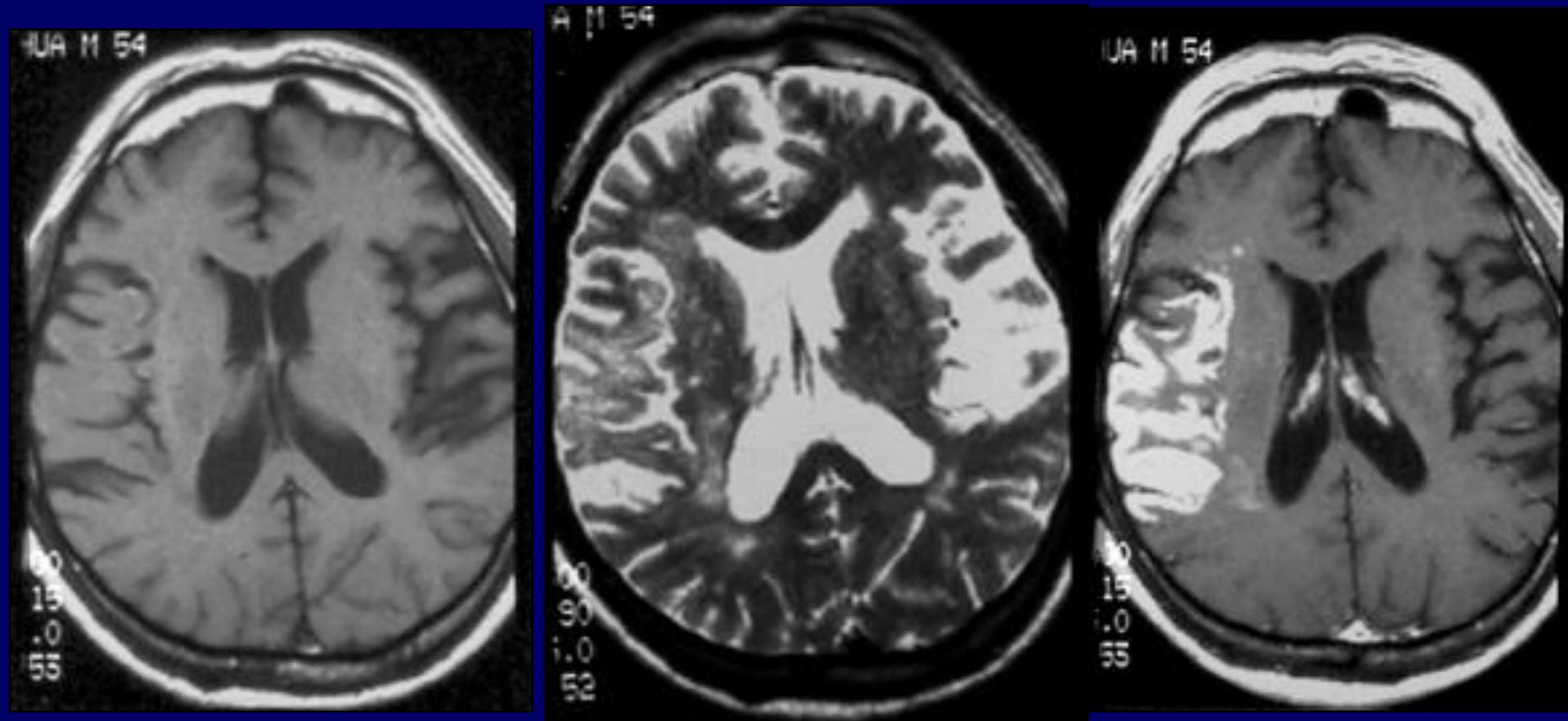
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Jul 24 2007  
03:35:45 PM  
Mag = 1.43  
FL:  
ROT:

溶栓与否?

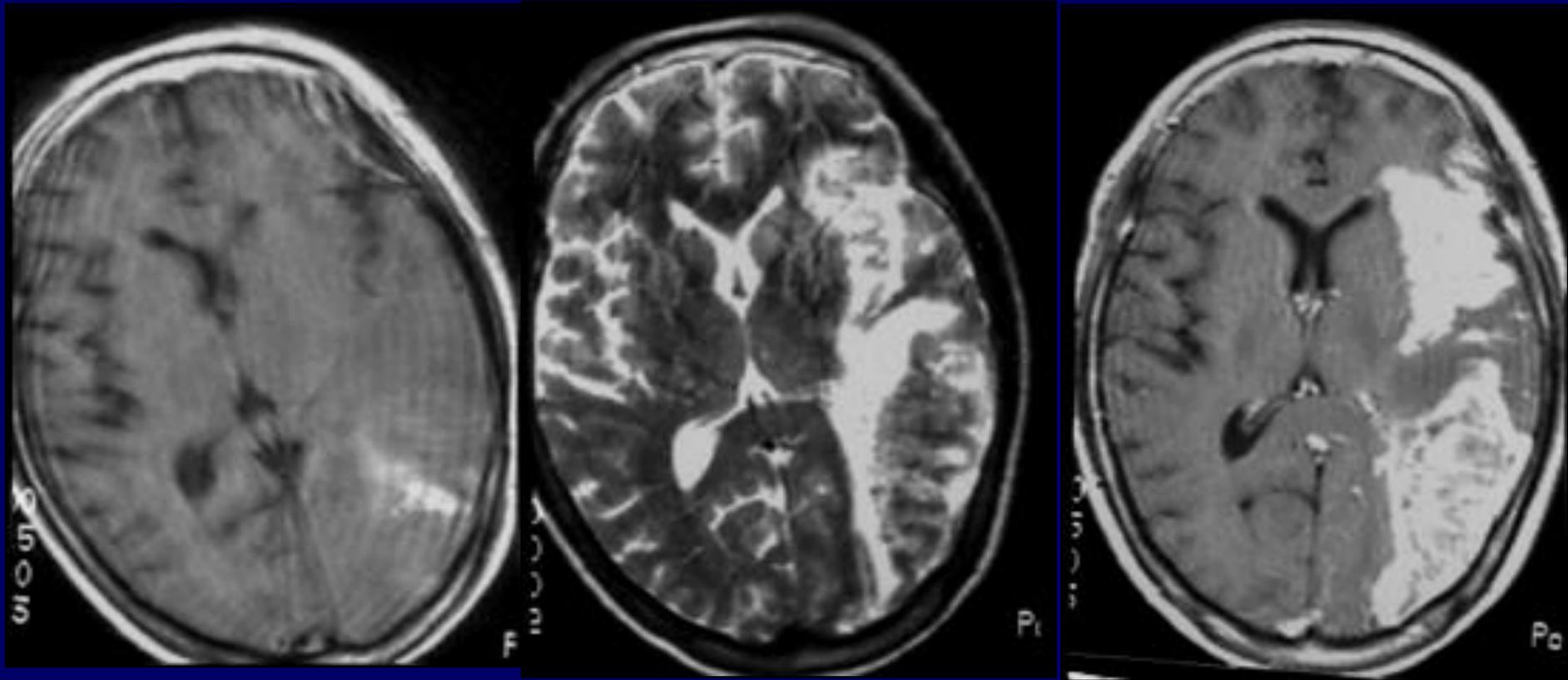


大脑中动脉夹层





皮质支闭塞皮层梗死，脑回样强化



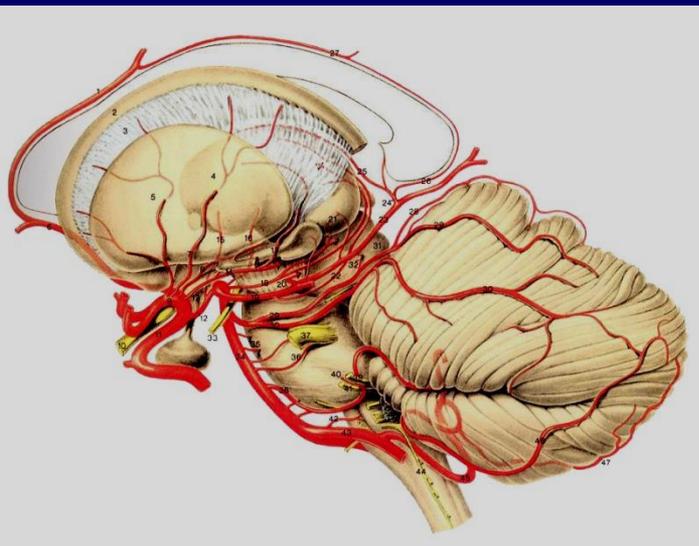
出血性脑梗死（梗死后渗血，约20%）



# 小脑供血动脉及供血范围

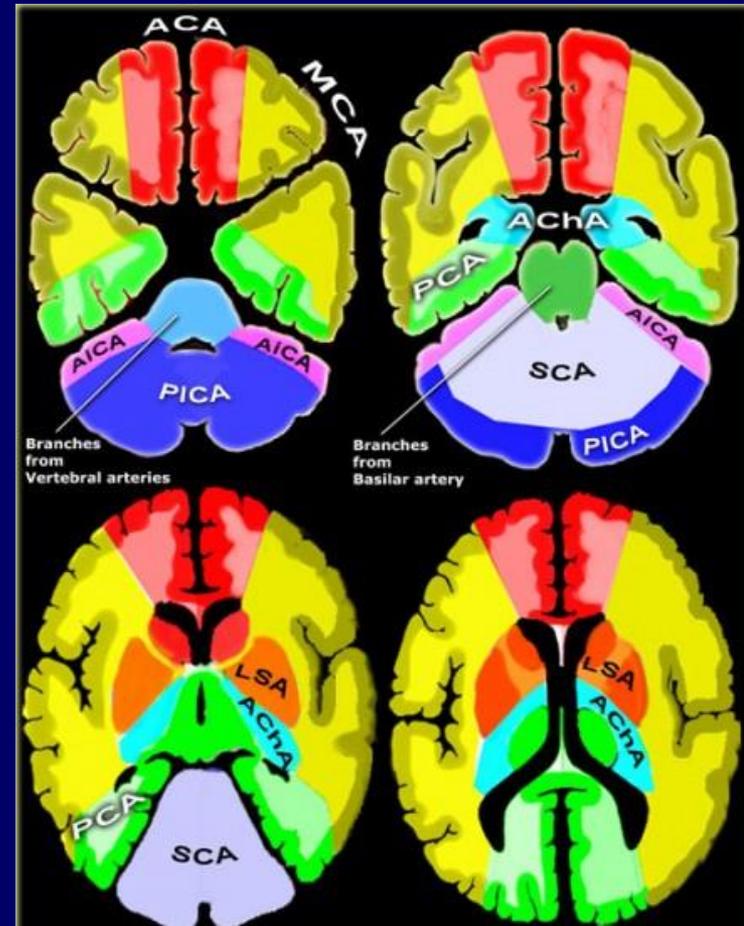
## (椎-基底动脉系)

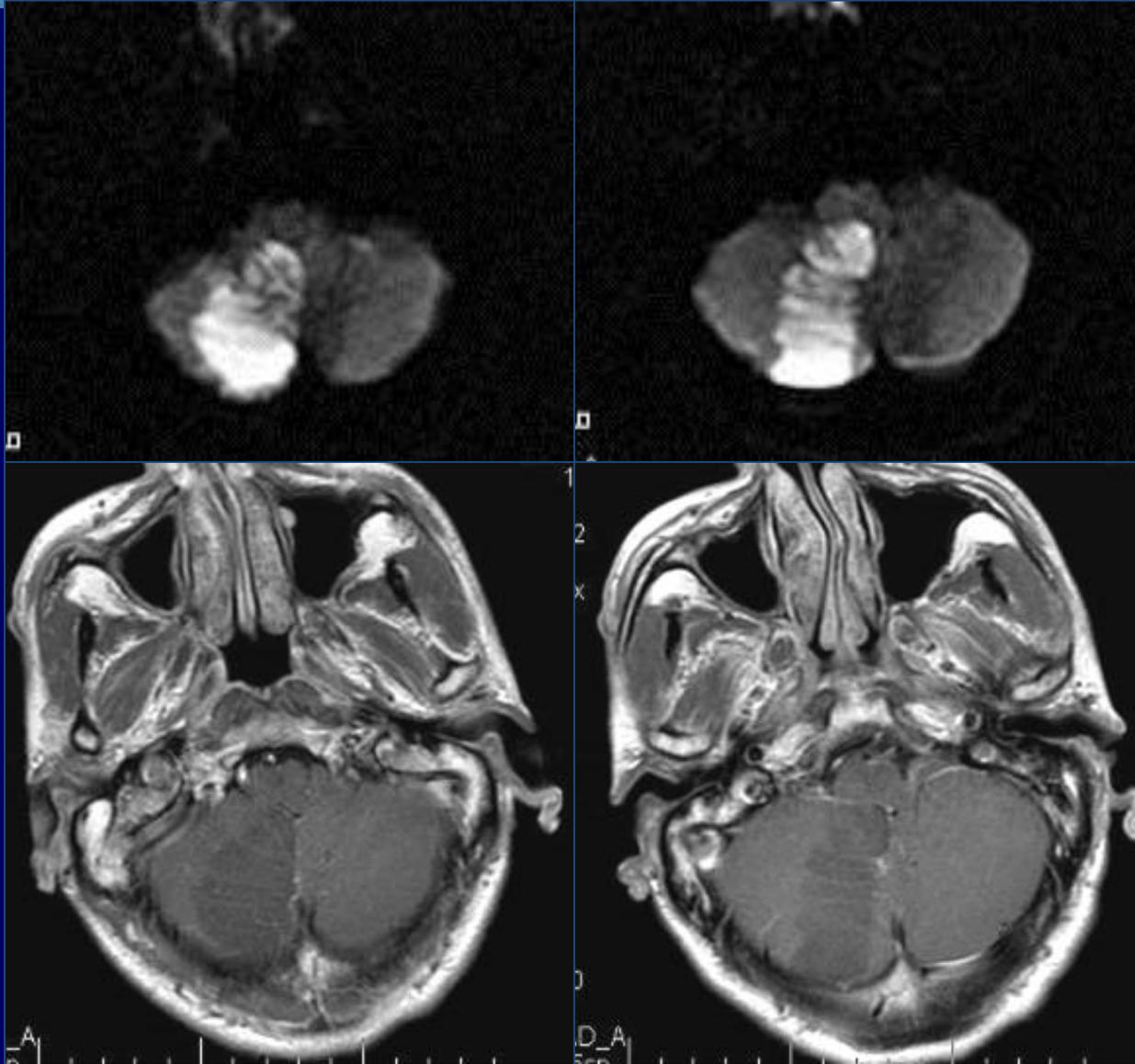
- 小脑前下动脉 (AICA)
- 小脑后下动脉 (PICA)
- 小脑上动脉 (SCA)



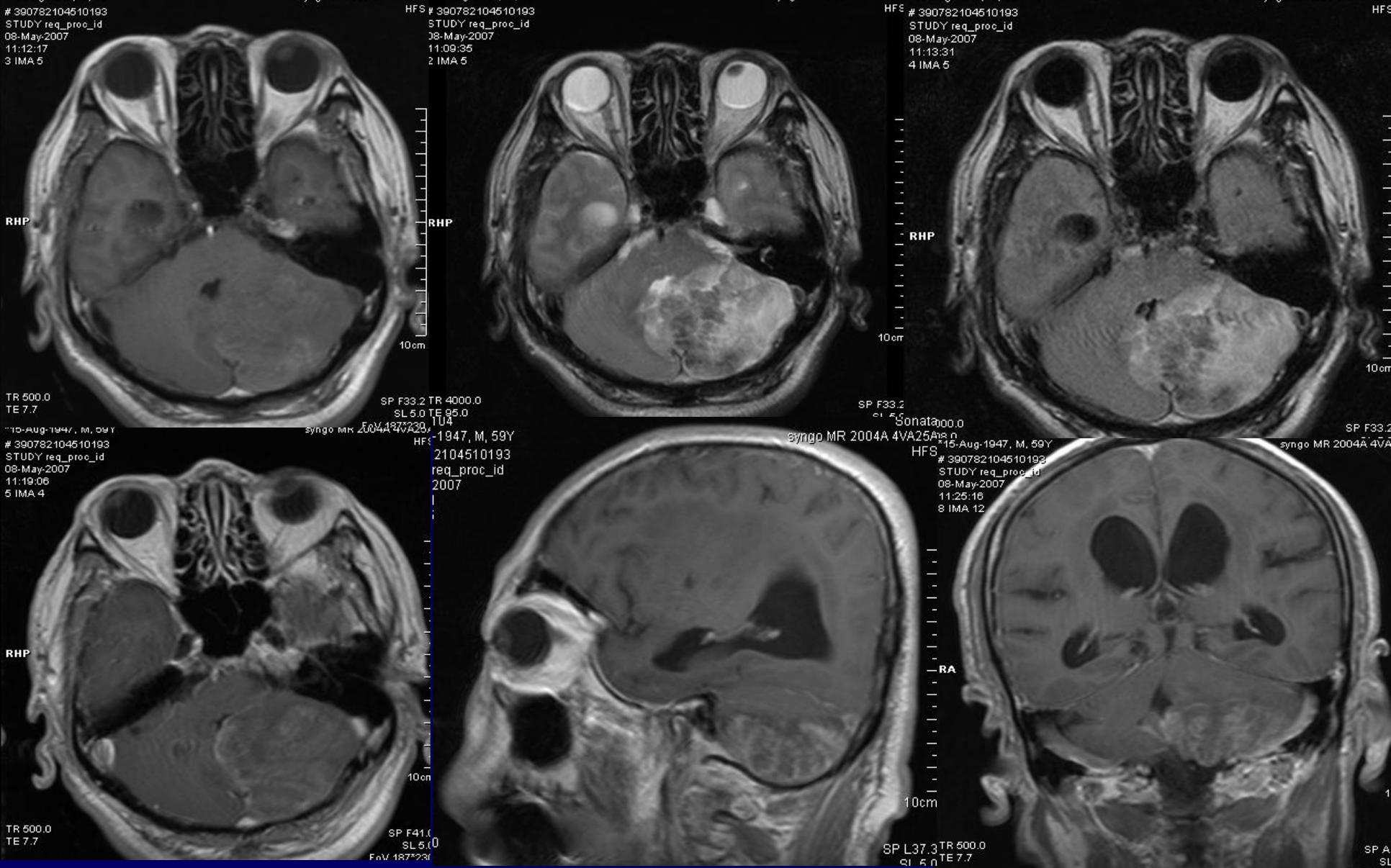
- ACA (红色)
- MCA (黄色)
- PCA (绿色)

AChA 脉络膜前动脉  
LSA 豆纹动脉





小脑后下动脉供血区梗死



左侧小脑半球片状等短混杂T1长短混杂T2异常信号，FLAIR呈  
 高低混杂信号，注入GD-DTPA后病灶内间见脑回样强化



脑干供血来自椎-基底动脉，分支为三类：

1,旁正中动脉 (paramedian arteries)

2,短旋支 (short circumferential arteries)

3,长旋支 (long circumferential arteries)

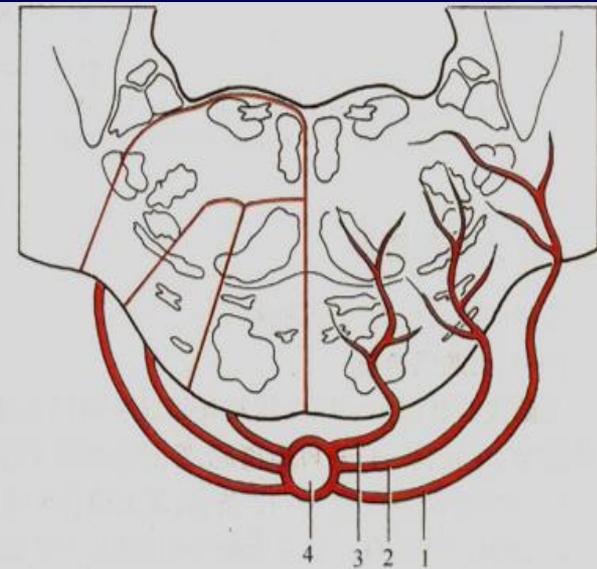
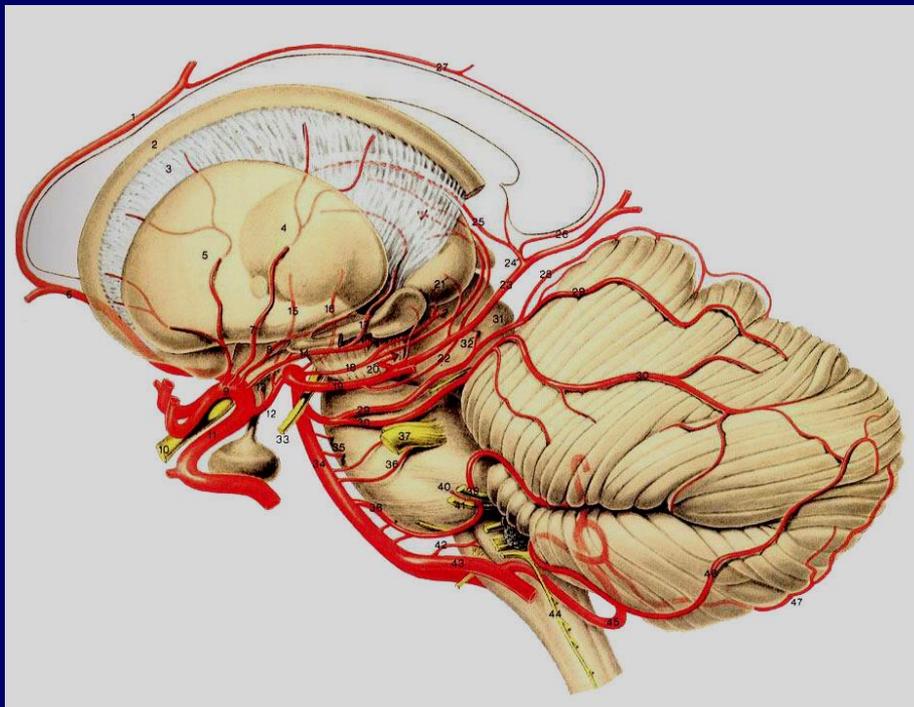


图 1-145 脑桥的血液供应

1. 长旋支 long circumflex branch; 2. 短旋支 short circumflex branch; 3. 旁正中支 paramedian branch; 4. 基底动脉 basilar



# 半侧分布、不交叉、不跨越中线

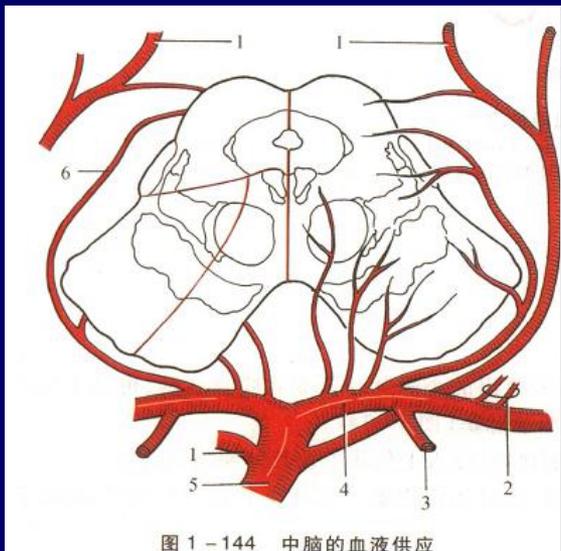


图 1-144 中脑的血液供应

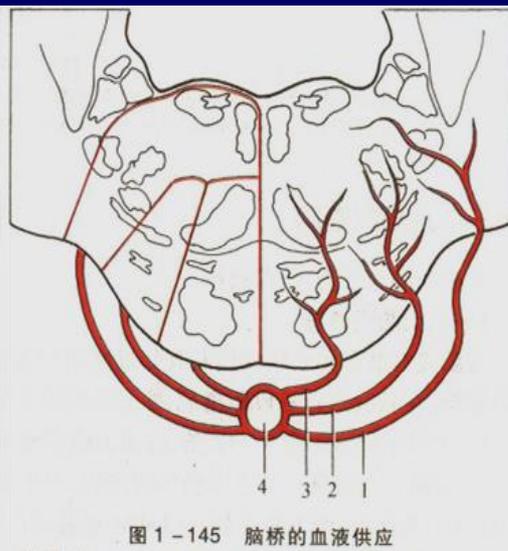
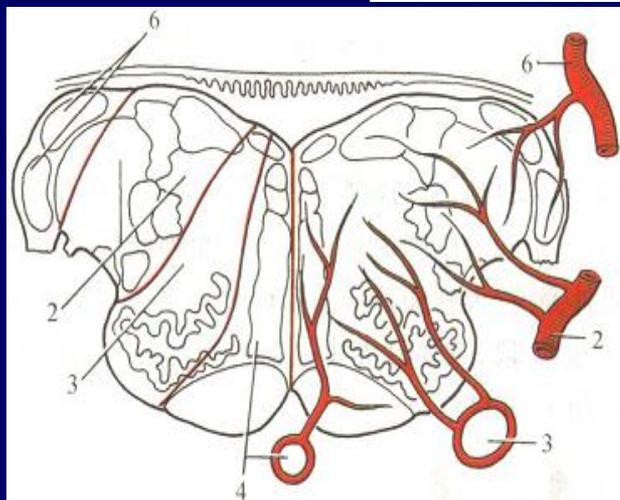
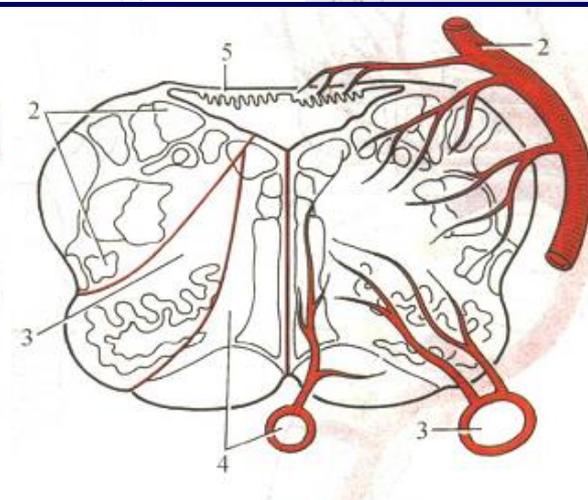


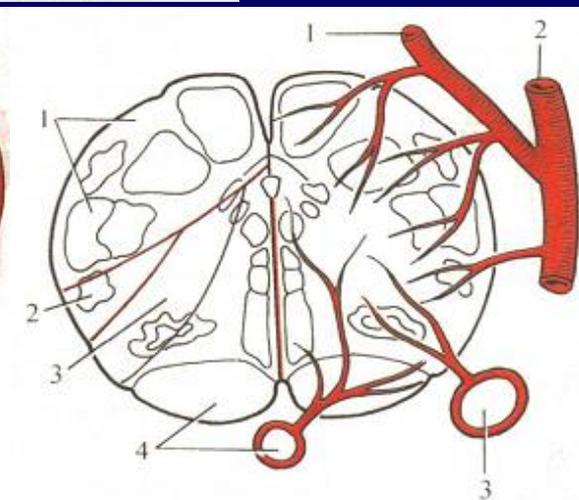
图 1-145 脑桥的血液供应



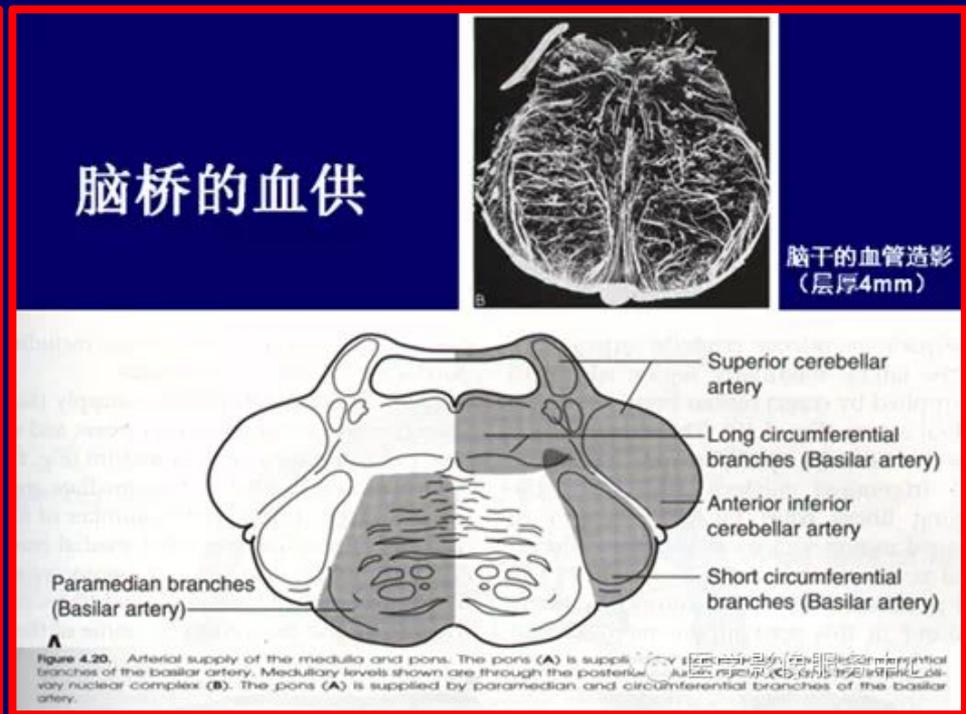
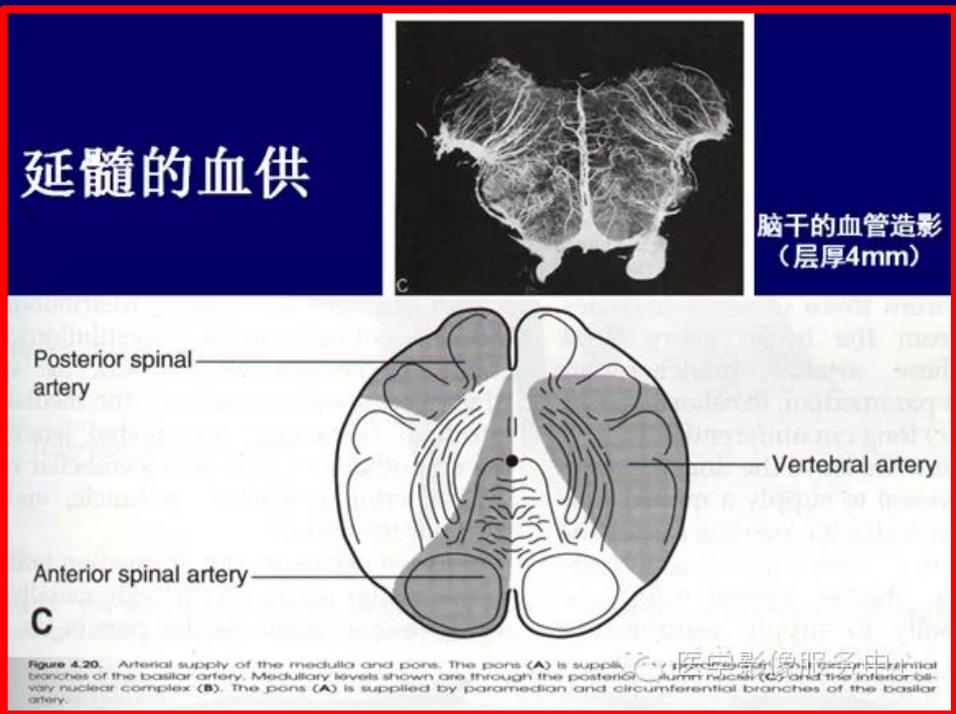
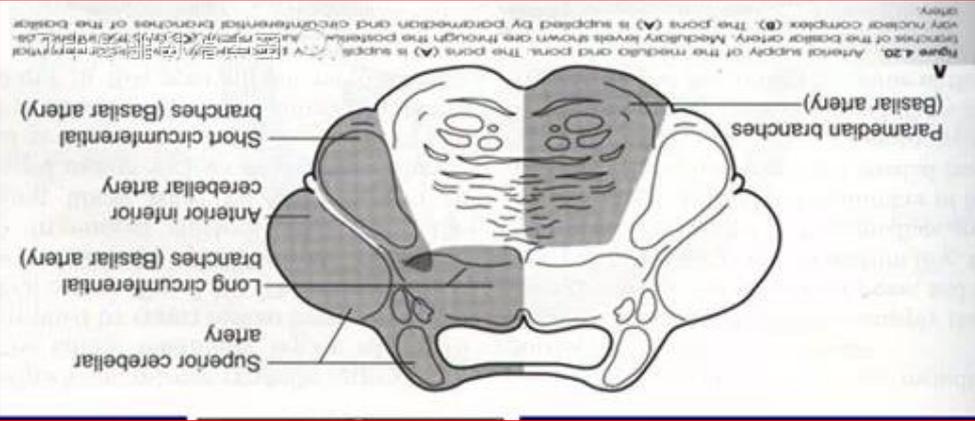
C. 经橄榄上份的横断面



B. 经橄榄下份的横断面



A. 经锥体的横断面





# 脑桥水平

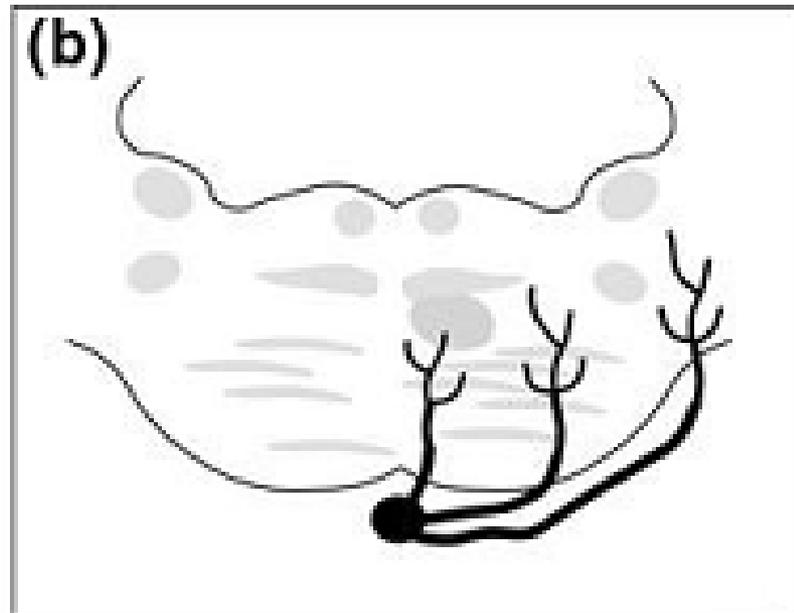
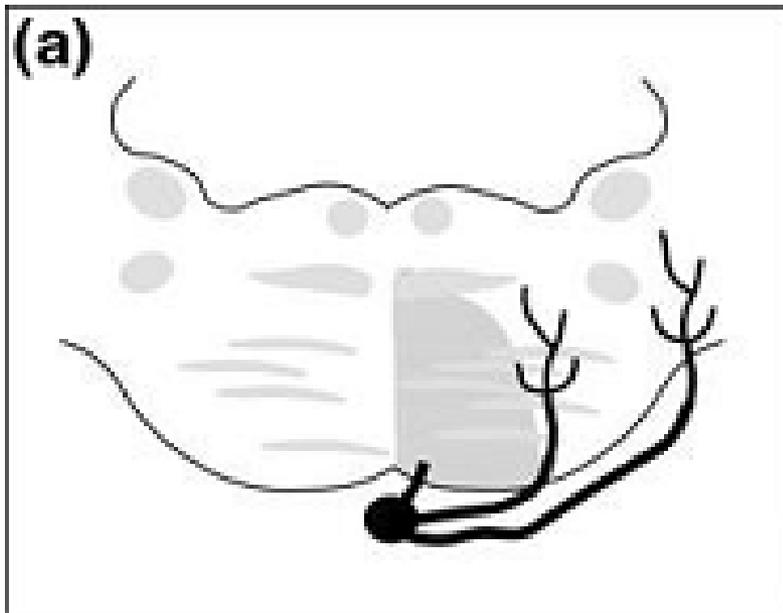
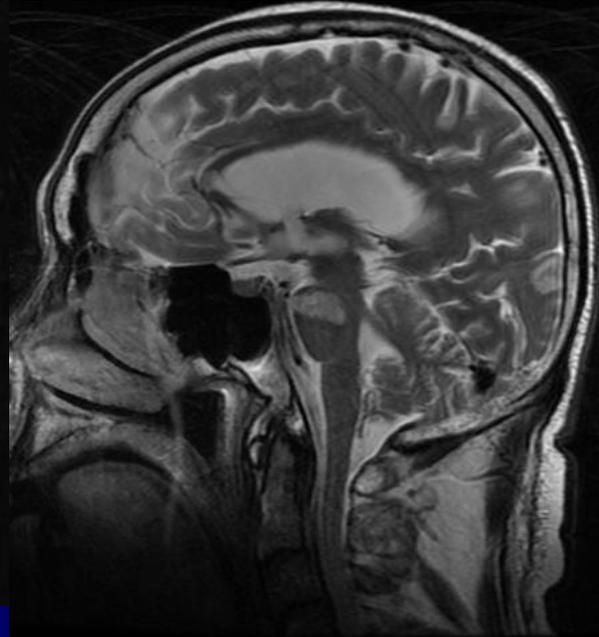
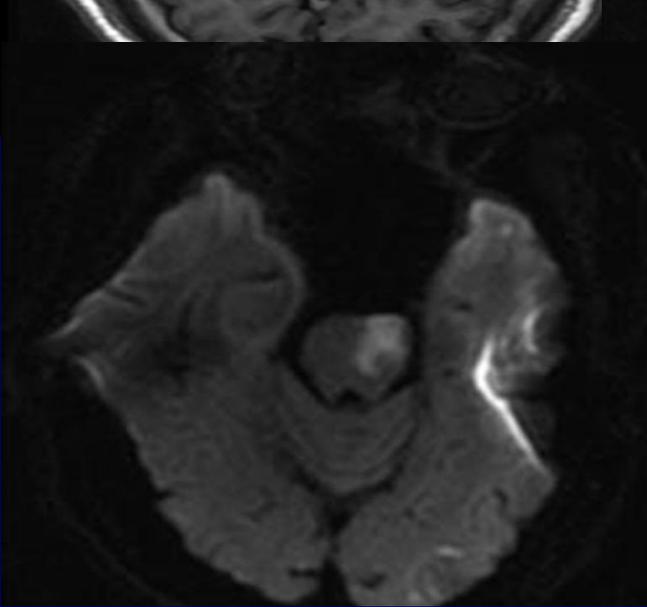
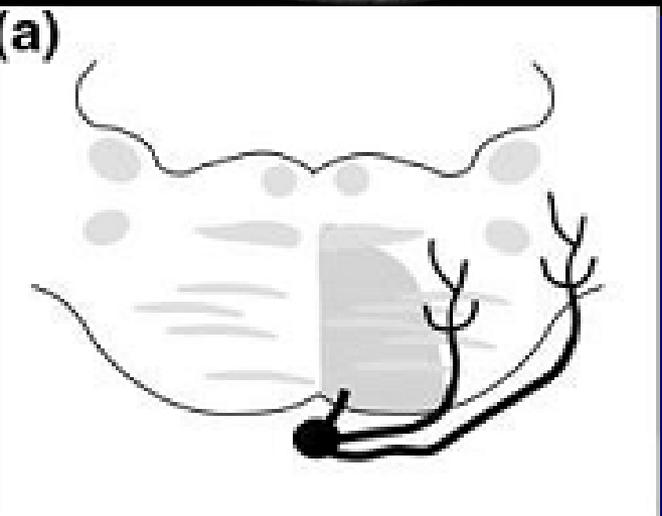
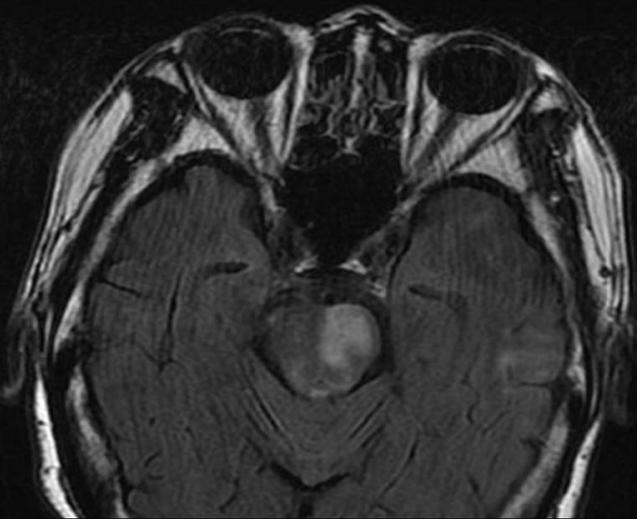
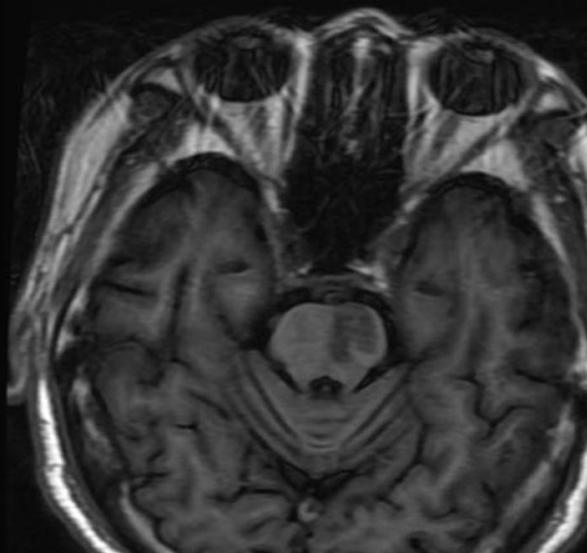


Figure 1 Schematic drawing showing the two types of pontine infarcts considered according to the extent or not to the anterior surface of the pons: (a) paramedian pontine infarct and (b) lacunar pontine infarct.



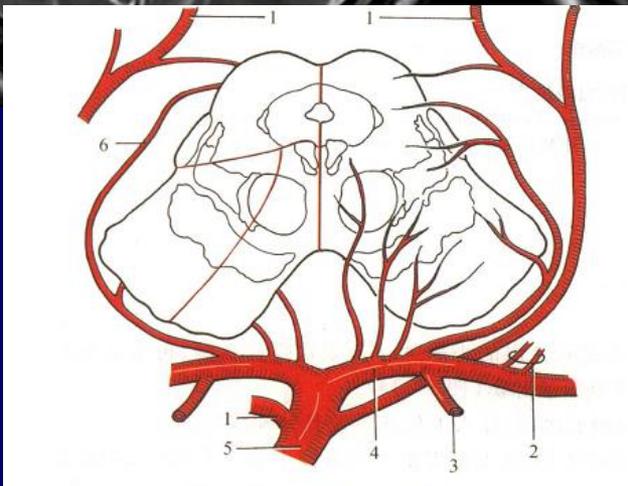
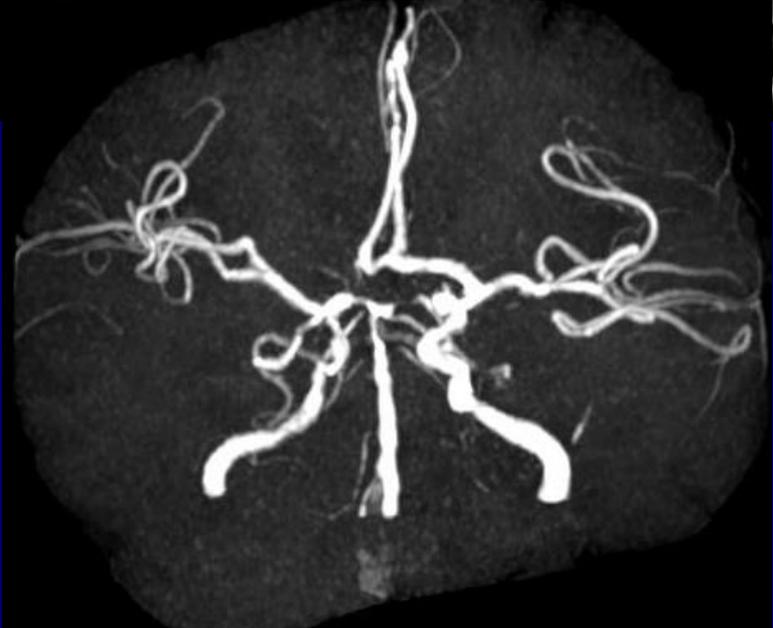
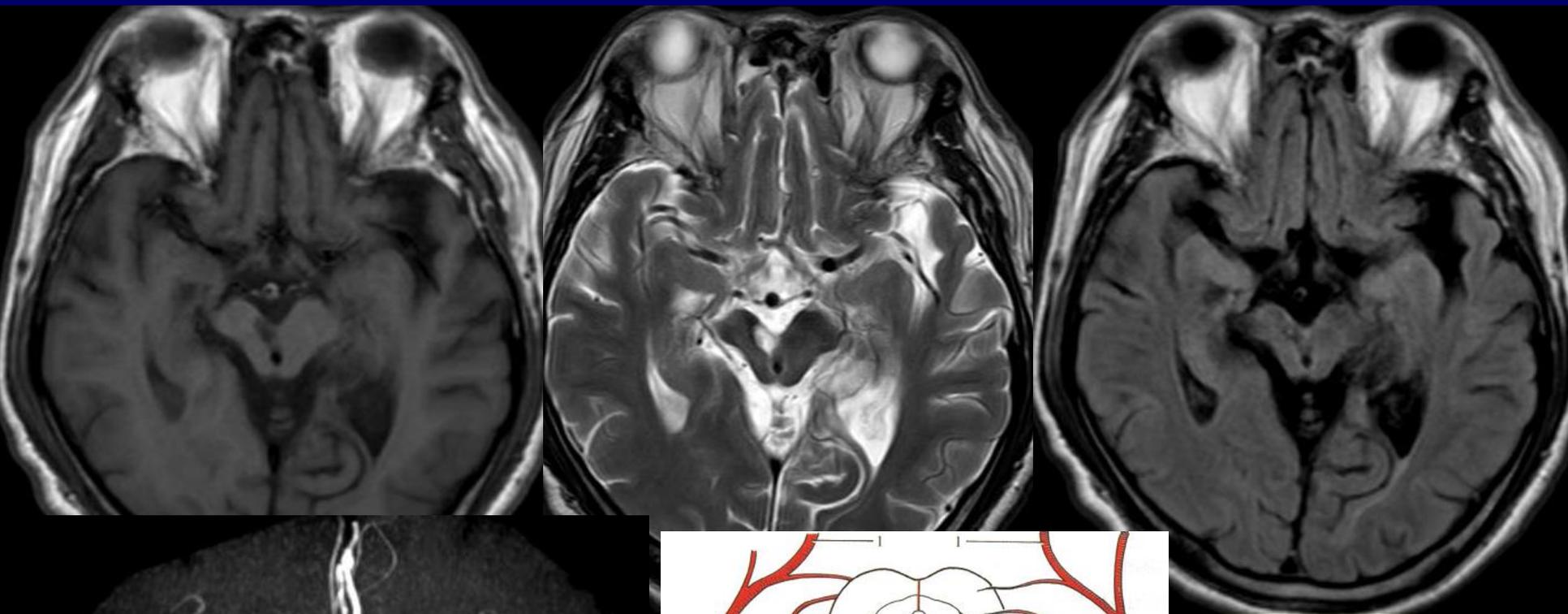
# 旁正中支闭塞

“脑干半切征”：病变不跨越  
脑干中线且内缘与中线平齐





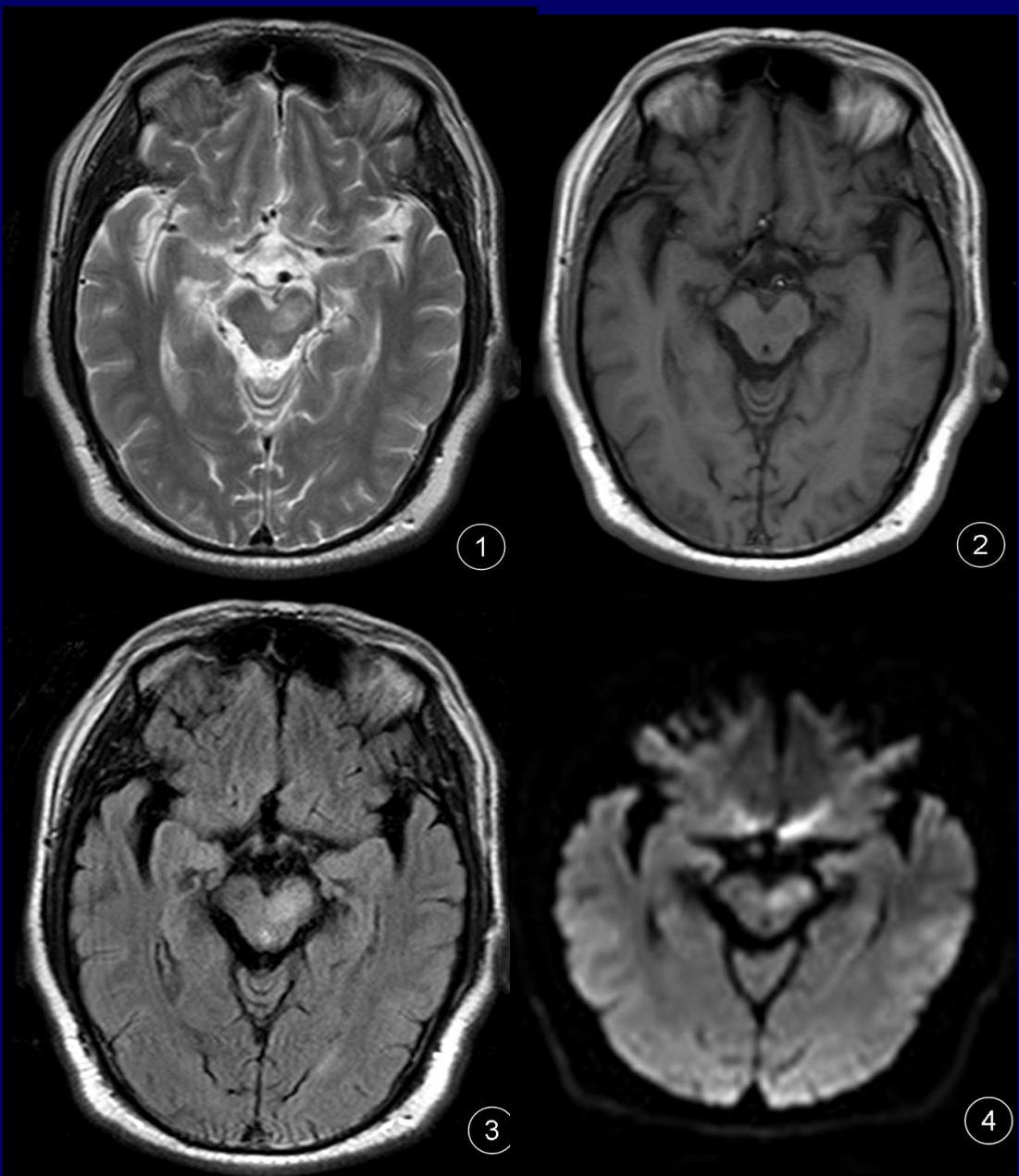
# 中脑水平



旁正中支闭塞

图 1-144 中脑的血液供应

- 1. 小脑上动脉 superior cerebellar artery;
- 2. 脉络丛后动脉 posterior choroidal arteries;
- 3. 后交通动脉 posterior communicating artery;
- 4. 大脑后动脉 (PI) posterior cerebral artery (PI);
- 5. 基底动脉 basilar artery;
- 6. 四叠体动脉 quadrigeminal artery



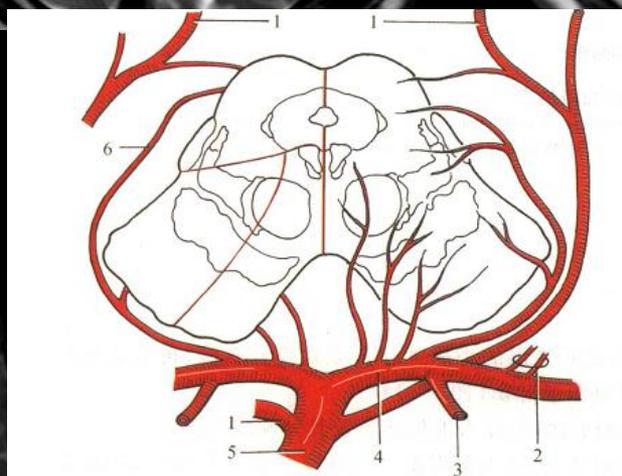


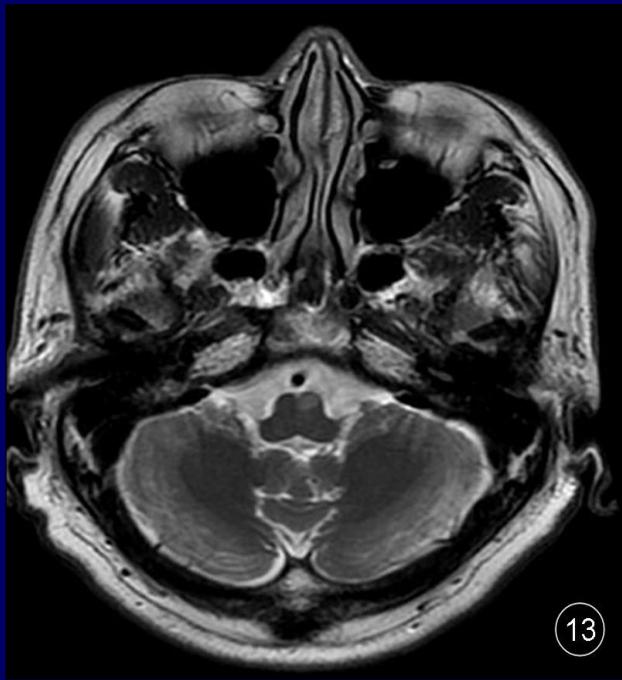
图 1-144 中脑的血液供应

- 1. 小脑上动脉 superior cerebellar artery;
- 2. 脉络丛后动脉 posterior choroidal arteries;
- 3. 后交通动脉 posterior communicating artery;
- 4. 大脑后动脉 (PI) posterior cerebral artery (PI);
- 5. 基底动脉 basilar artery;
- 6. 四叠体动脉 quadrigeminal artery

旁正中支或  
短旋动脉闭塞



# 延髓水平

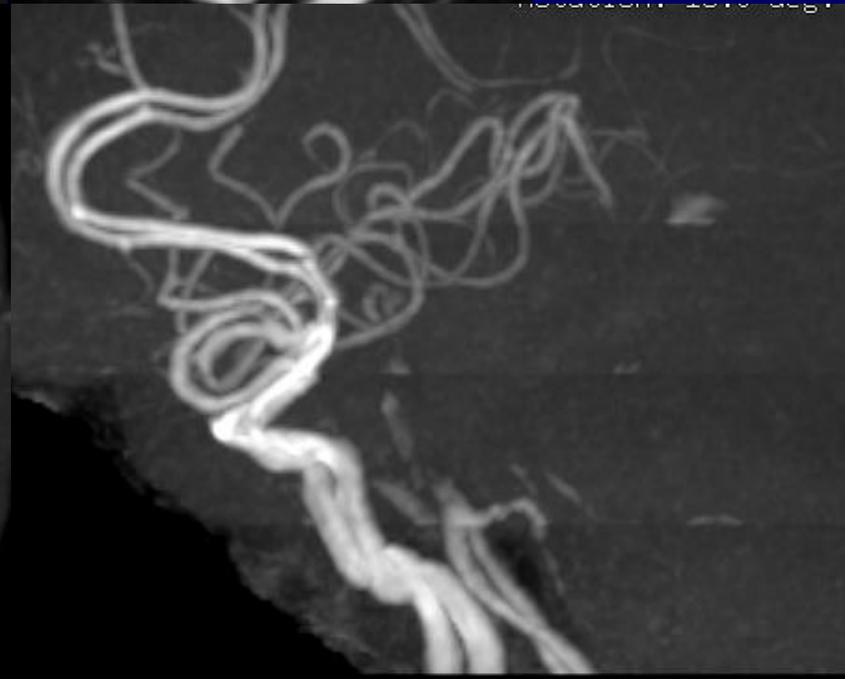
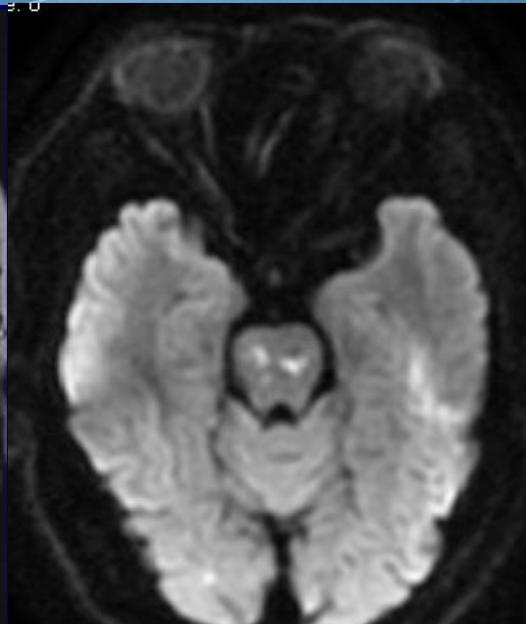
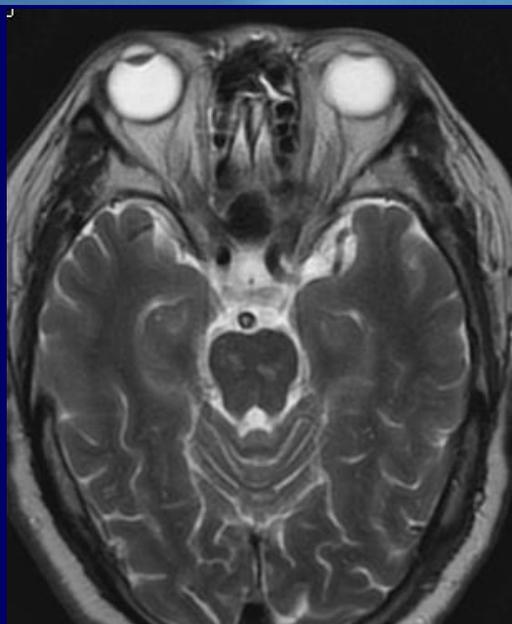


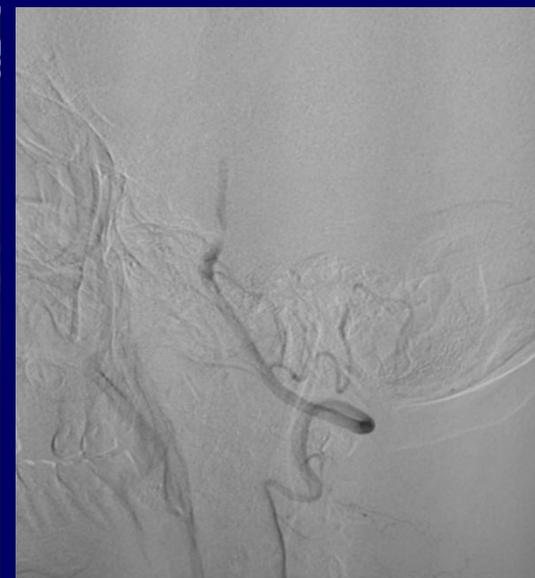
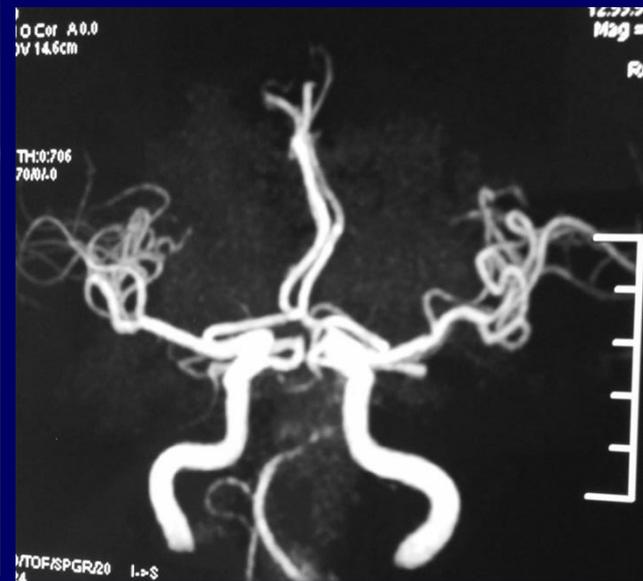
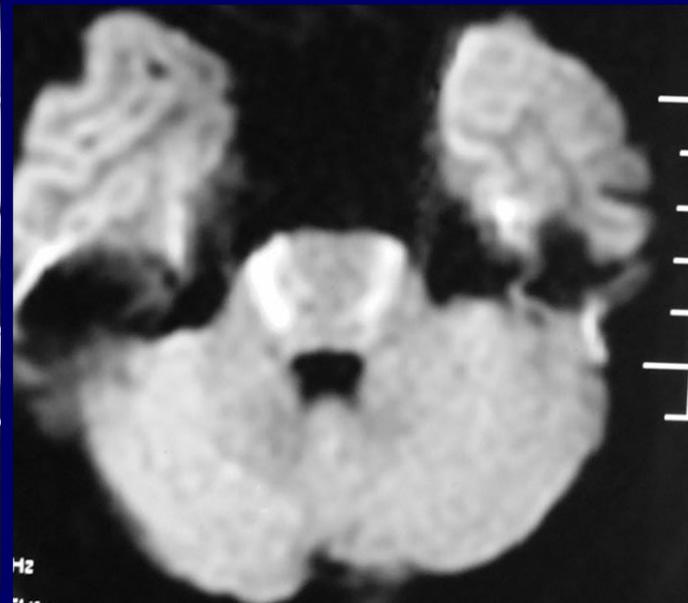
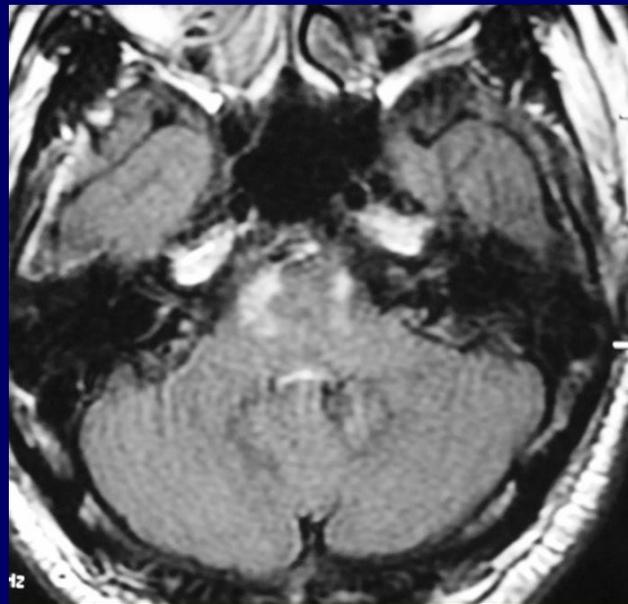
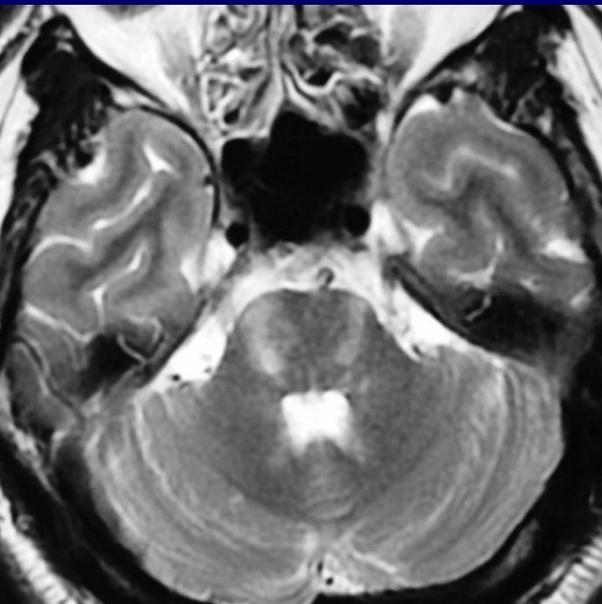
旁正中支闭塞



长旋动脉闭塞

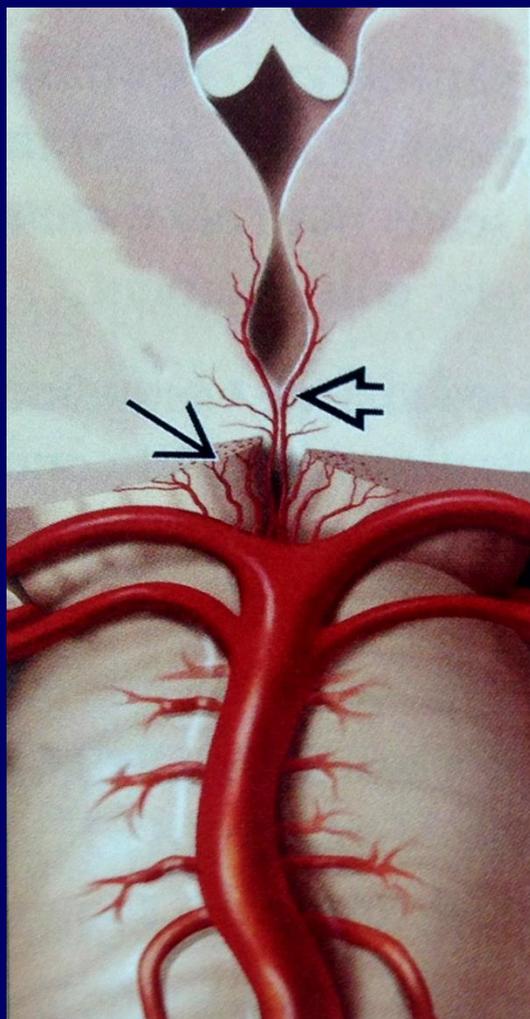




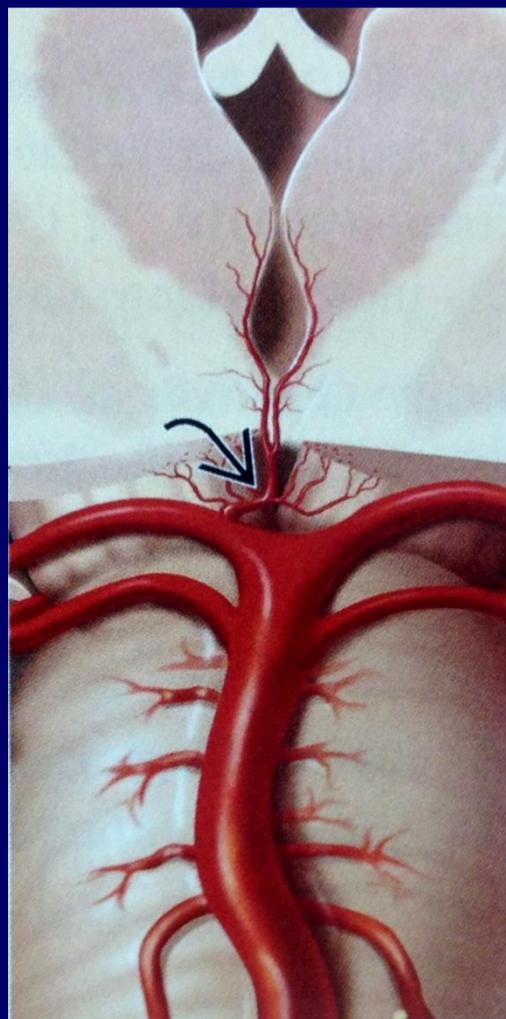




## 丘脑（内侧）的血供

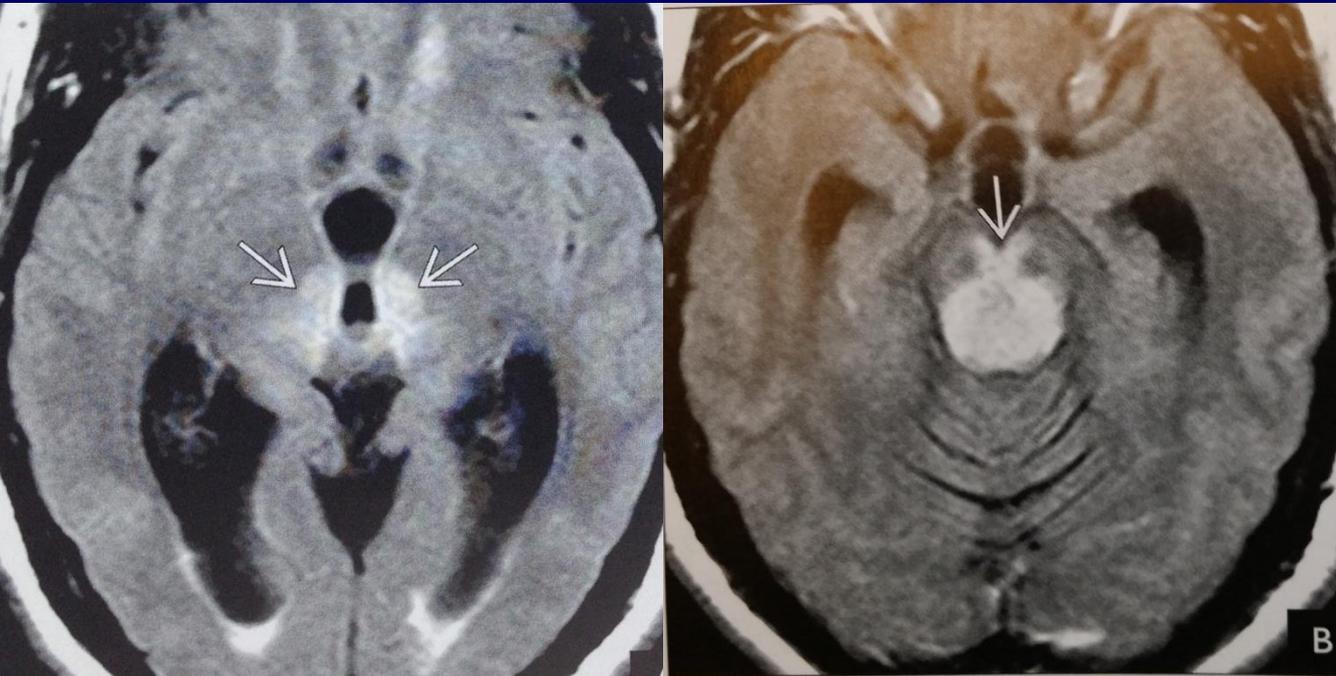


正常



变异

Percheron动脉

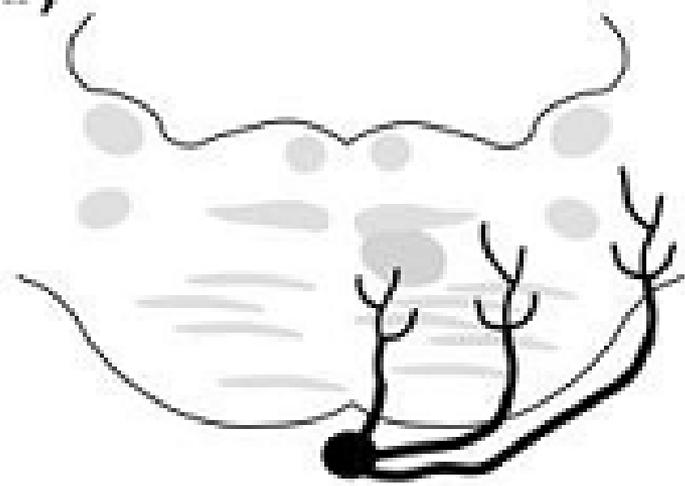


## Percheron动脉梗死

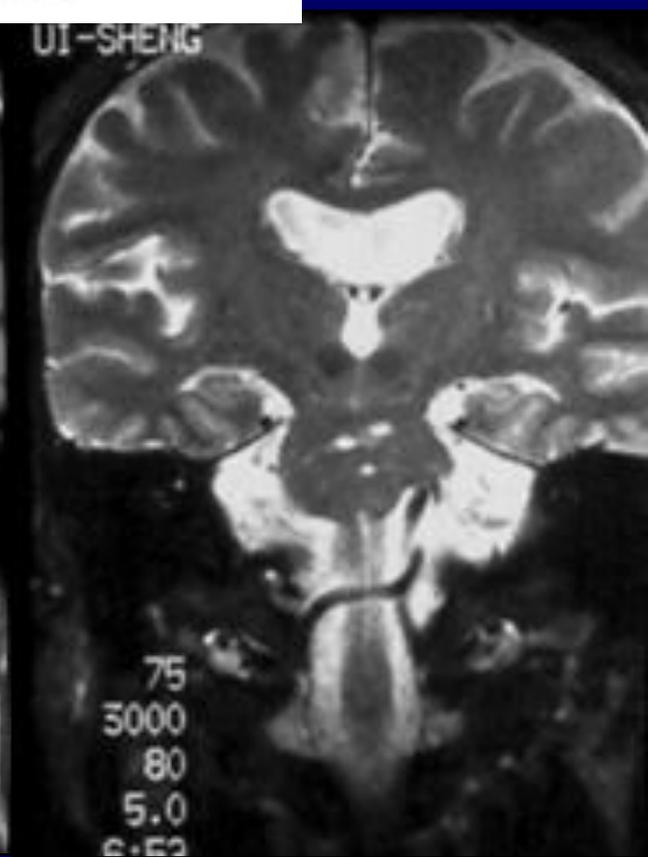
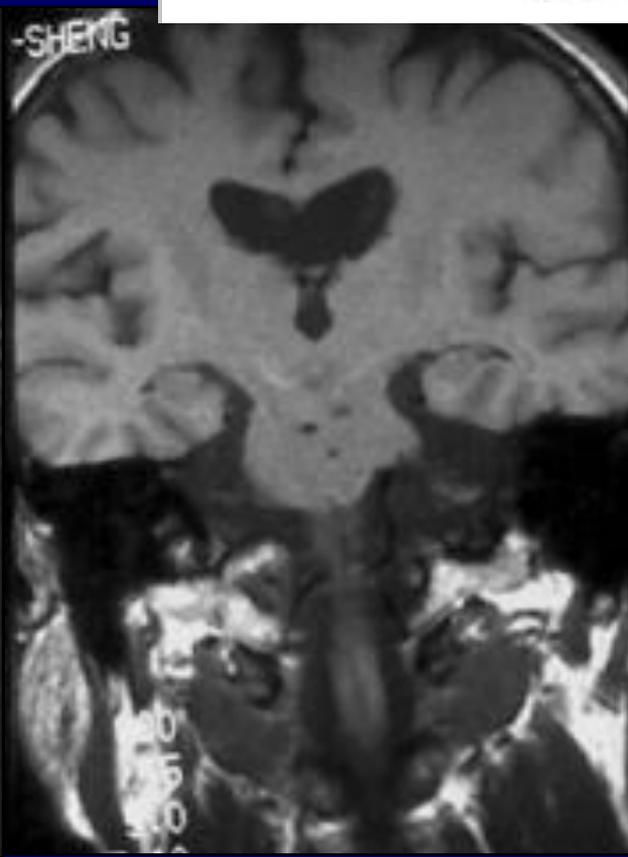
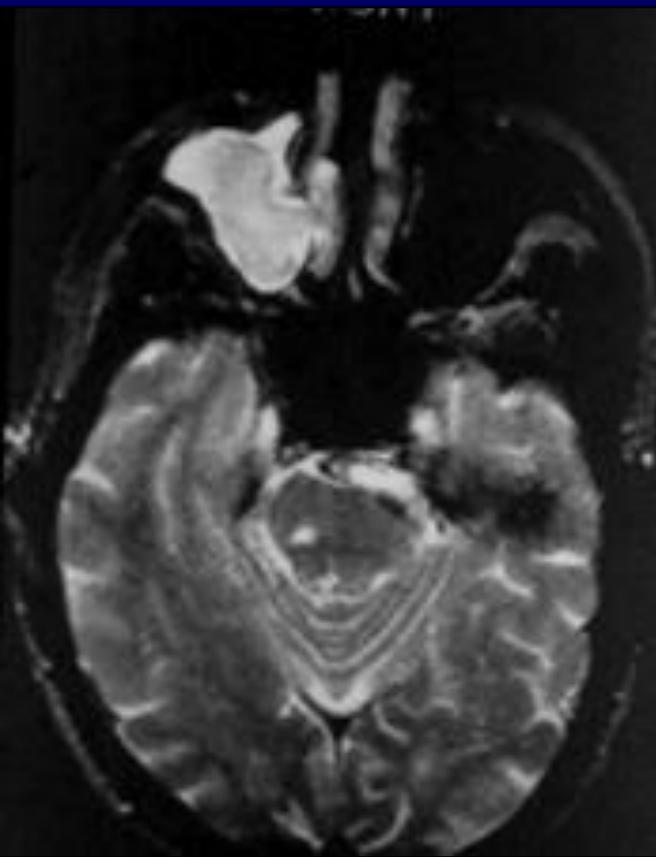
双侧腹内侧丘脑综合征 (bilateral ventromedial thalamic syndrome, BVTS), 又称双侧丘脑旁正中综合征, 大多是由单次卒中所致的双侧丘脑腹内侧梗死引起。临床症状以意识障碍、睡眠节律改变、淡漠及眼动障碍为主



(b)



供血动脉远端闭塞  
腔隙性脑梗死

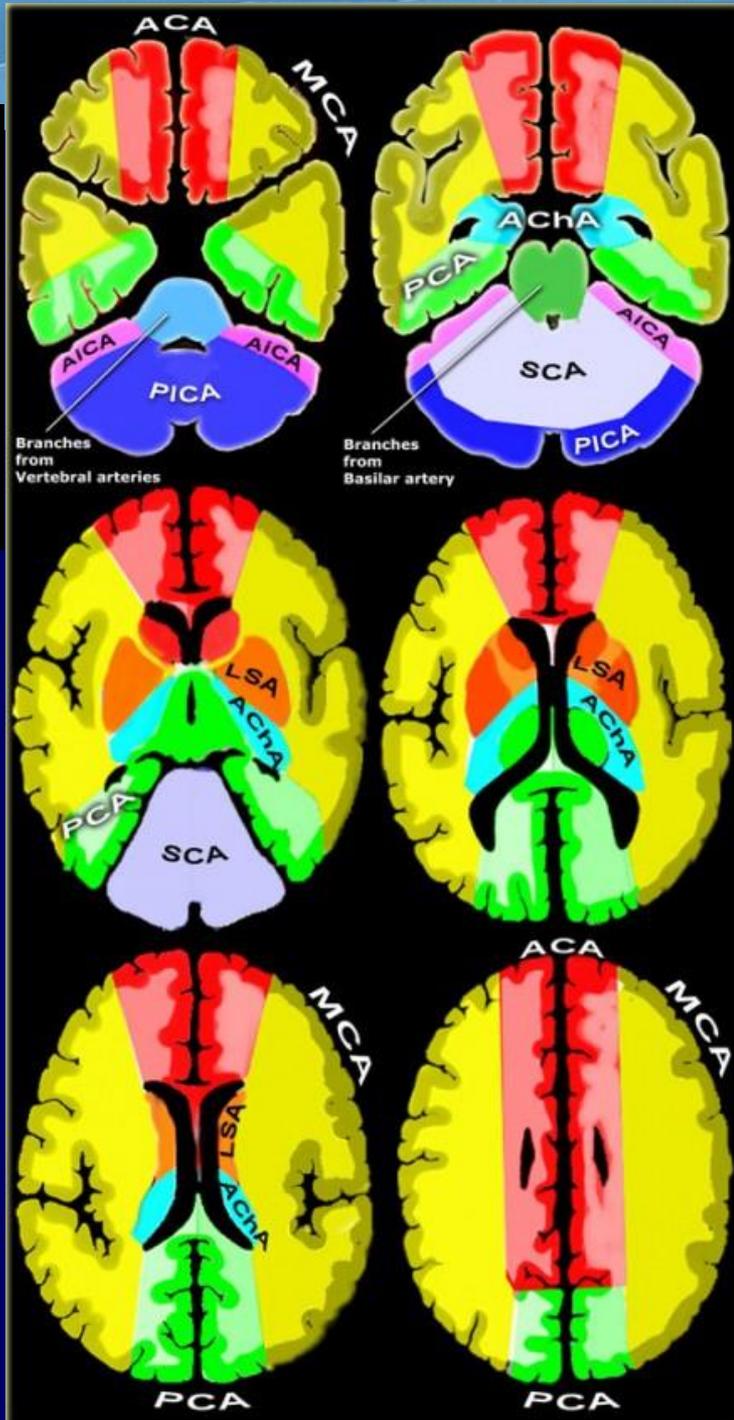
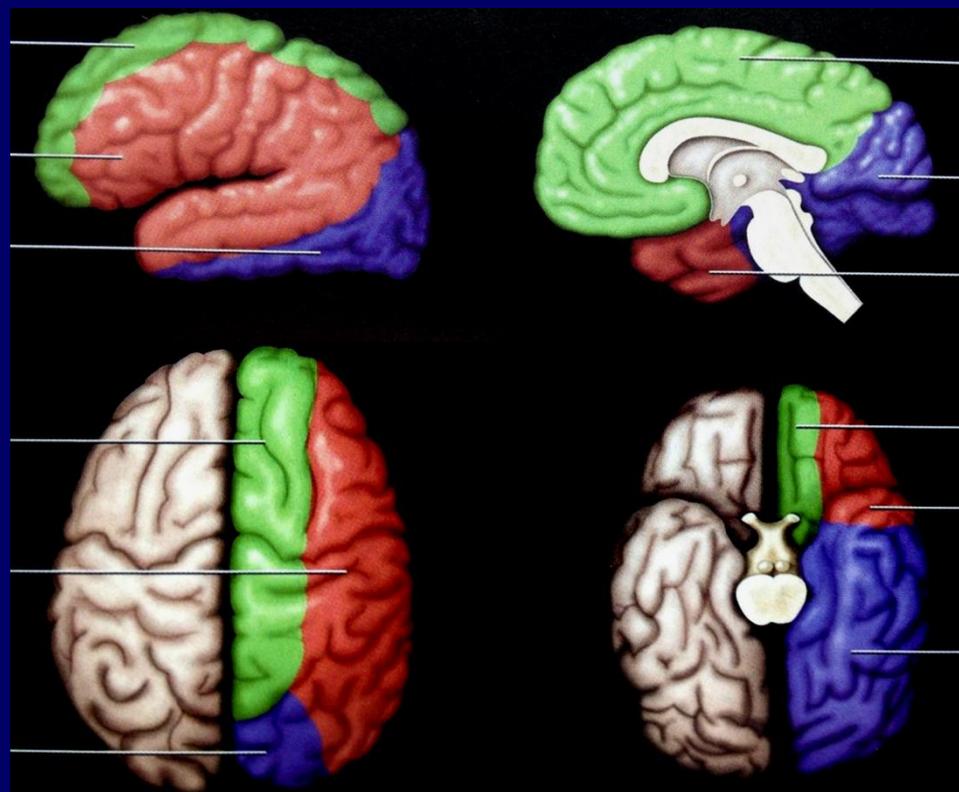




# 分水岭梗死:

二(以上) 供血动脉血管供血  
范围之间脑组织的缺血梗死  
占脑梗死的10%-12%

ACA  
MCA  
PCA



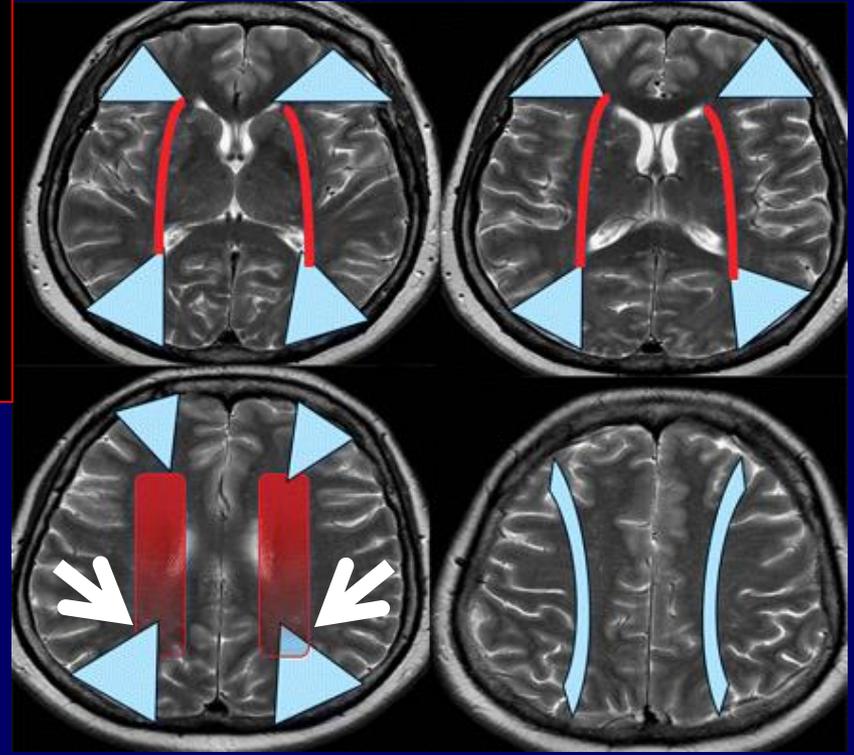


# 分水岭梗死



- 沿侧脑室背外侧角的脑室周围白质地带；
- 大脑前、中、后动脉交界所形成的一个卵圆（三角）形地带
- 尾状核头，大脑前动脉回返支与大脑中动脉豆纹动脉外侧丛交界处；
- 脑干：四脑室底（旁正中支、短旋支、长旋支交界地带）和桥脑中央（椎—基底动脉与颈内动脉交界处）

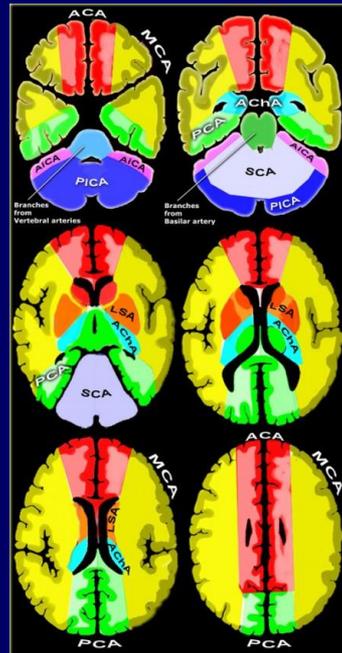
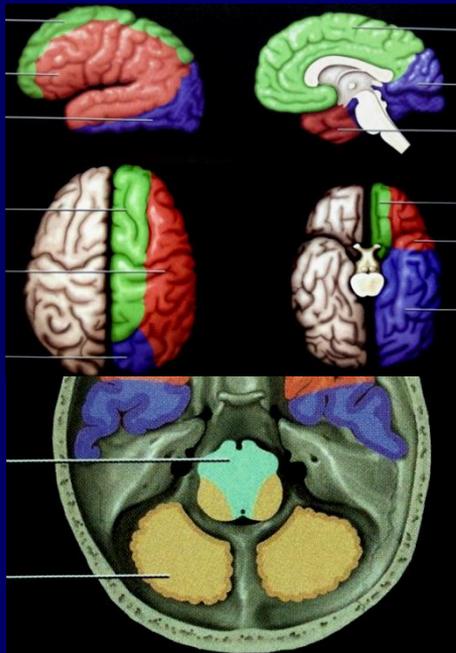
三角形：ACAs、MCAs、PCAs间分水岭（外分水岭）

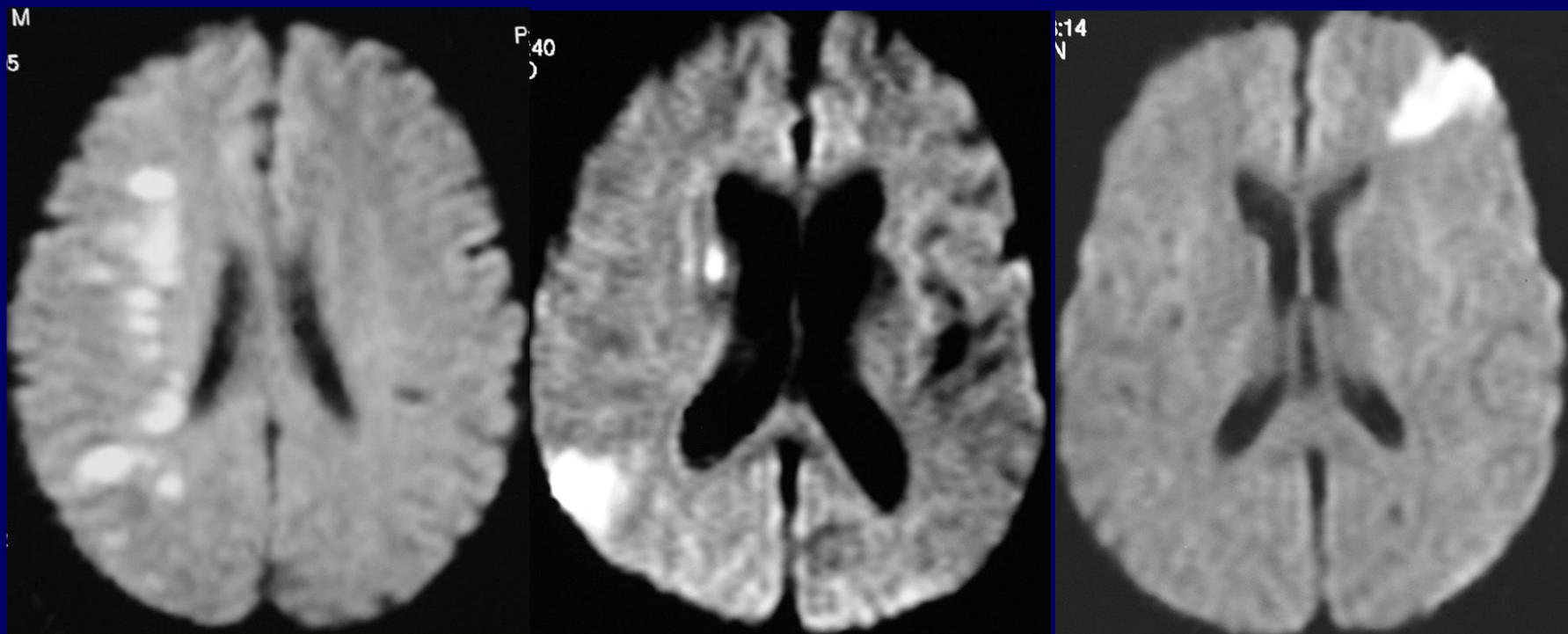


红色：内分水岭  
主要供血动脉的  
穿支动脉

皮层下分水岭

箭标处：三支主要动脉之间的分水岭区





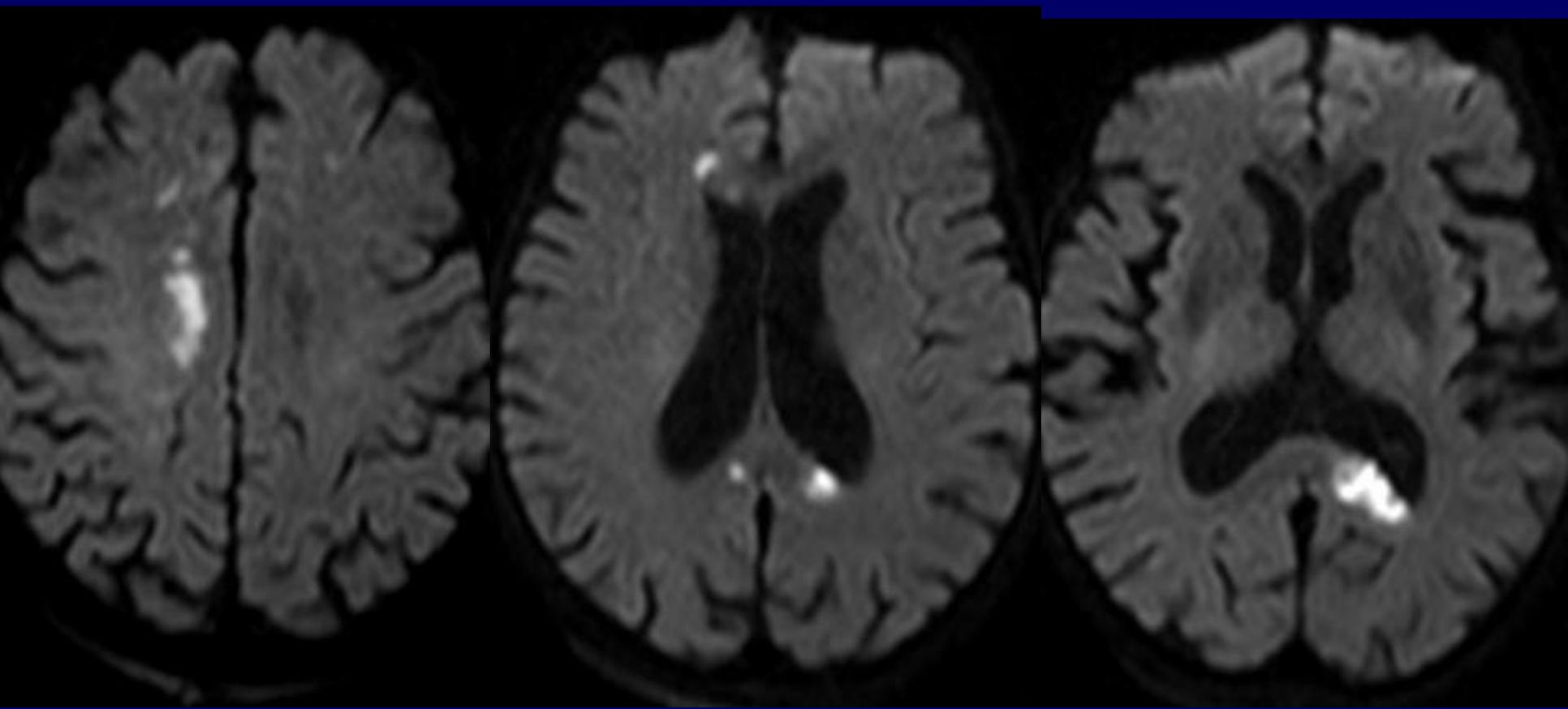


## 二、脑栓塞 (cerebral embolism)

- 各种栓子随血流进入颅内动脉使血管腔急性闭塞
- 占脑梗死15%-20%
- 栓子：心源性、非心源性、来源不明
- 常见于颈内动脉系，MCA尤为多见
- 影像学特点：分布无规律，散在多发



女，82Y，头晕、言语不清4小时



病变为多发，非一支血管供血区内。栓塞！



## 三、腔隙性脑梗死 (lacuna infarct)

- **大脑半球或脑干深部的小穿通动脉**，在长期高血压的基础上，血管壁发生病变，最终管腔闭塞，导致**缺血性微梗死**，**缺血、坏死和液化的脑组织**由吞噬细胞移走形成**空腔**
- 1965年，**Fisher**对已发生坏死囊变后小的脑梗死启用了“腔隙综合征”一词，以后称之为腔隙性脑梗死（简称“腔梗”）
- 实为慢性腔隙性脑梗死，已坏死囊变
- 源于基底动脉的**小脑**的某些较细、长的动脉分支供血区也可发生腔隙性脑梗死，相对较少



# 腔隙性脑梗死 (lacuna infarct)

- 主要累及脑的深部白质、基底节、丘脑和脑桥  
    深部核团 (壳 37%, 丘脑 14%, 尾状核 10%)  
    脑桥 16%, 内囊后肢 10%  
    内囊前肢及小脑较少见
- 部分无症状, 称静息性梗死或无症状性梗死
- 占脑梗死20%–30%



# 腔隙灶

- 起源于法语的la lacune
- 1838年Dechanmbre作为病理学用语首次提出
- 指大脑深部小梗死在恢复过程中贮满液体的小腔隙（慢性期梗死、软化灶）

实际应为陈旧性腔隙性脑梗死



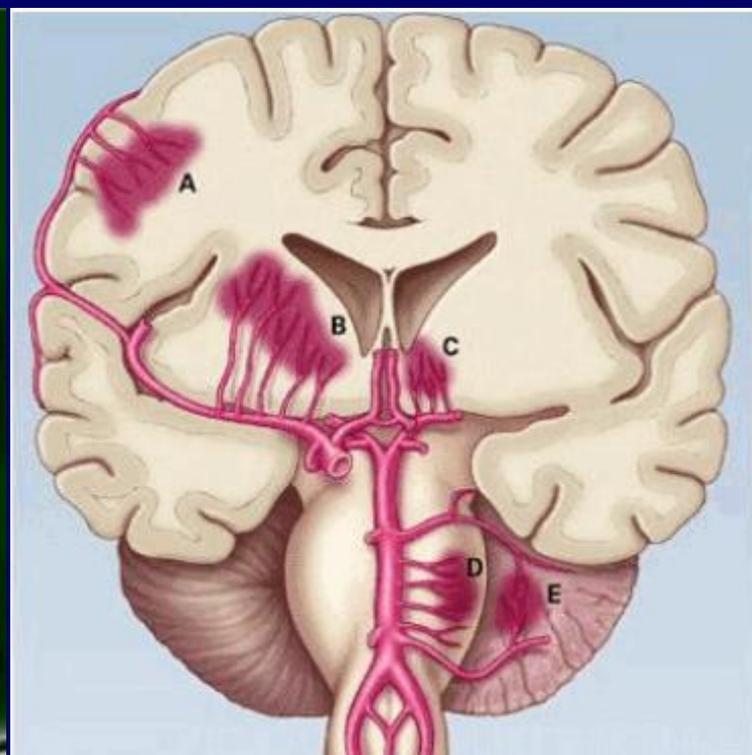
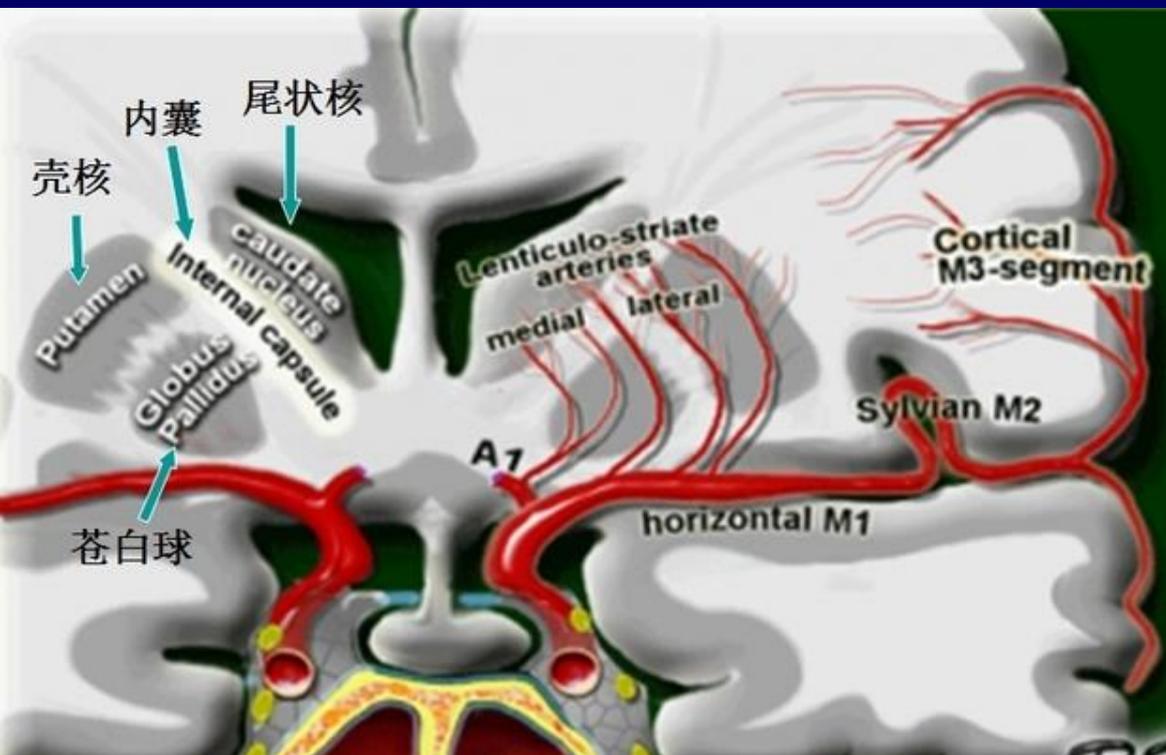
## 命名较为混乱

- 由于对腔隙（**lacune**）、腔隙性脑梗死（**lacunar infarct**）和腔隙综合征（**lacunar syndrome**）等词的认识和理解存在差异和争论，一个多世纪以来对它争论颇多
- **Behrouz**等认为在未取得公认的统一命名之前，建议以**小血管性脑梗死**（**small vessel infarct, SVI**）一词替代腔梗（**但现在仍沿用腔梗**）

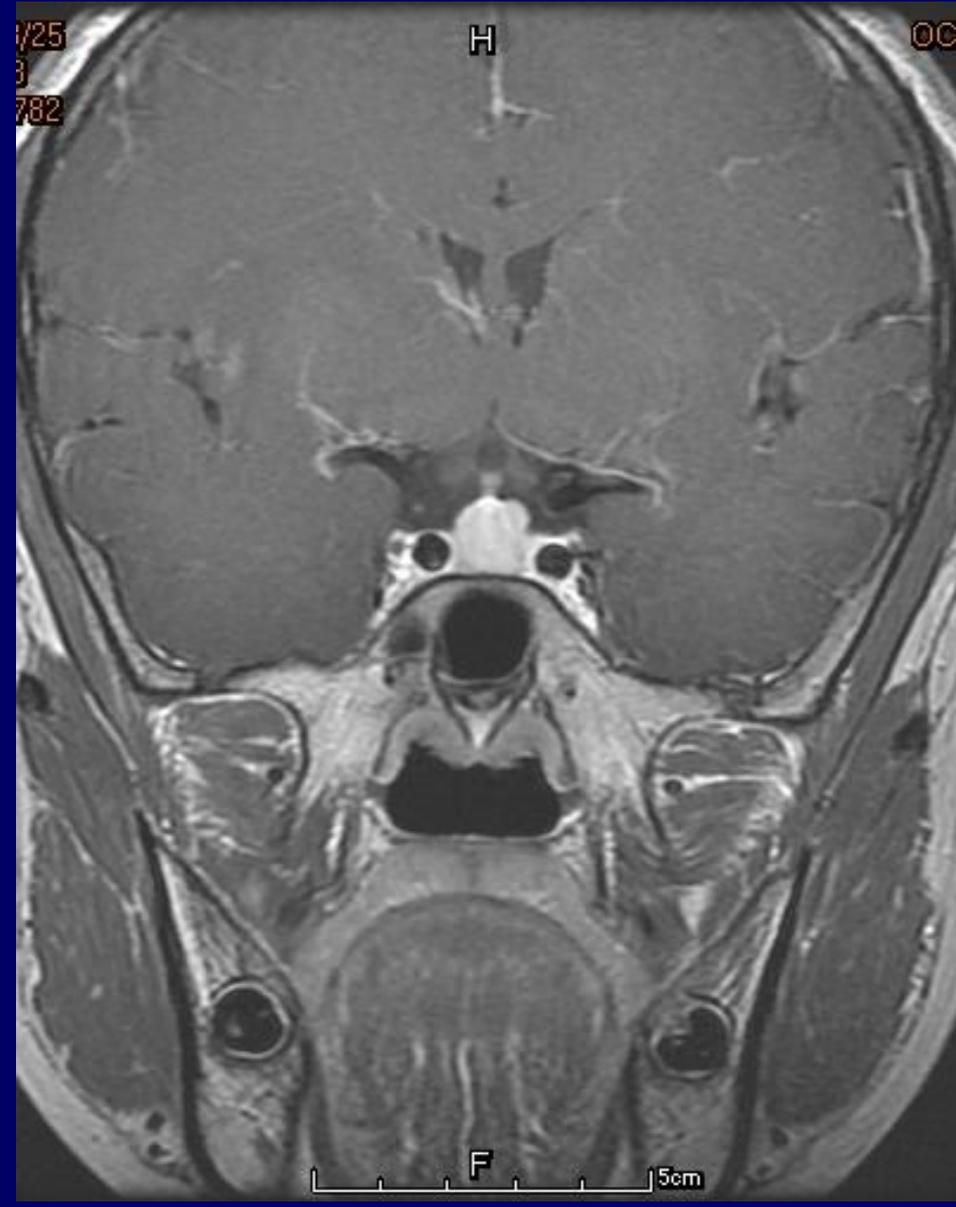
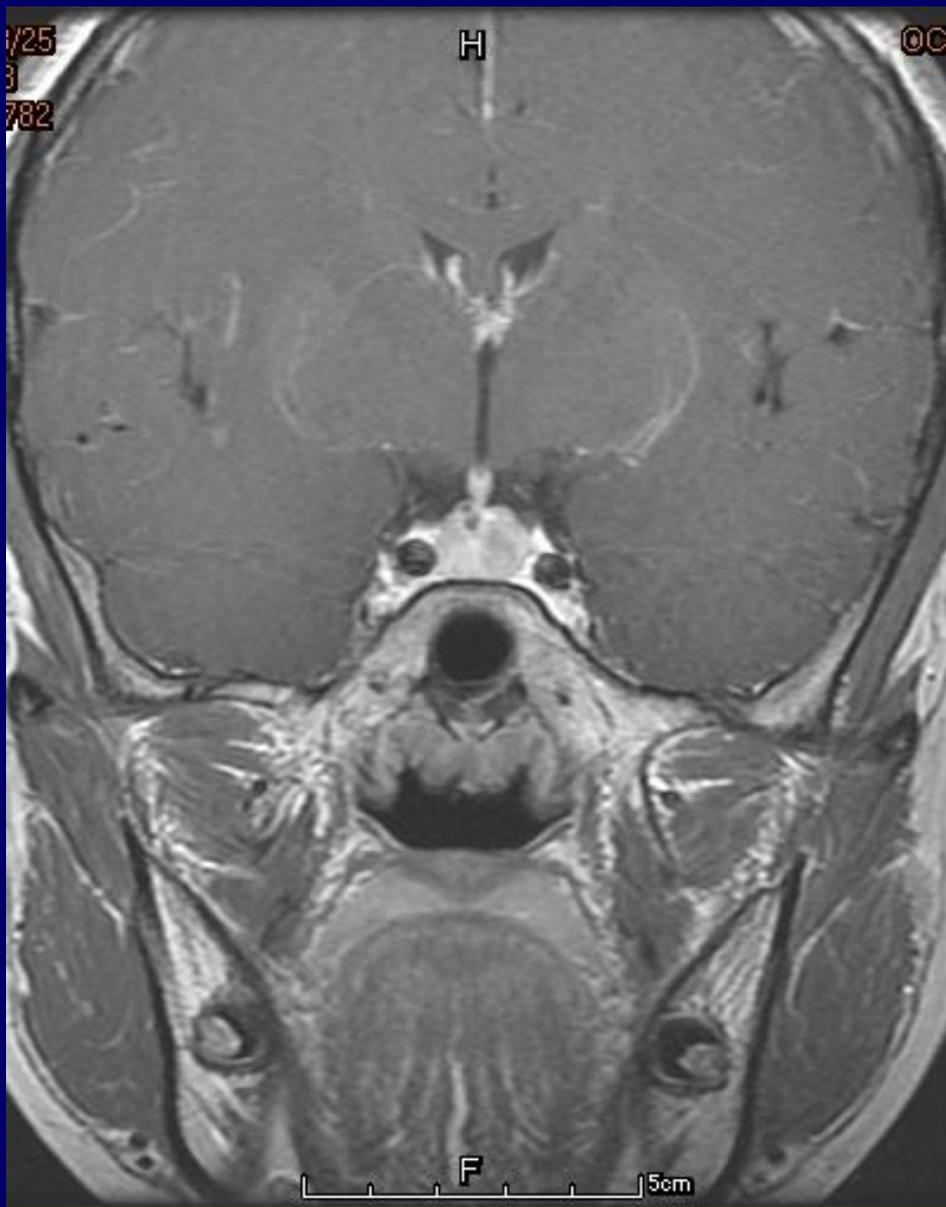


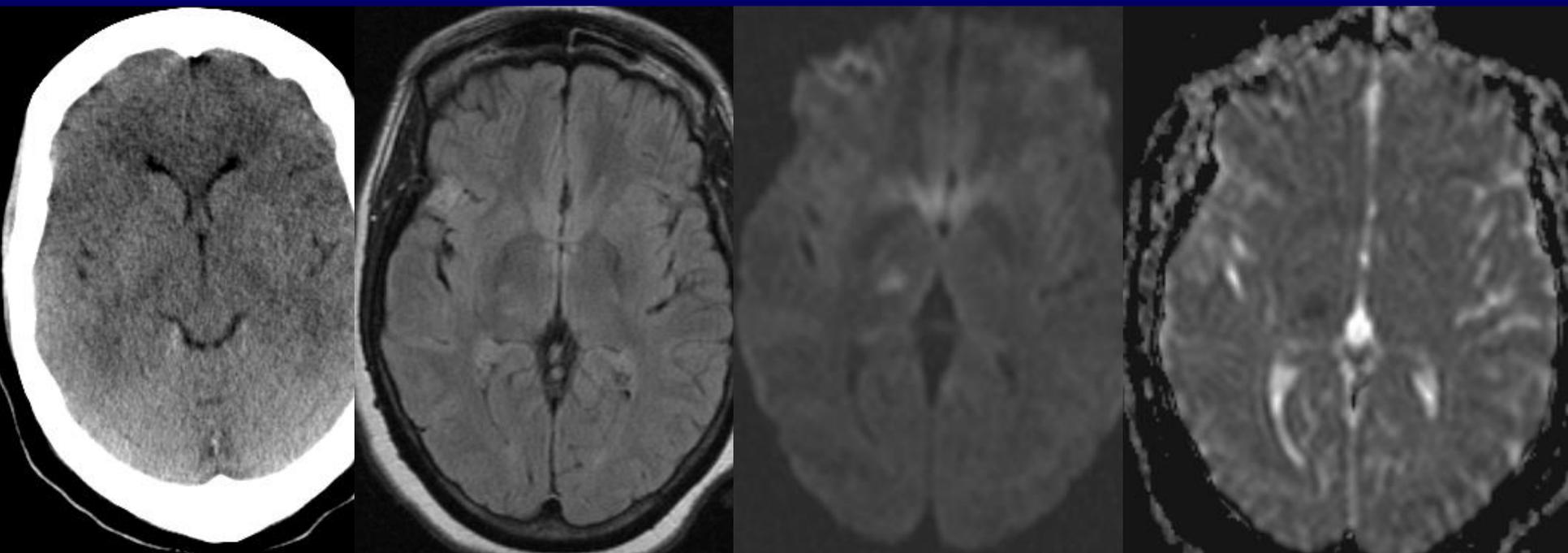
# 腔隙性脑梗死病理改变

- 高血压导致小动脉及微小动脉壁**脂质透明变性**
- **小血管病**，多为直径100-200  $\mu\text{m}$ 的深穿支（豆纹动脉、丘脑穿通动脉、基底动脉旁中央支等，多为终末动脉，侧枝循环差）
- 高血压性小动脉硬化致管腔狭窄时，继发血栓形成或脱落的栓子阻断血流
- 不规则圆形、卵圆形或狭长型
- 直径**0.2-20mm**，多为**3-4mm**（一般不超过15-20mm）

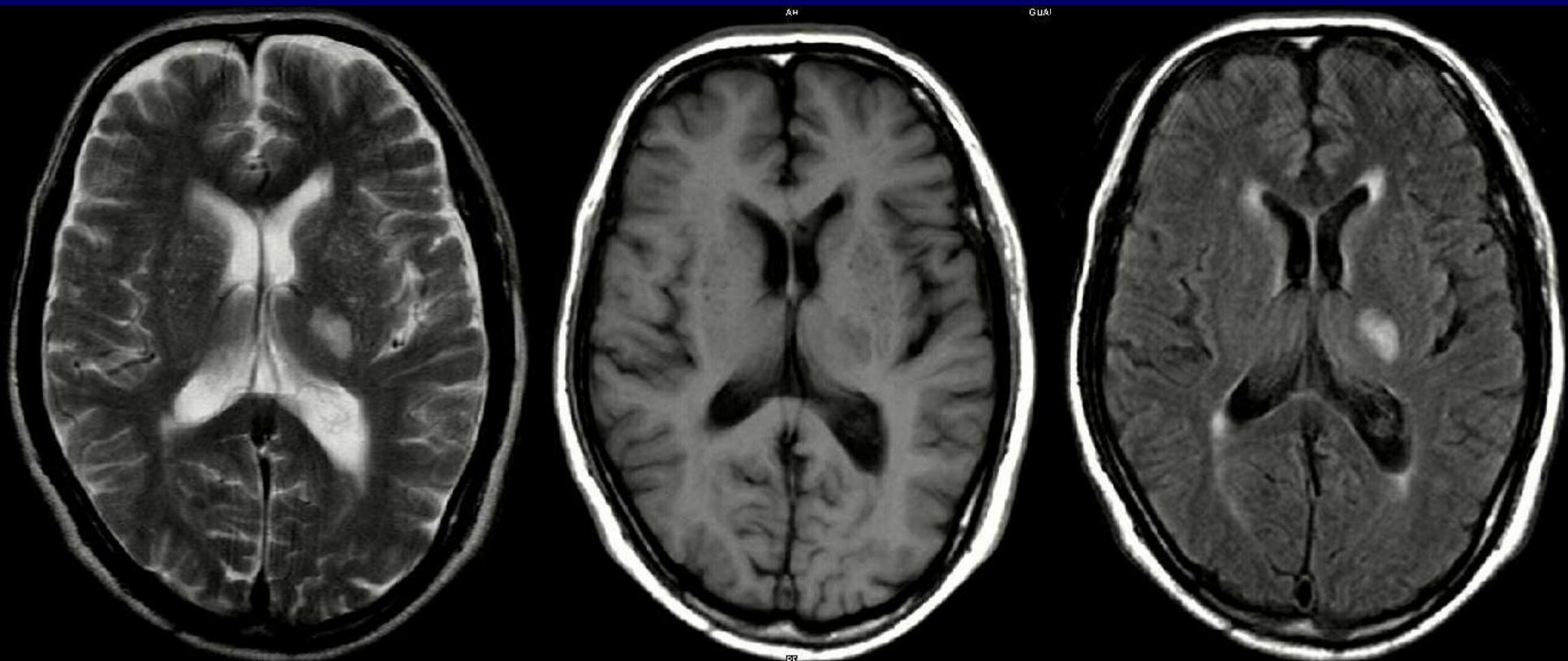


大部分发生于豆纹动脉、Heubner回返动脉、  
穿丘动脉和旁正中动脉支配区

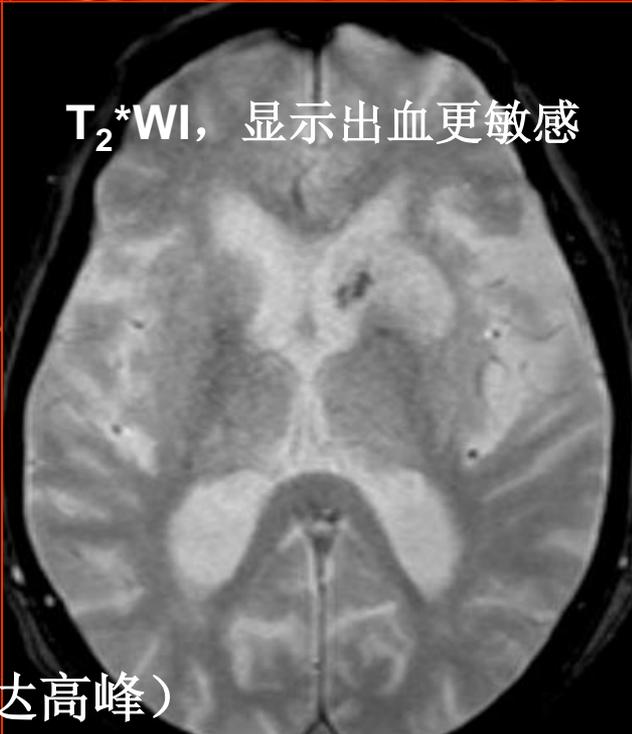
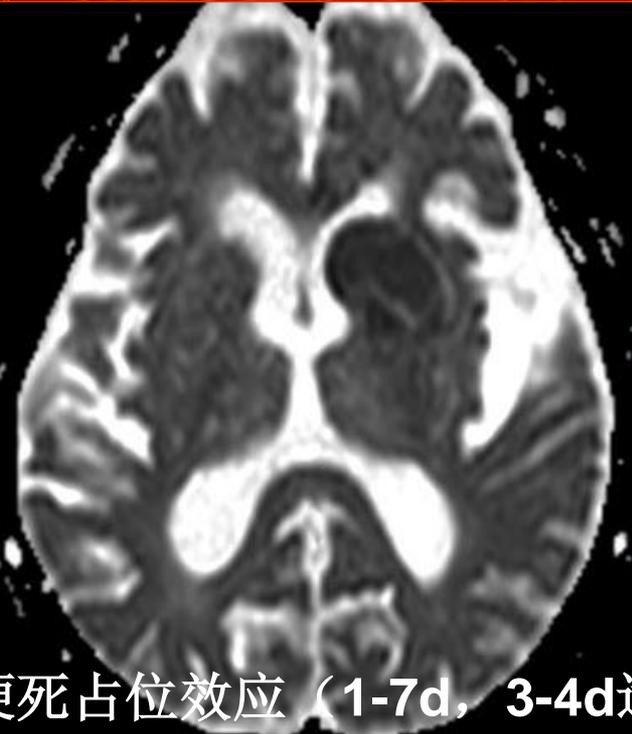
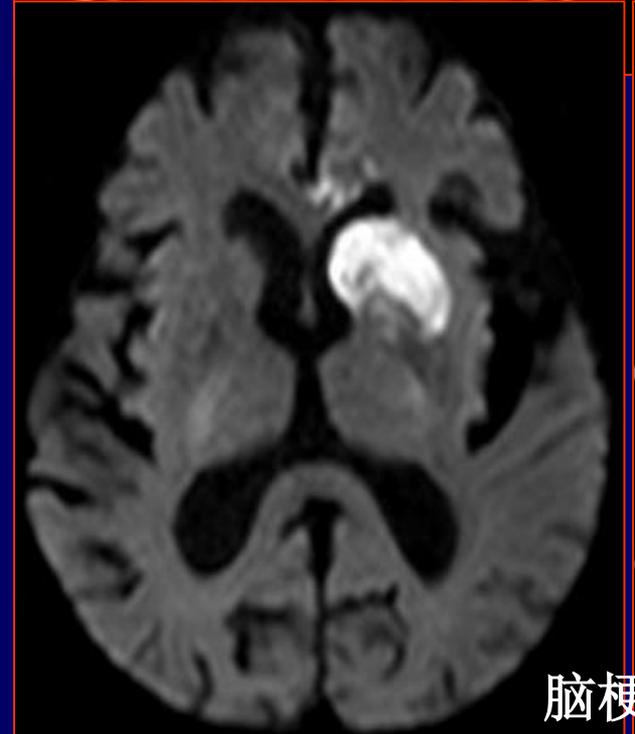
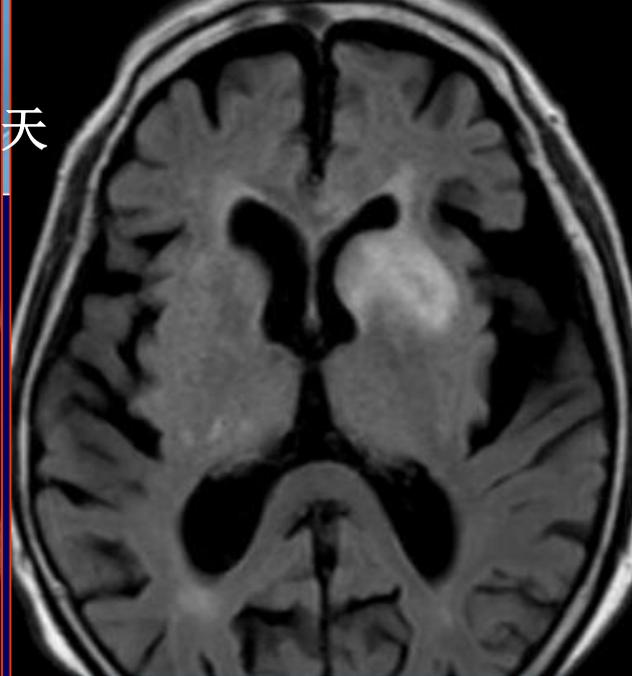
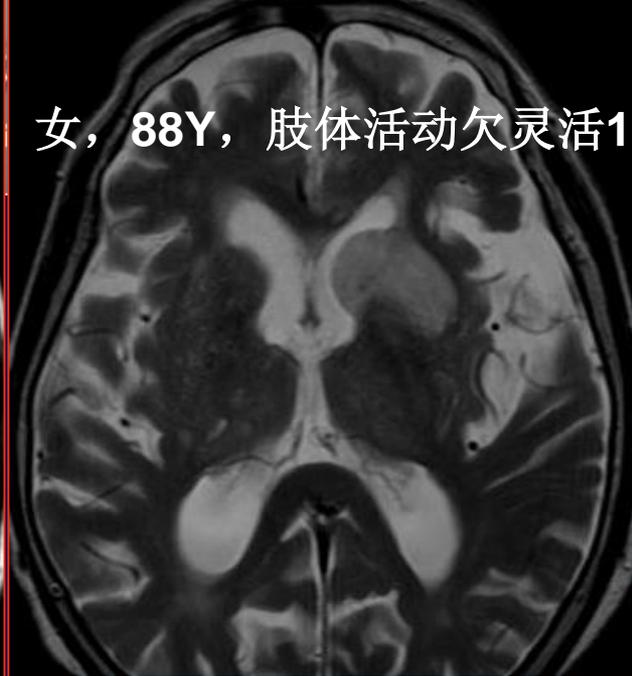
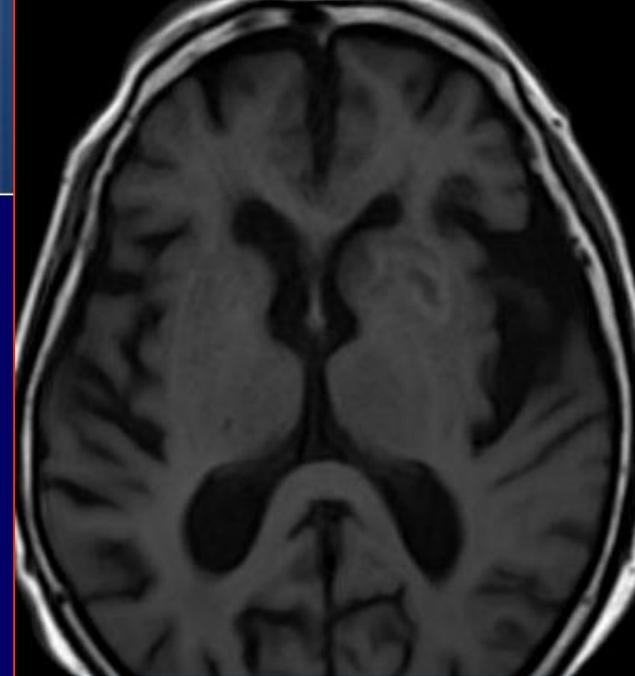




急性、症状性脑梗死（腔隙性）



女, 88Y, 肢体活动欠灵活1天



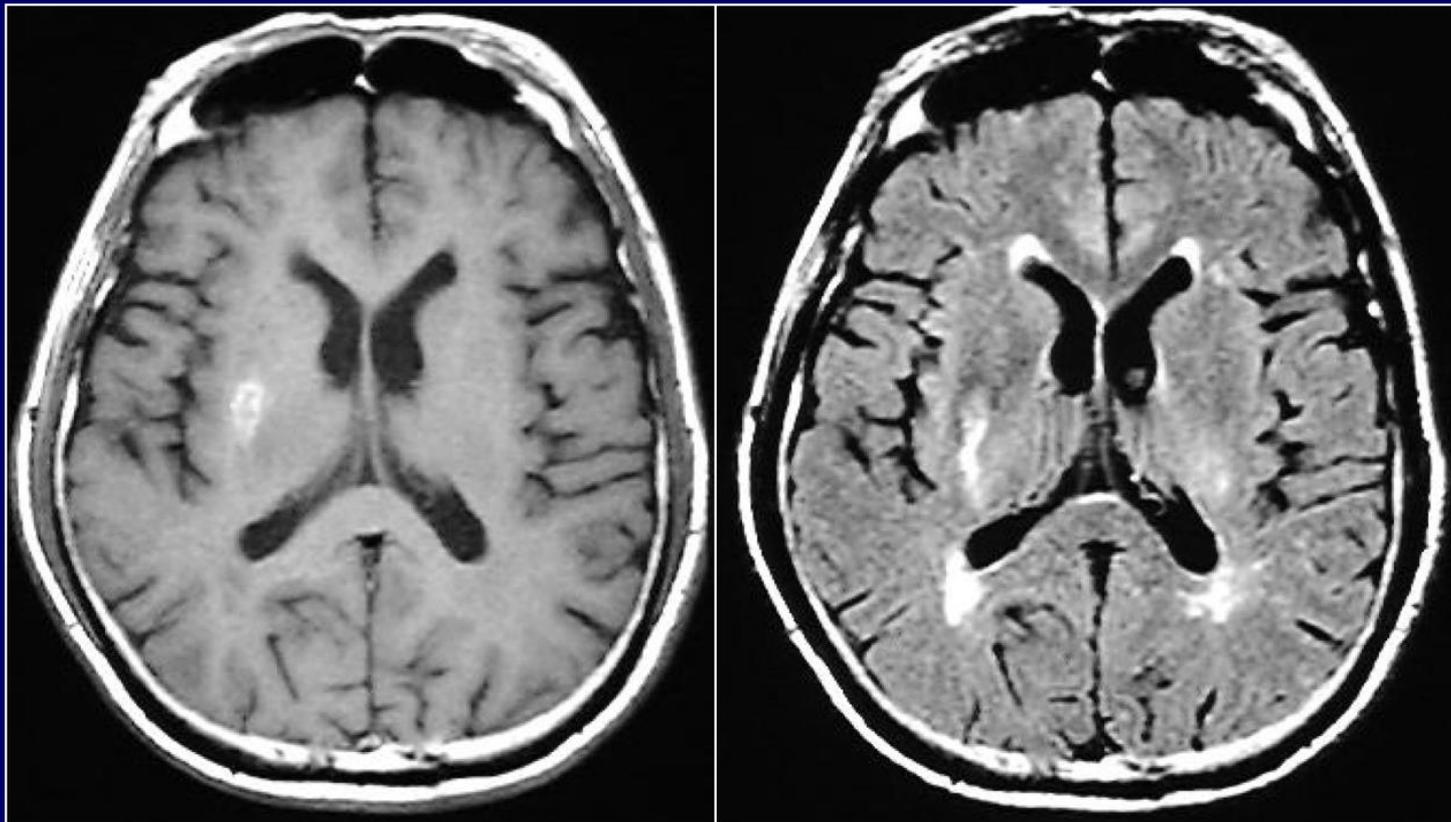
T<sub>2</sub>\*WI, 显示出血更敏感

脑梗死占位效应 (1-7d, 3-4d达高峰)



# 亚急性期腔隙性脑梗死

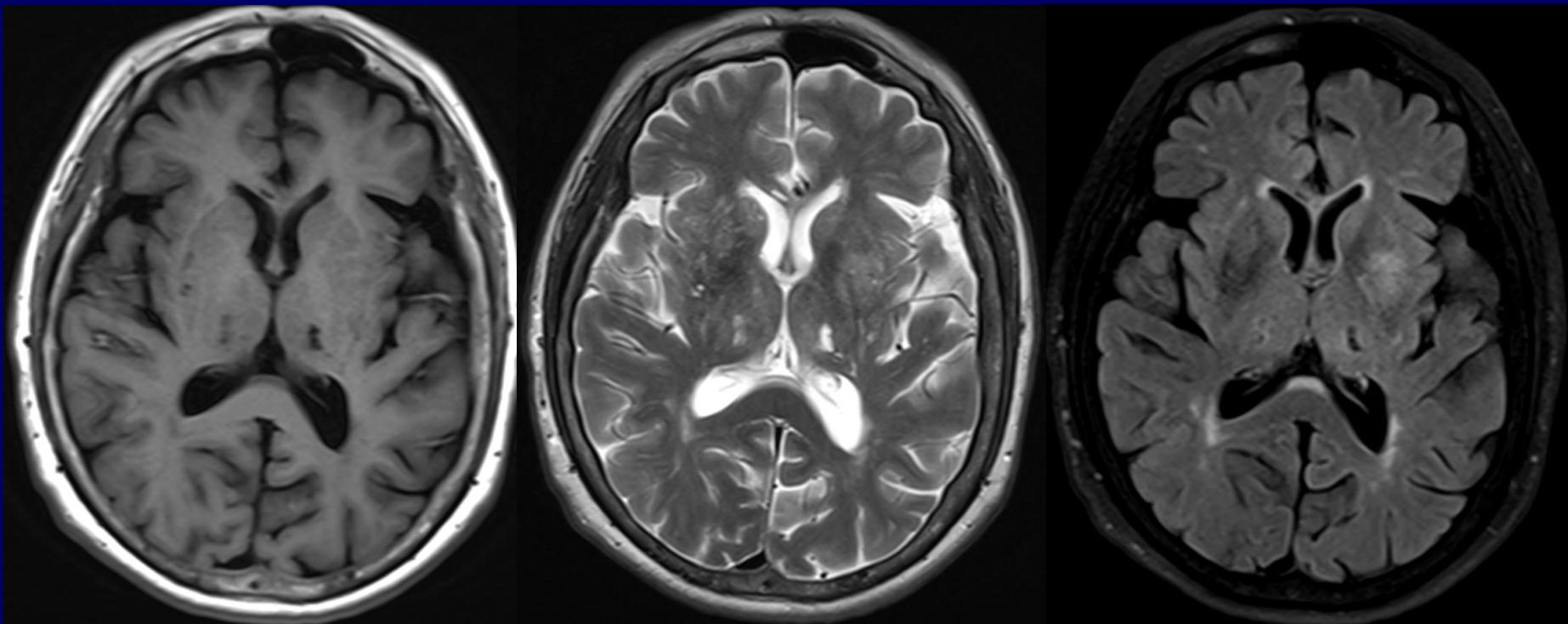
- T1WI周边稍高信号，提示渗血

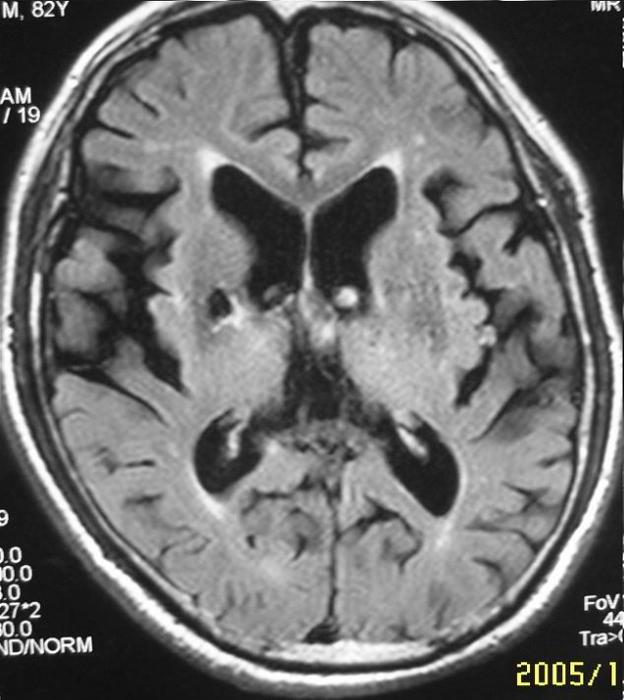
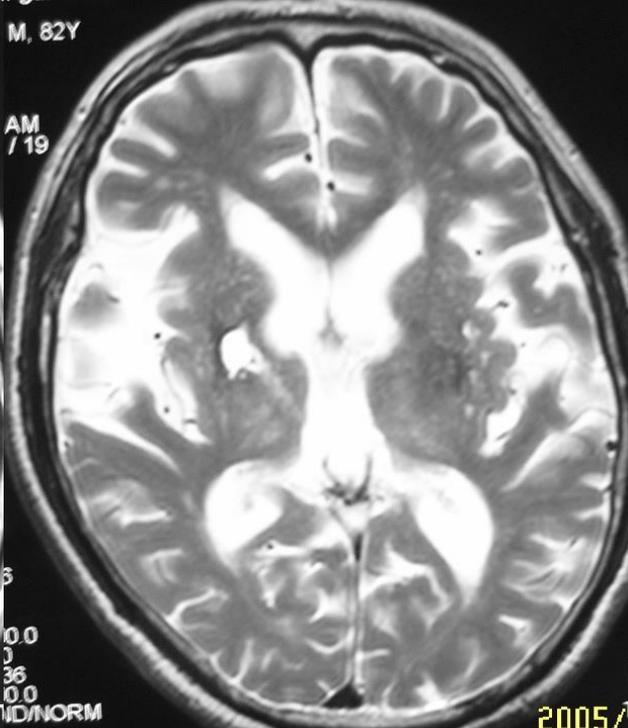
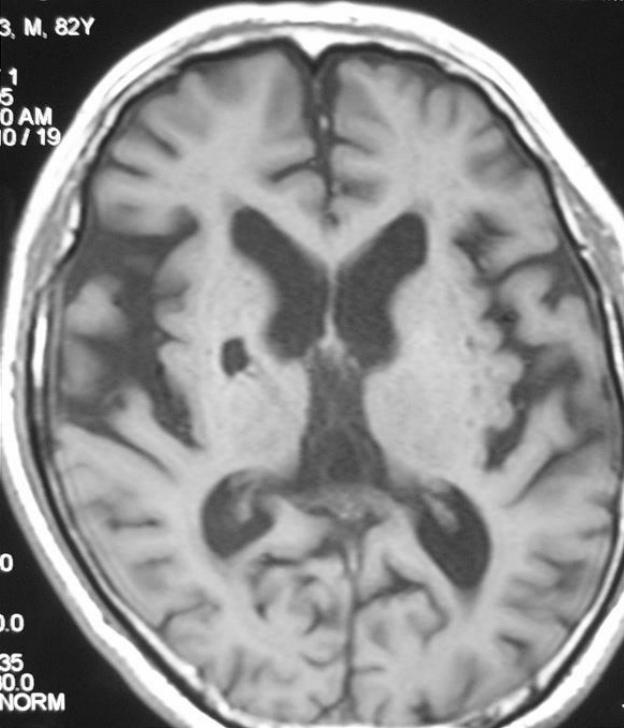




# 腔隙灶

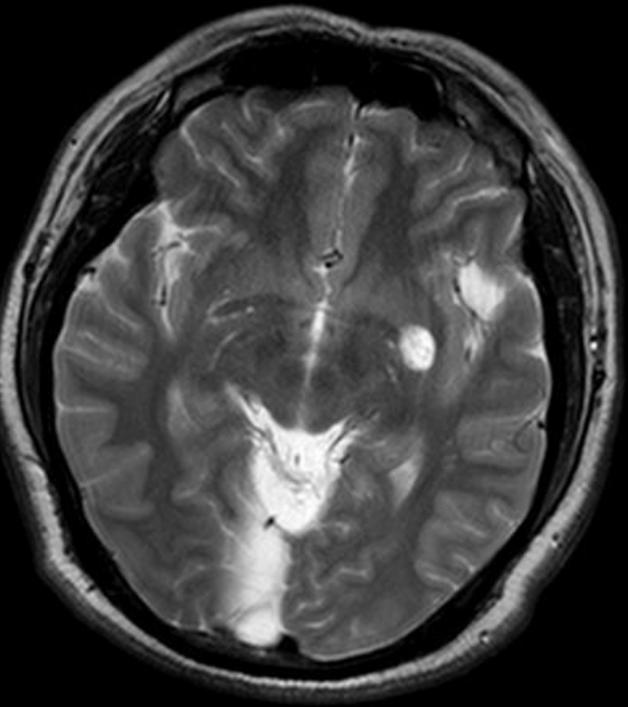
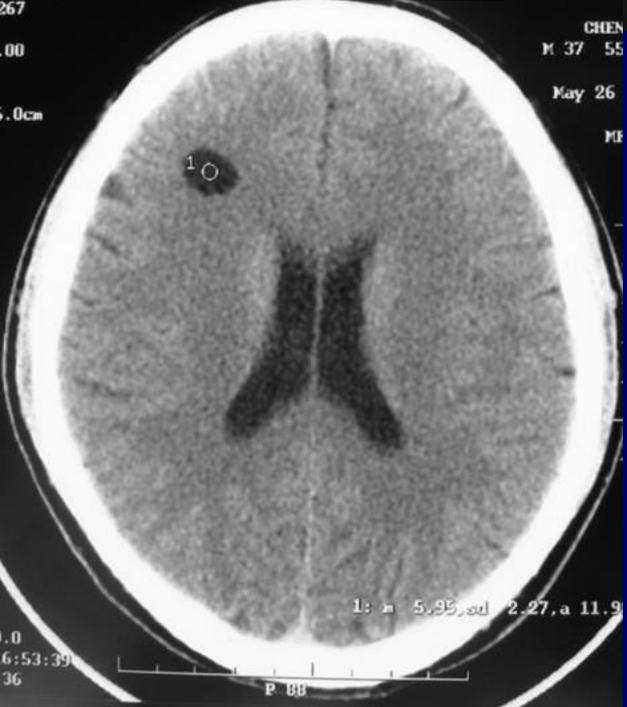
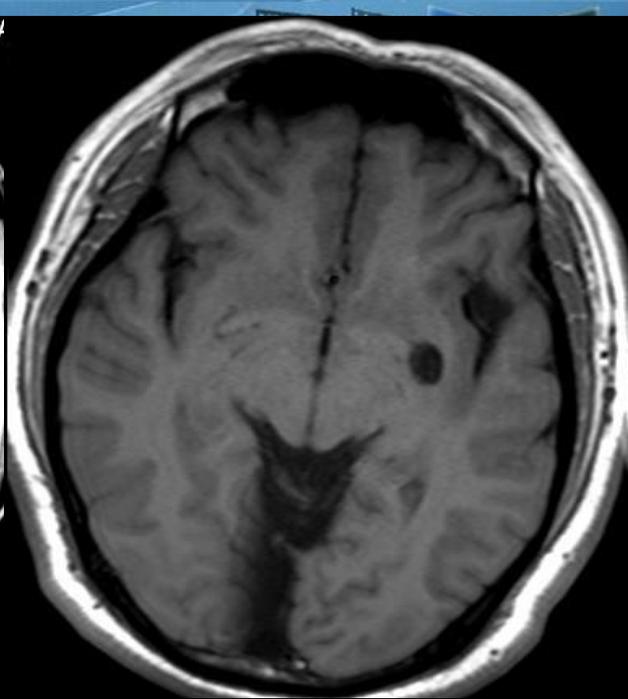
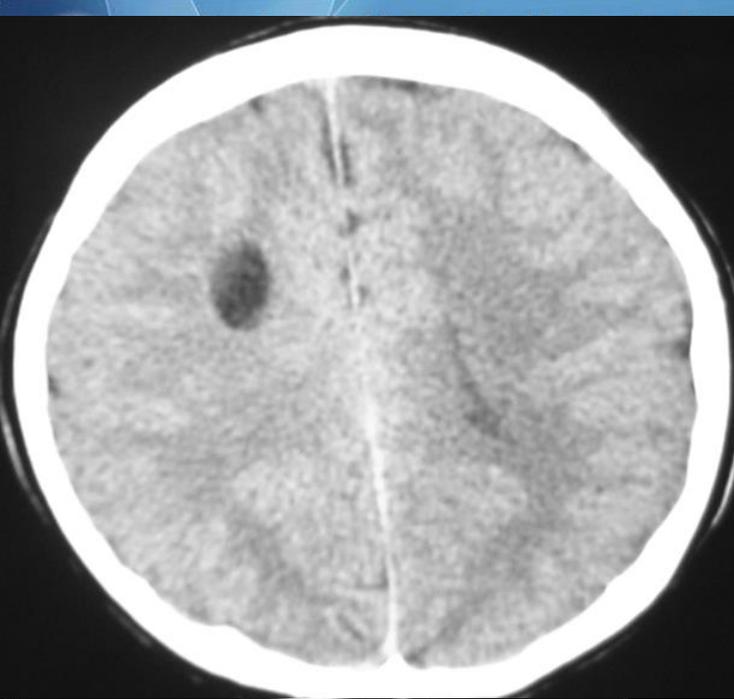
- T1WI无病灶周边稍高信号影





**陈旧腔梗软化灶:**

- 形态不规则
- T1WI、FLAIR示周边环形高信号提示胶质增生  
(出血性软化灶周边可见环形低信号)





**Perivascular space (PVS)**  
**Virchow-Robin space(VRS)**  
**血管周围间隙**  
**V-R间隙**  
**是一种常见的影像学征象**

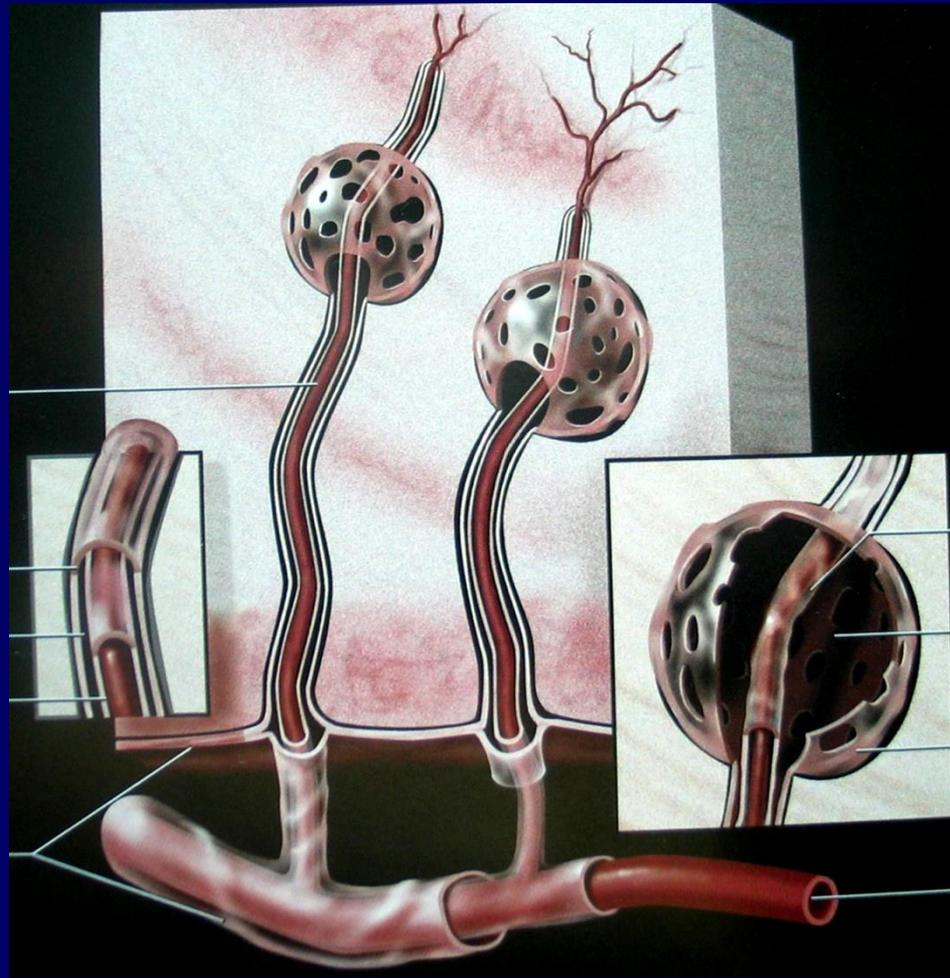


- 1849年Pestalozzi率先进行描述
- 1851年德国病理学家Virchow提出血管周围间隙是邻近毛细血管的动脉外膜下间隙
- 1859年德国解剖学家Robin进一步证实血管周围间隙位于血管外膜内并且是封闭的
- 因此，人们又将血管周围间隙称为Virchow-Robin space，或V-R间隙



# 血管周围间隙

- 脑穿支血管由蛛网膜下腔进入脑实质时，邻近的软脑膜内陷在小血管周围（**不包括毛细血管**）形成的介于两层软脑膜（**并非蛛网膜内陷**）之间或软脑膜与血管外膜之间的间隙（**不一**）
- 血管周围间隙中有小梁与血管相连
- 动、静脉周围皆可周围间隙
- 不直接与SAS相通，**内含组织间液，非CSF**
- 其发生部位一定是在穿支血管进入脑实质处

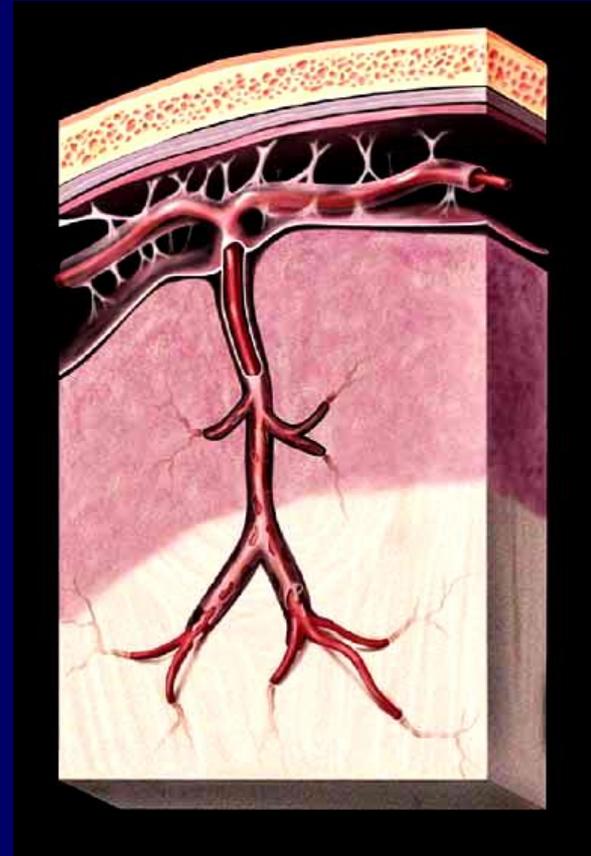


脑底穿支动脉，2层软脑膜之间



# 血管周围间隙

- 软脑膜内陷，包绕小血管
- 潜在的软脑膜下间隙（**软脑膜与血管外膜之间**）
- 软脑膜逐渐薄弱、有筛孔
- 于毛细血管处软脑膜消失  
**(毛细血管水平无血管周围间隙)**

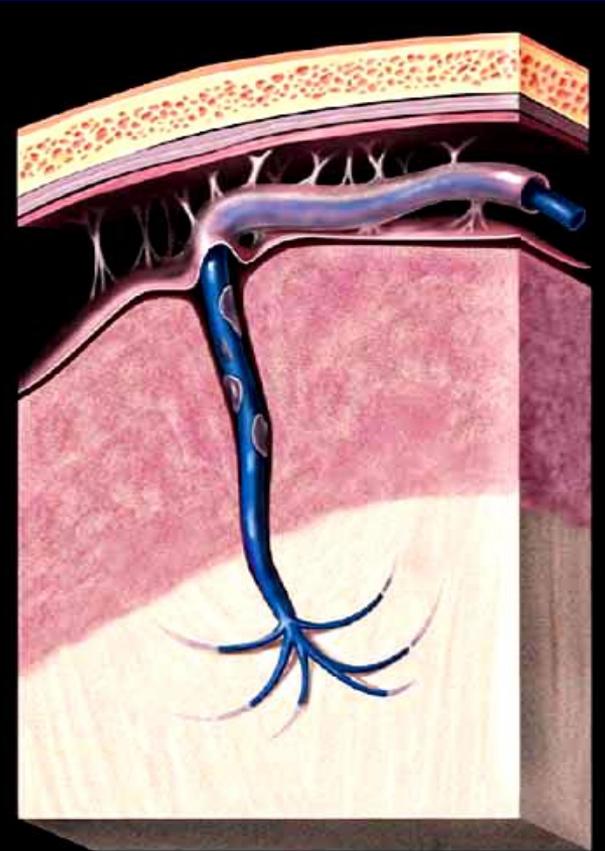


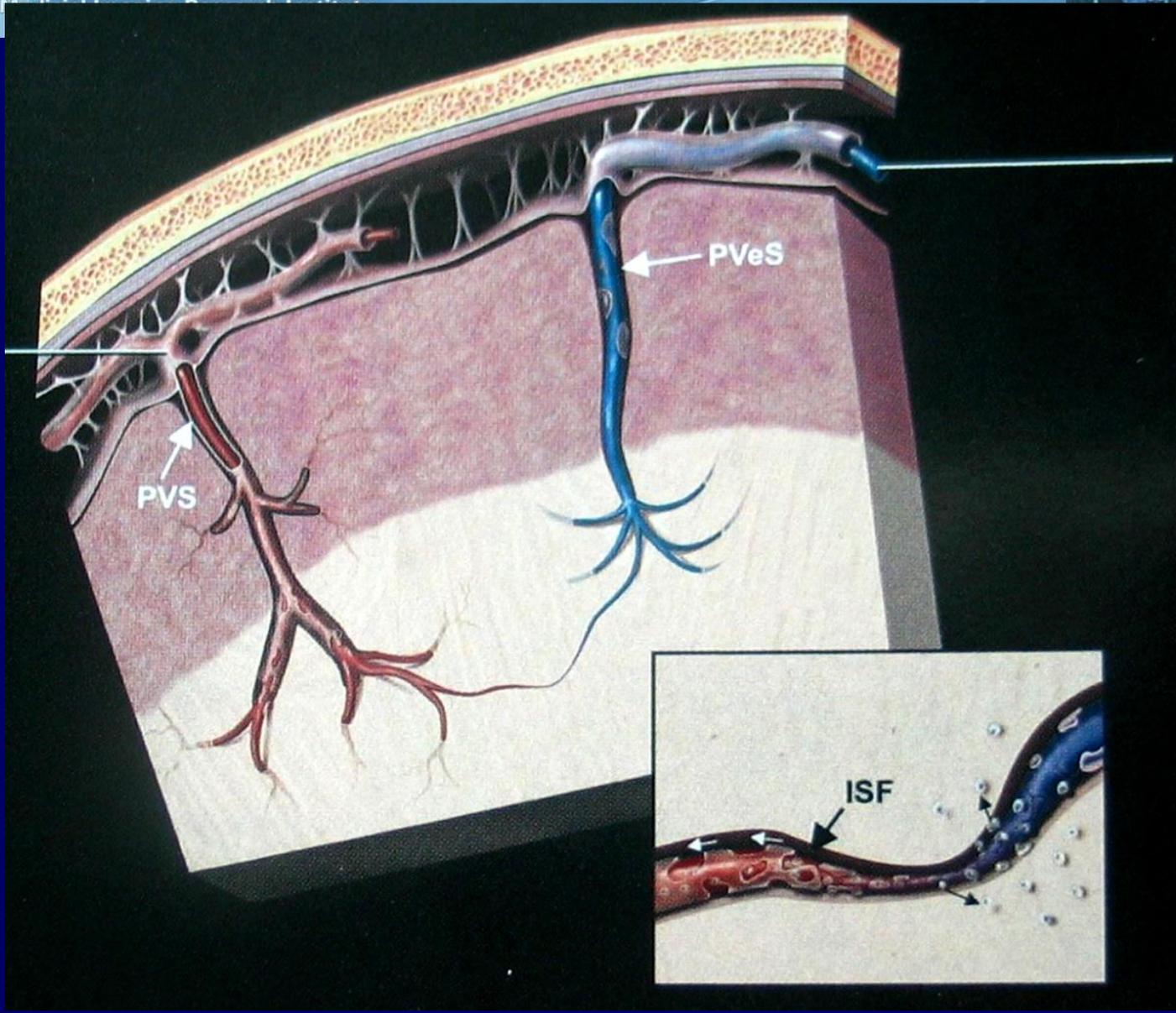
大脑凸面



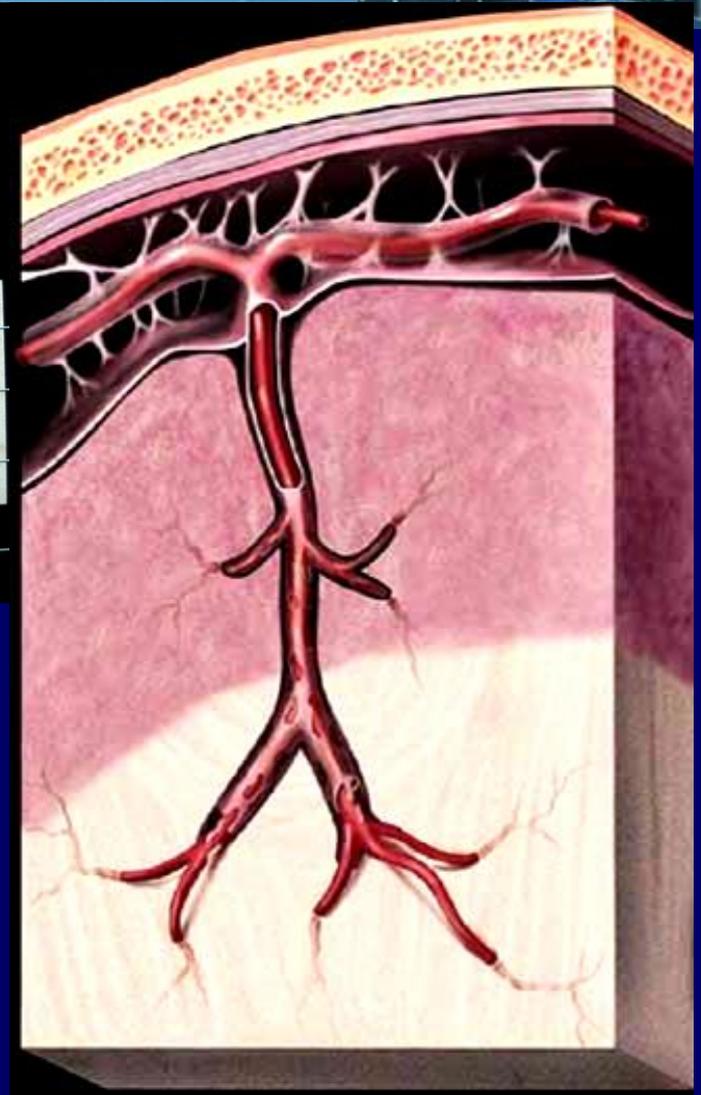
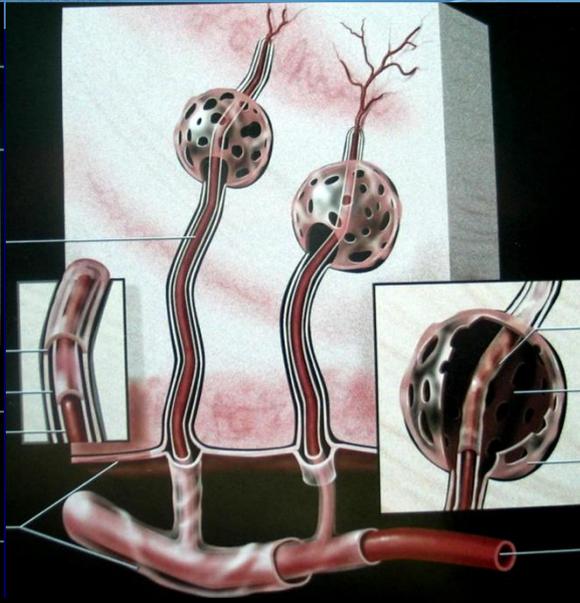
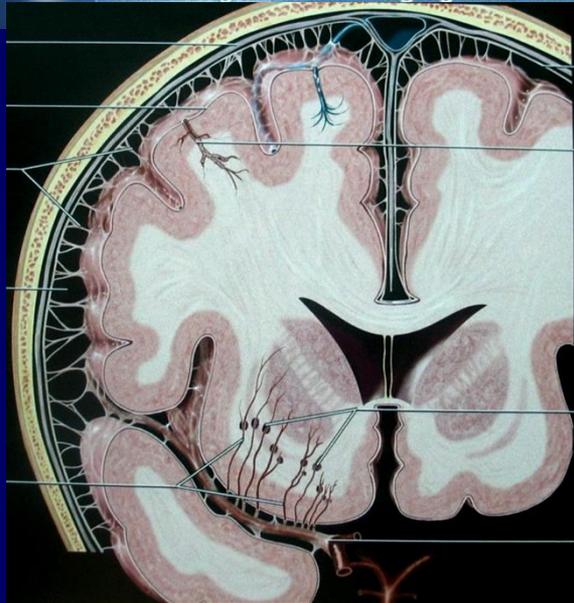
# 静脉周围也有静脉周围间隙 (perivenous space, PVeS)

- 静脉周围软脑膜薄弱、有筛孔
- 淋巴细胞、单核细胞透过毛细血管静脉端管壁进入到 PVeSs

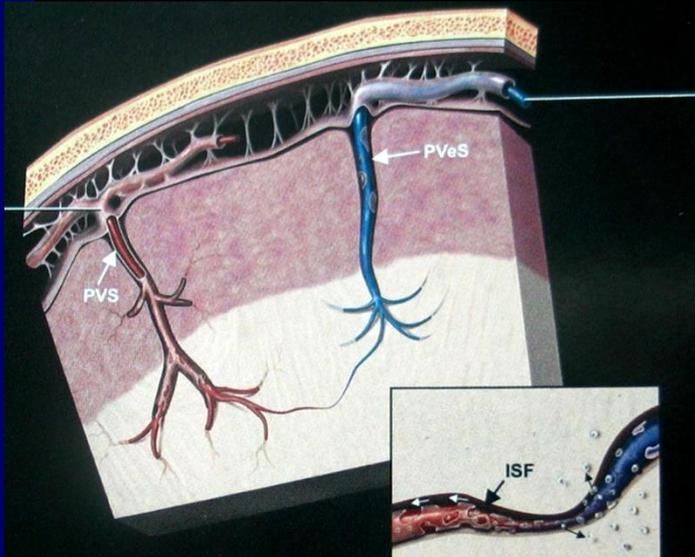




毛细血管水平无血管周围间隙



脑底穿支动脉，2层软脑膜之间



毛细血管水平无血管周围间隙

大脑凸面：软脑膜与血管外膜之间



## V-R间隙常见位置:

- 前连合附近
- 大脑凸面皮层下半卵圆中心
- 脑干（大脑脚）
- 极外囊
- 小脑、丘脑（相对少见）

**血管周围间隙一般不存在于皮质内**

由于血管周围间隙是穿支动脉自蛛网膜下腔进入脑实质引起软脑膜内陷造成的，所以其发生部位一定是在穿支血管进入脑实质处



# 血管周围间隙

- 最好发部位
  - 基底节下1/3，前联合周围
- 常见部位
  - 中脑（黑质周围）
  - 深部白质
  - 岛叶皮层下、最外囊
- 次常见部位
  - 丘脑
  - 齿状核
  - 胼胝体、扣带回
- 不累及皮层



# CT、MRI表现

- **形态规则**：圆形、卵圆形、线状、斑点状、斑片状
- **边界清晰、光滑、锐利**，周边无胶质增生
- 无占位效应（绝大多数）
- 与 CSF 等密度/信号（CT低密度，T1WI低信号，T2WI高信号）
- T2-FLAIR 低信号, DWI弥散不受限！！
- 强化扫描偶可见间隙内血管强化

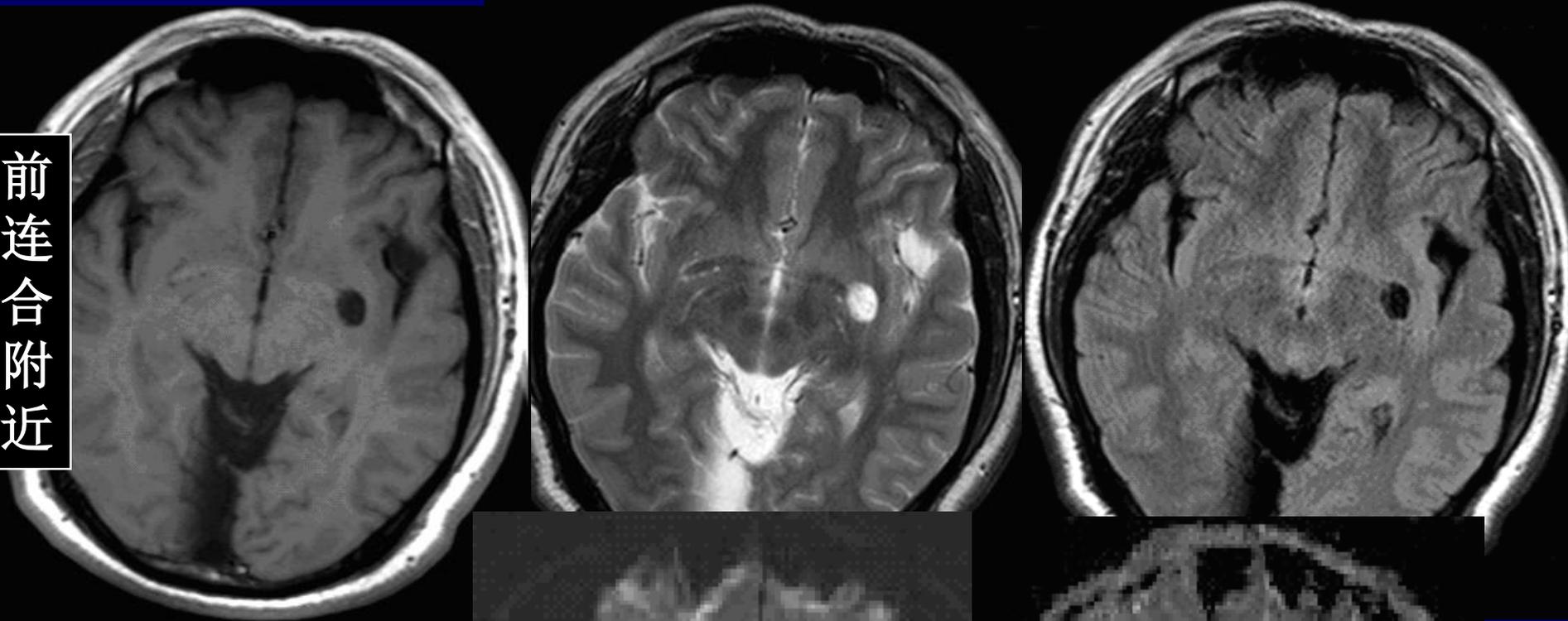


# 要点

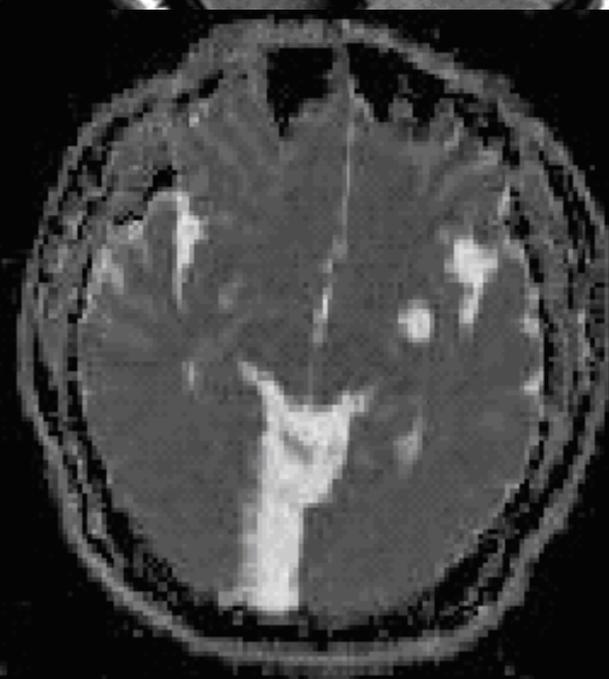
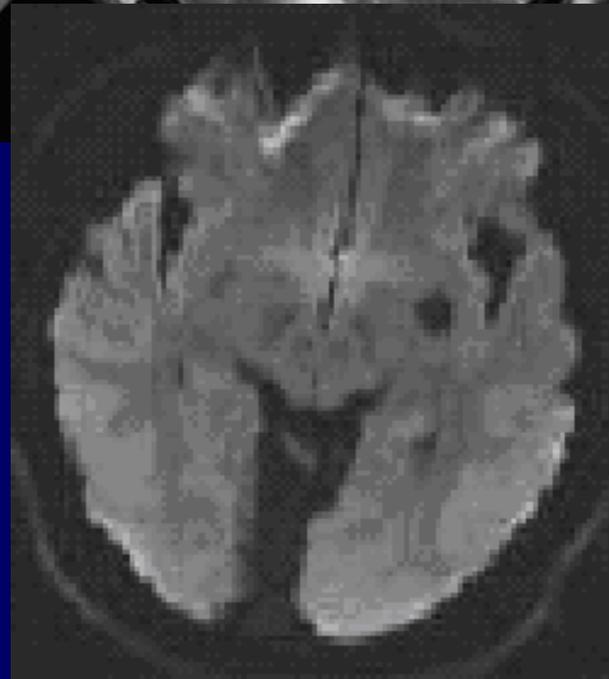
- 特殊位置、**密度/信号**、形态、边界
- 绝大多数情况下无占位效应
- 无胶质增生
- 走行方向（纤维）
- **一般无症状，但可为疾病蔓延途径**



前连合附近

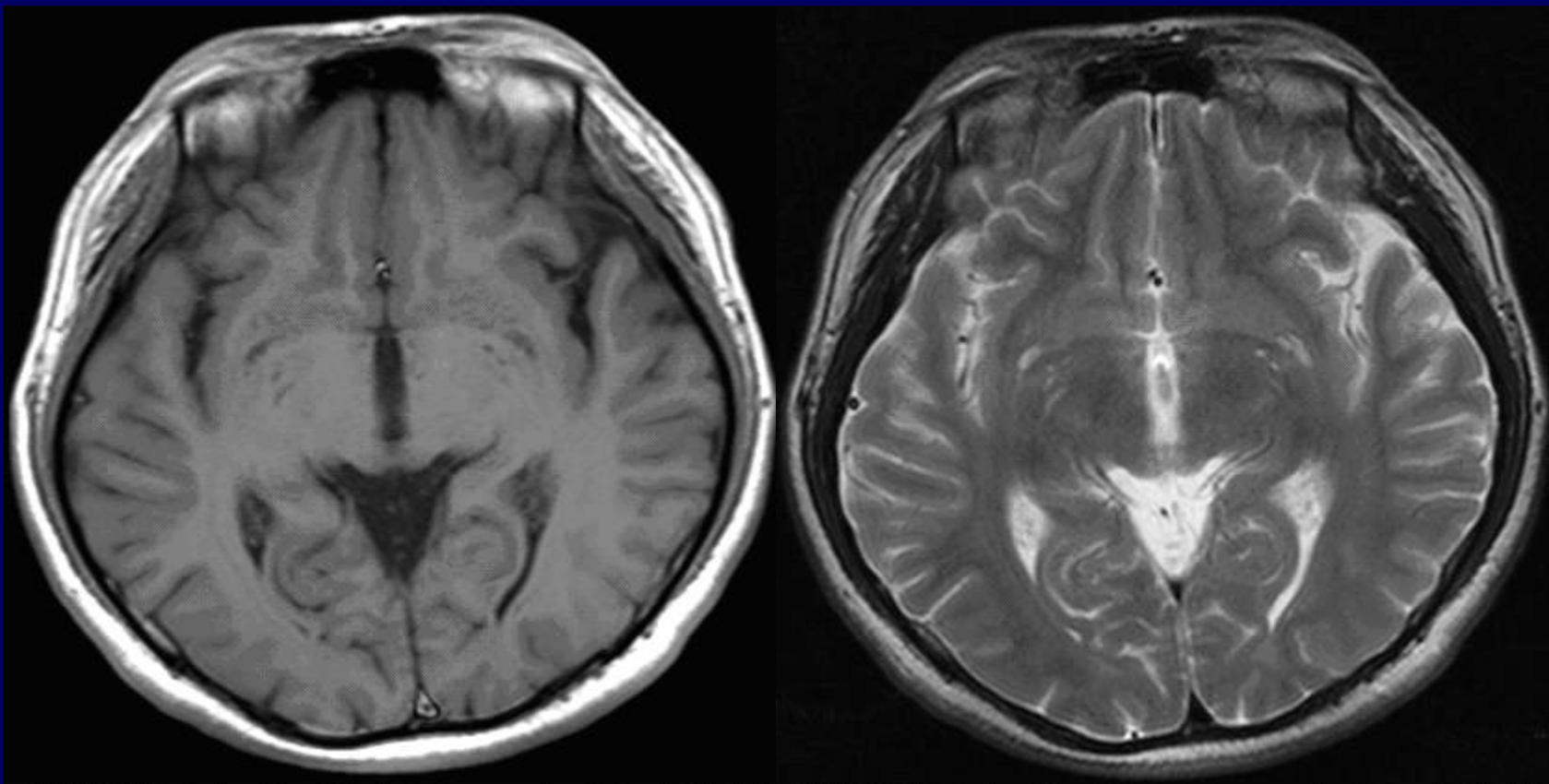


形态规则  
边界清晰、光滑、锐利  
无占位效应  
无胶质增生  
任何序列皆与CSF等信号



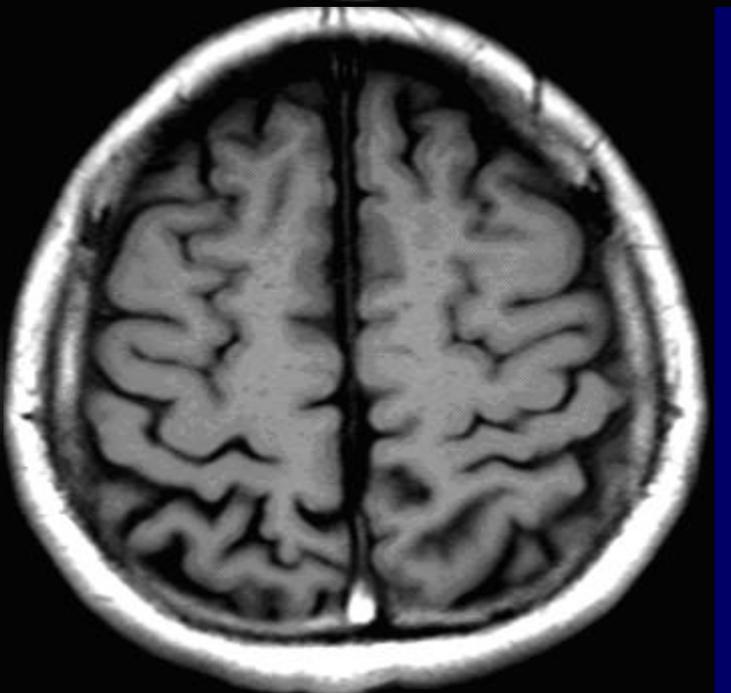
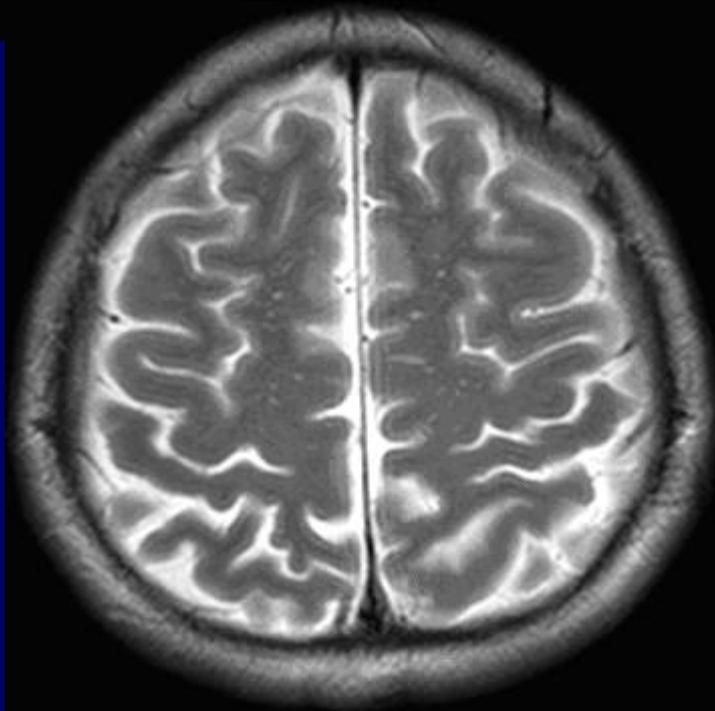
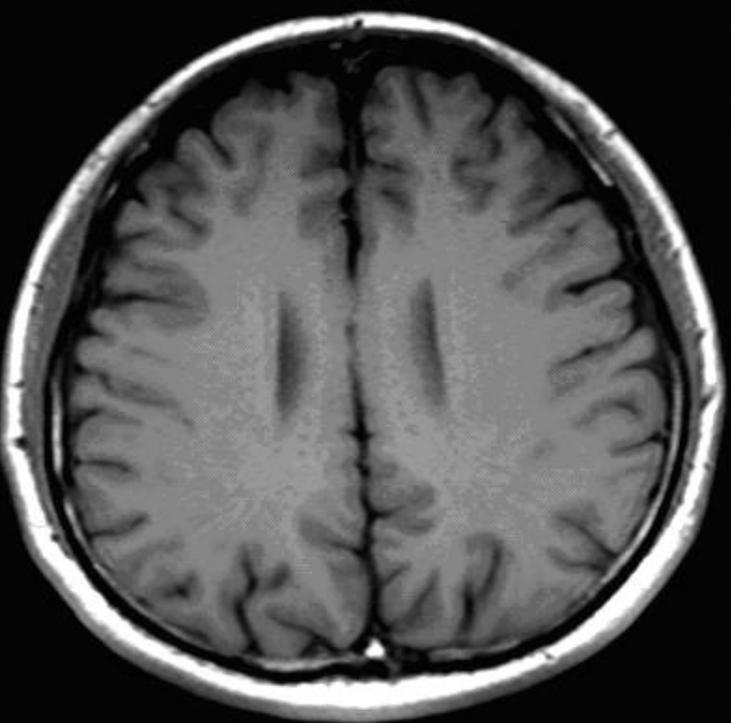
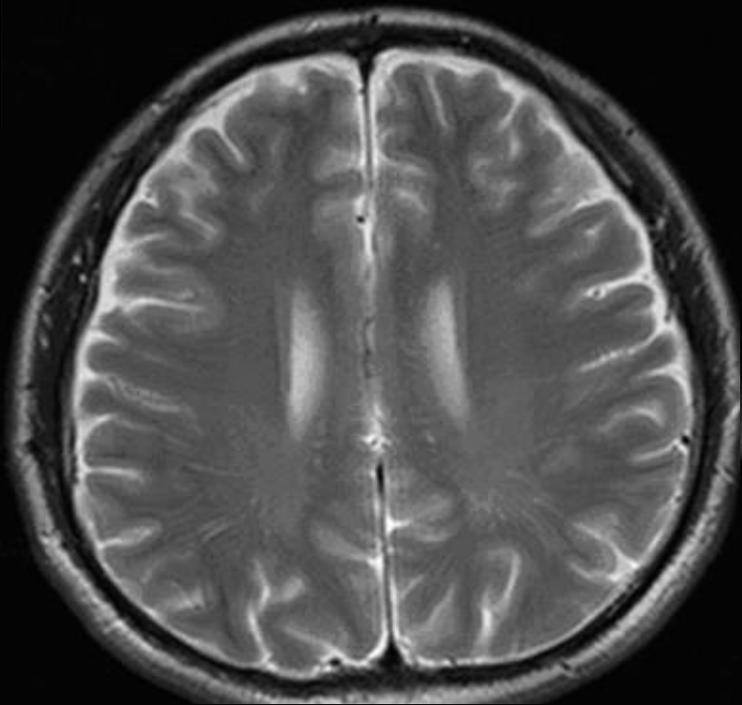
无弥散受限

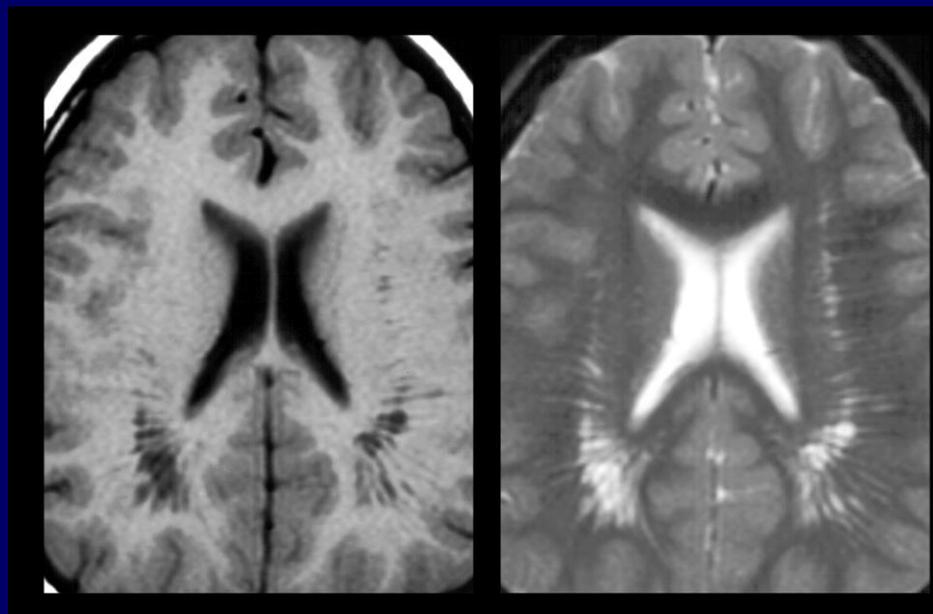


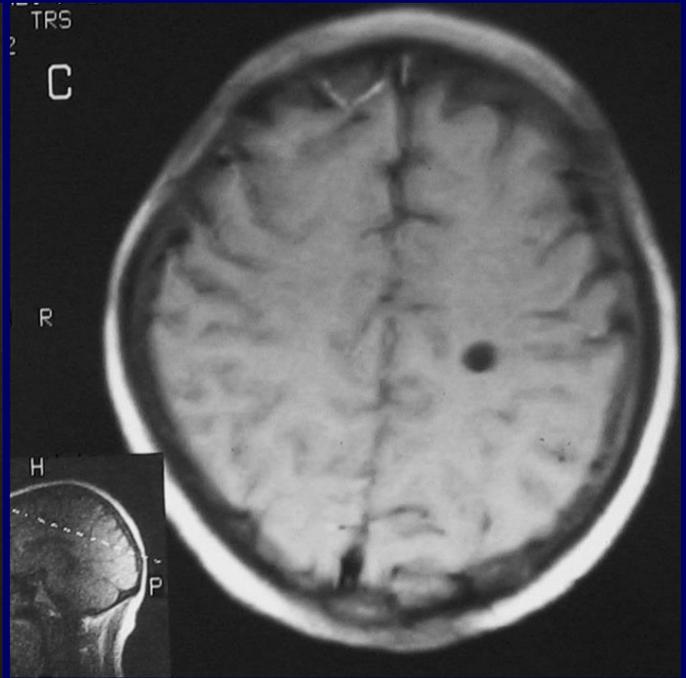
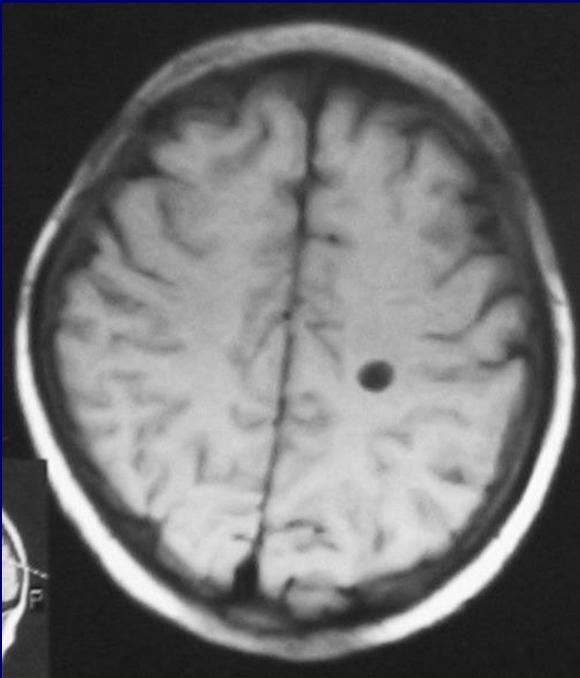
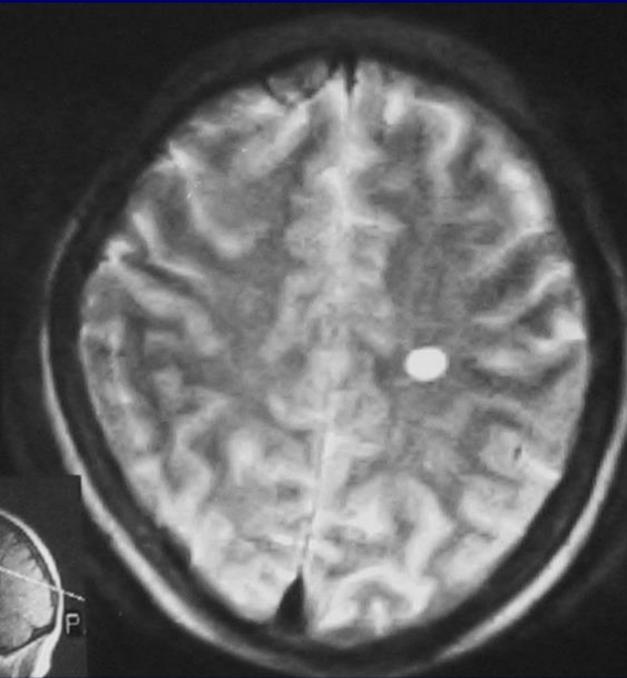
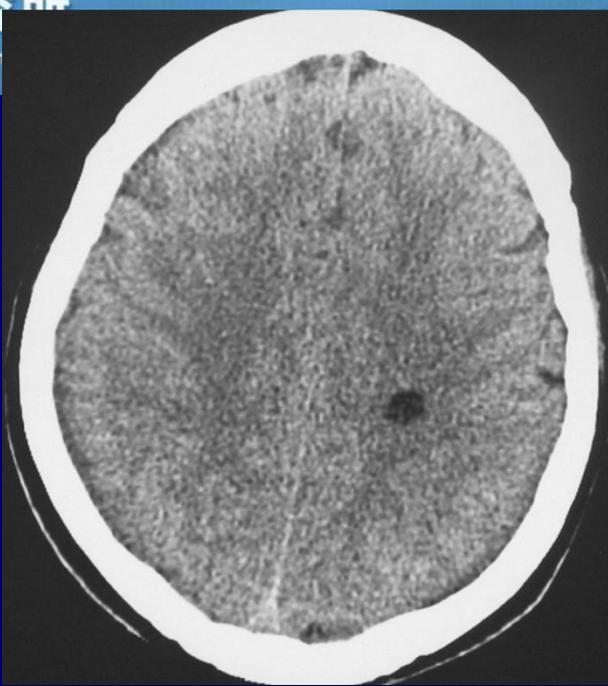


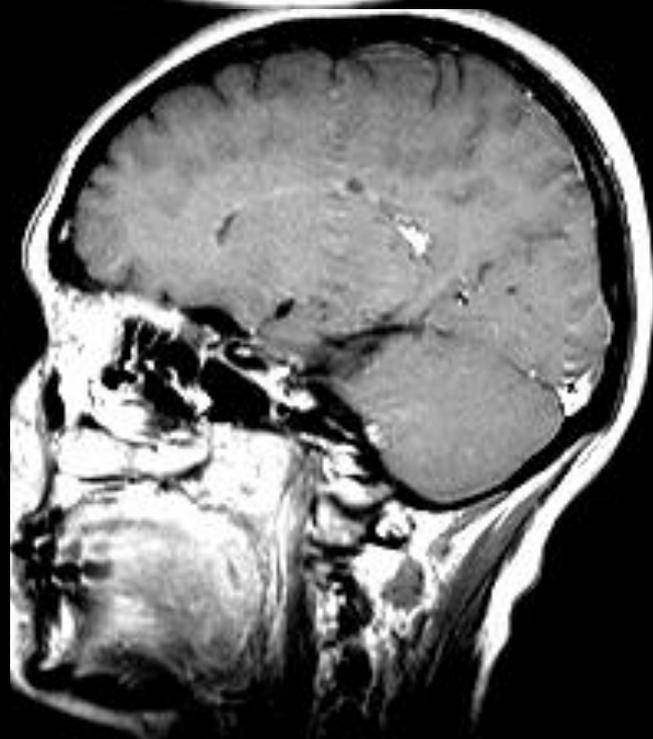
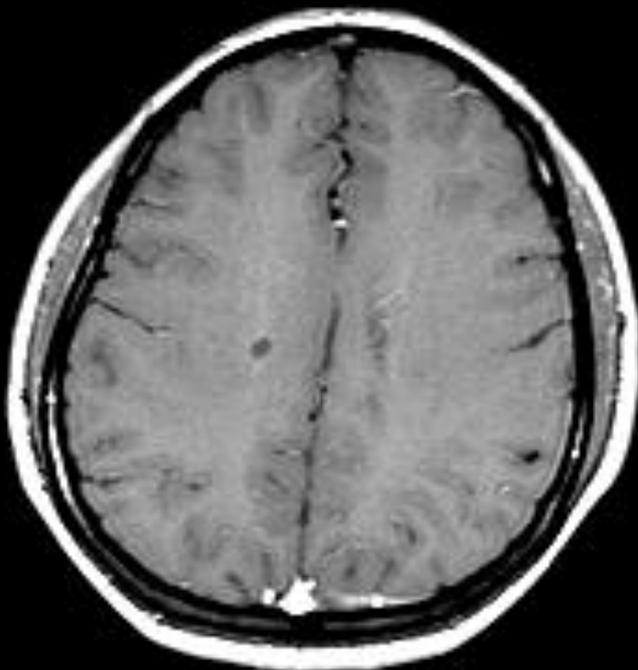
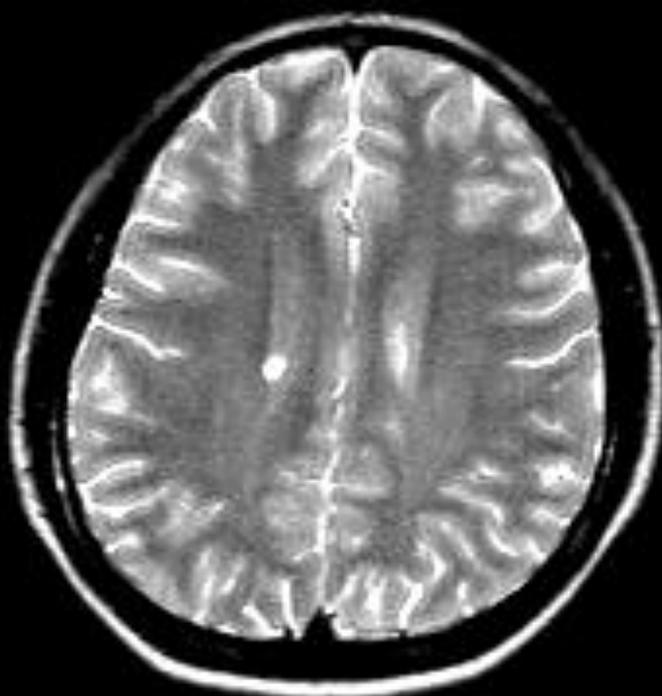
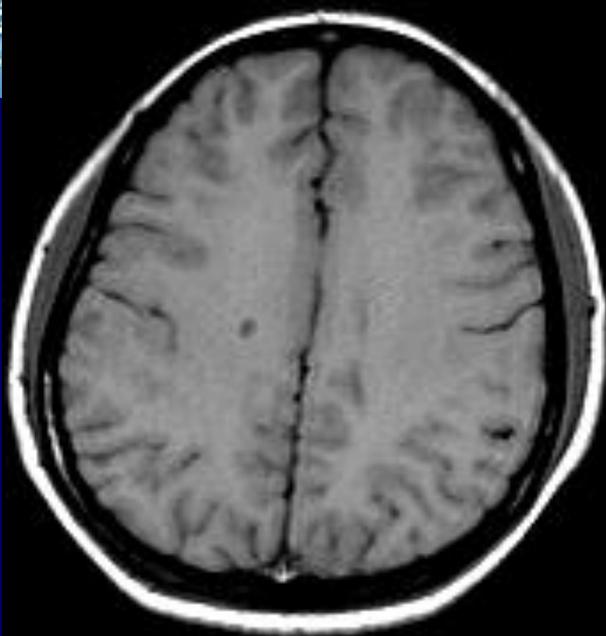


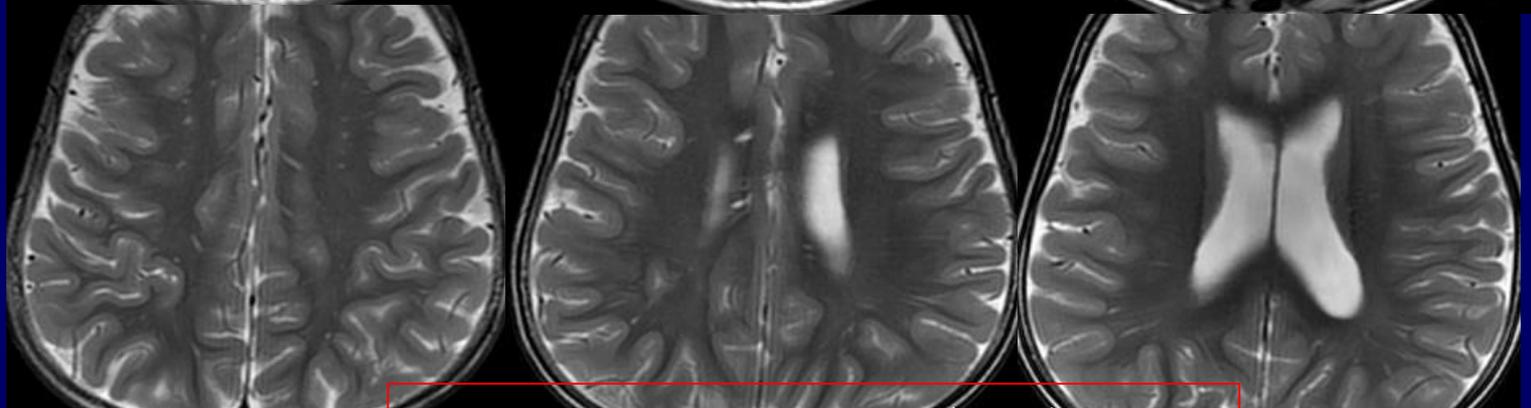
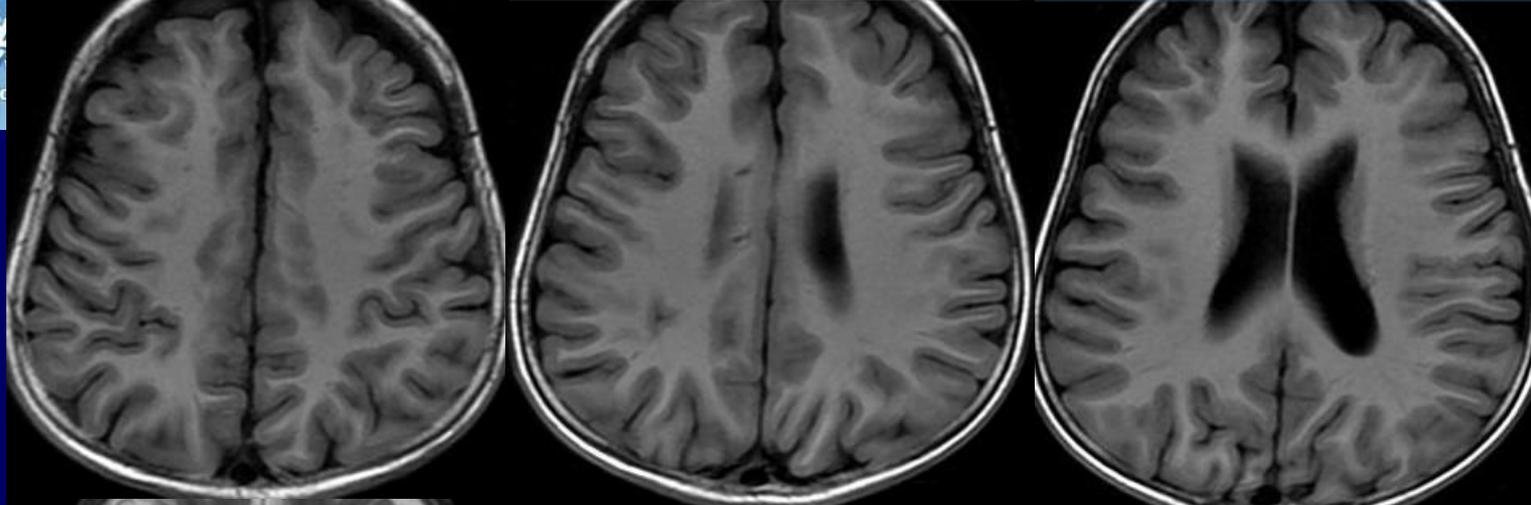
大脑凸面皮层下半卵圆中心



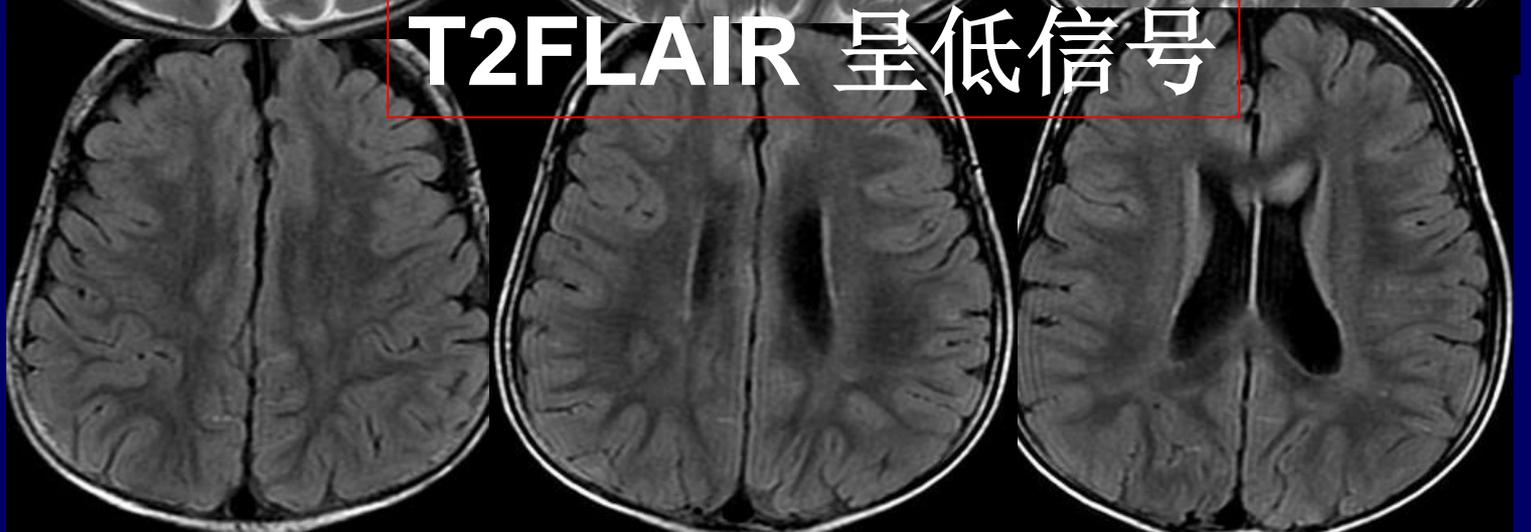




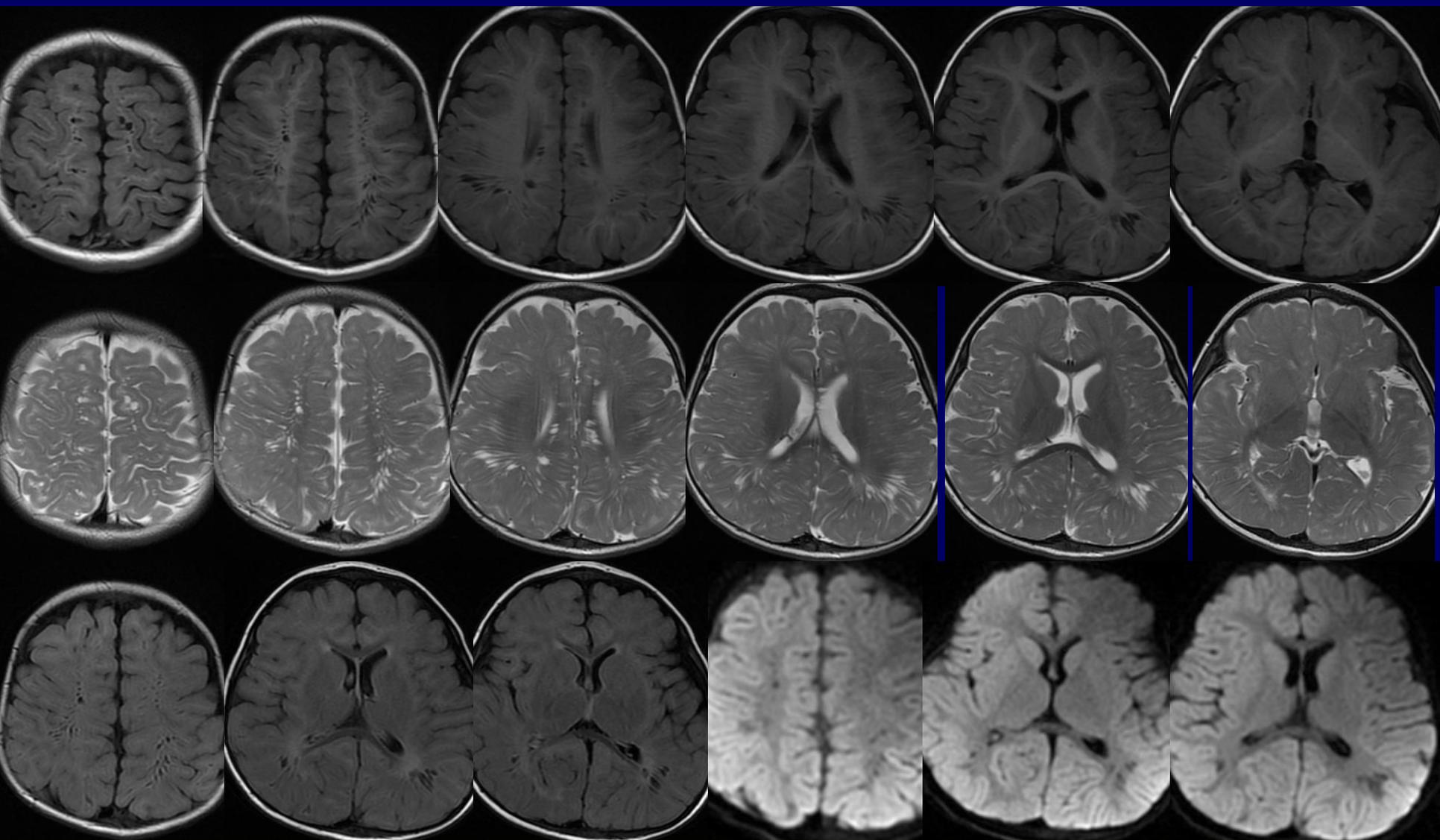




T2FLAIR 呈低信号



# 深部白质，FLAIR、DWI低信号



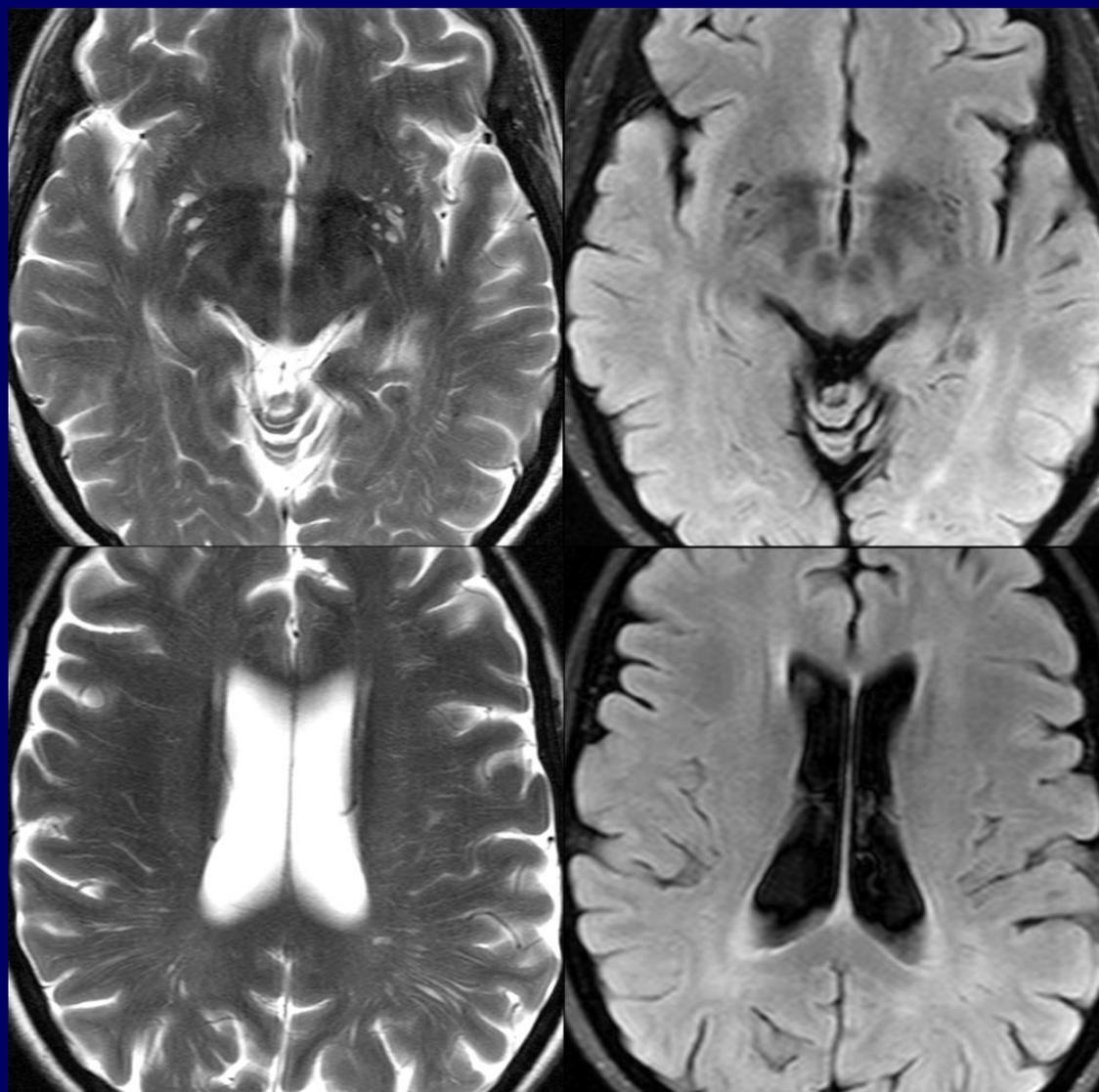
•与年龄无明显相关性



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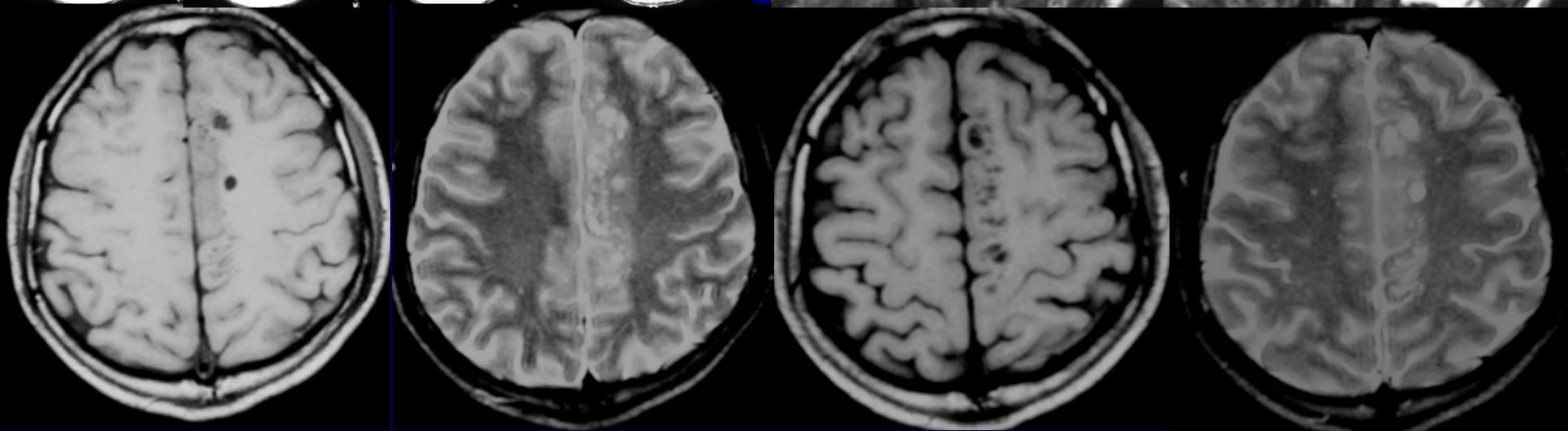
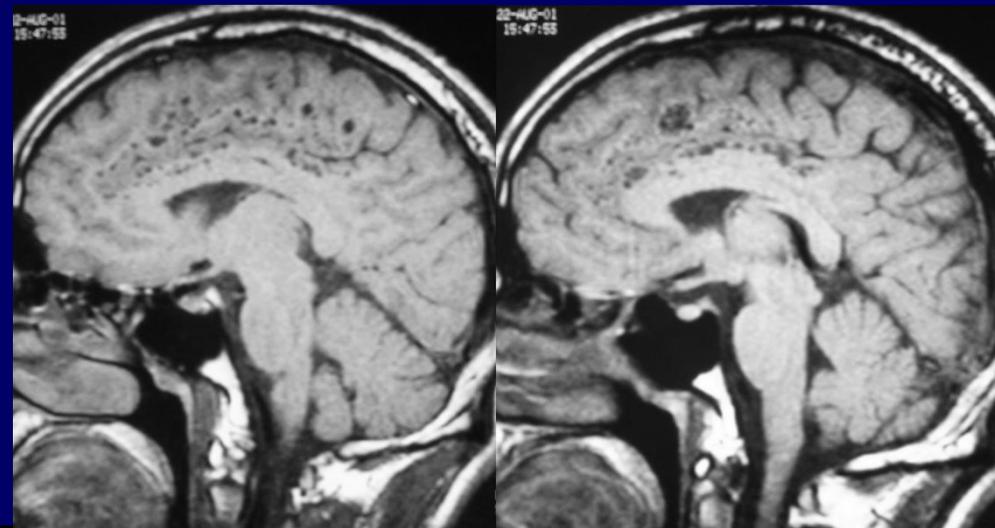
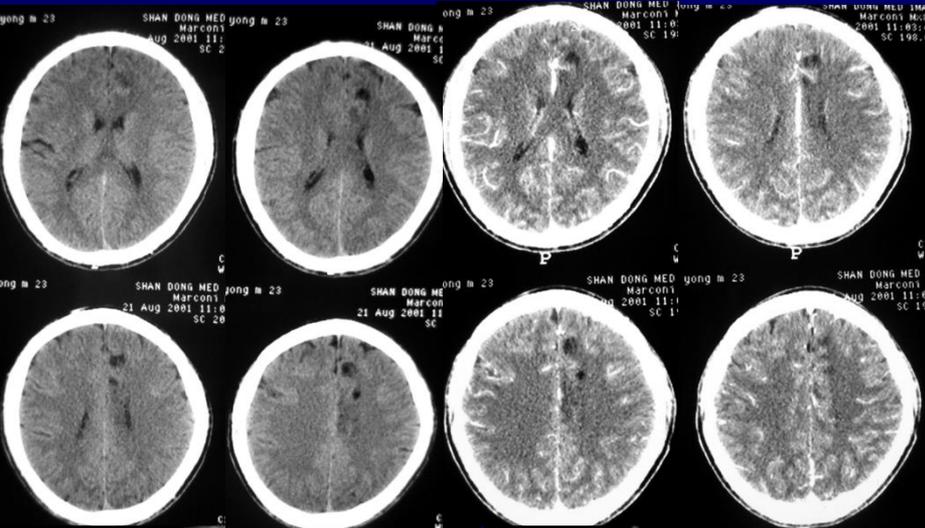
Shandong Medical University

# T2FLAIR 呈低信号



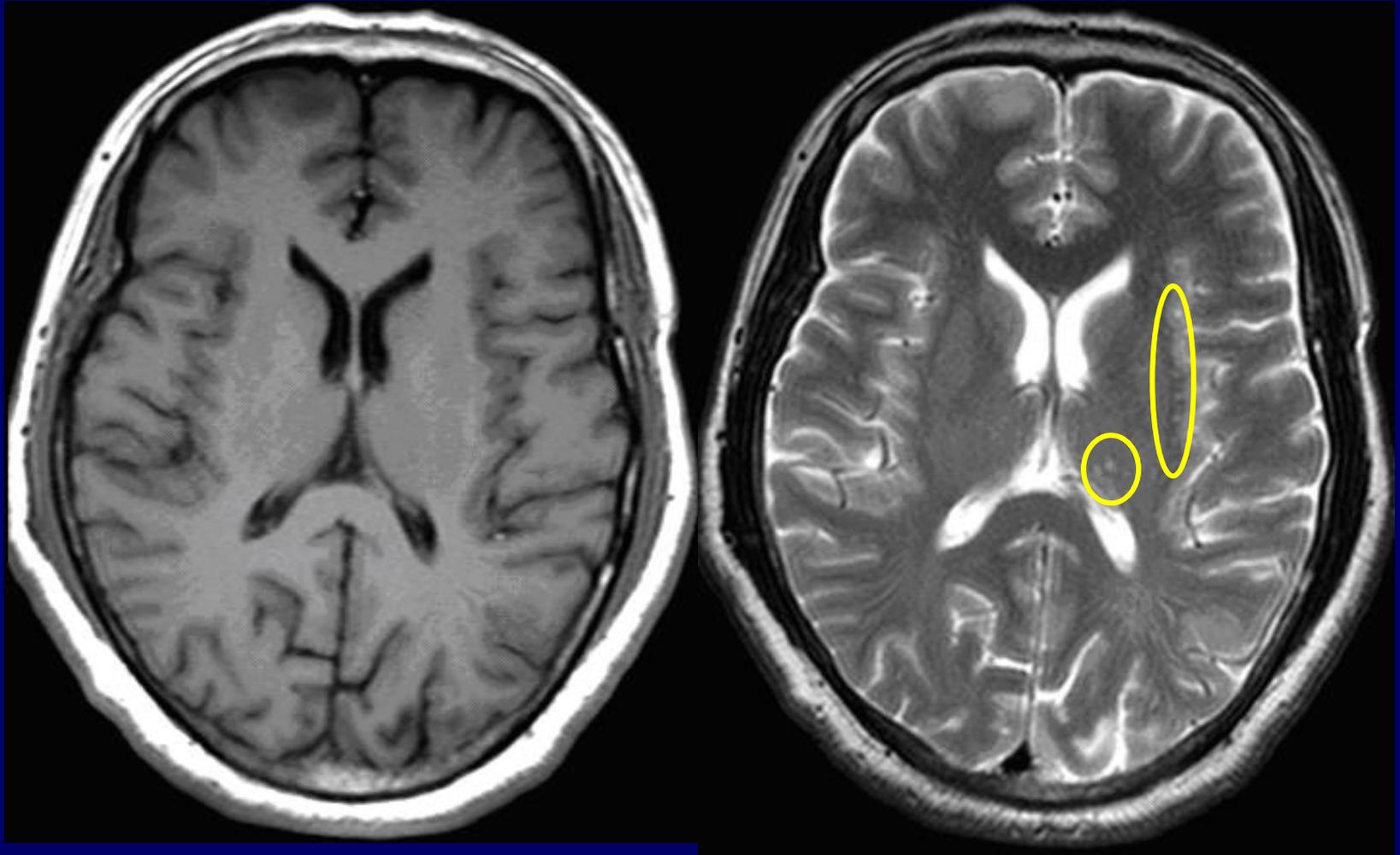
T2WI

Fat-suppressed FLAIR



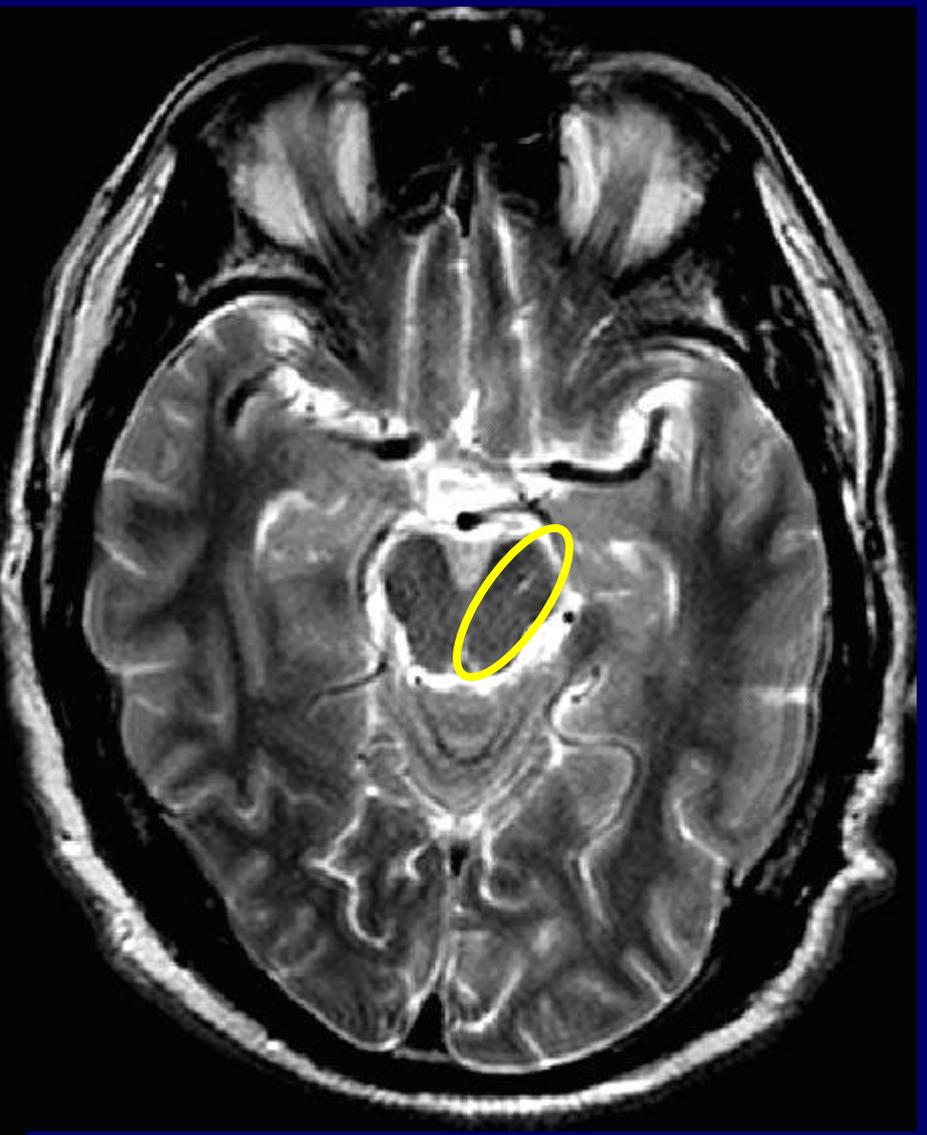
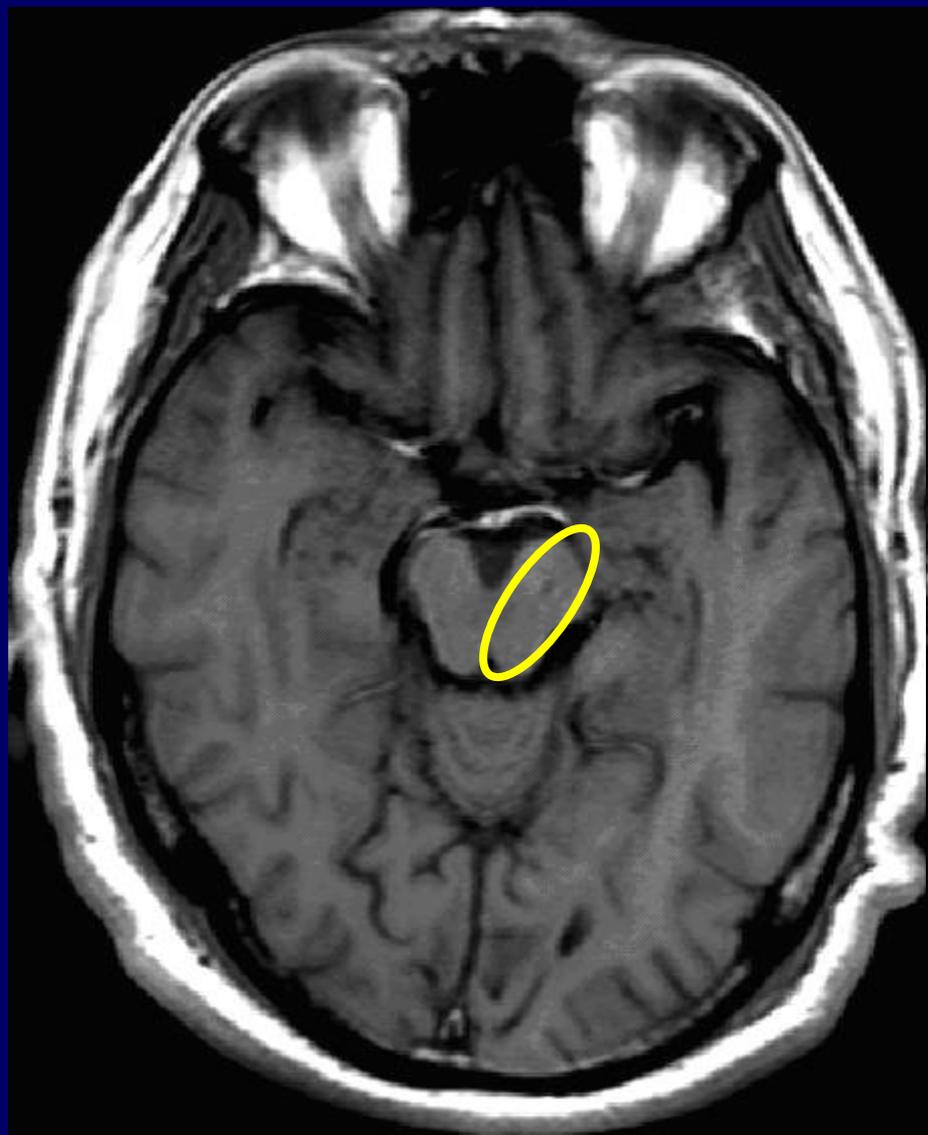


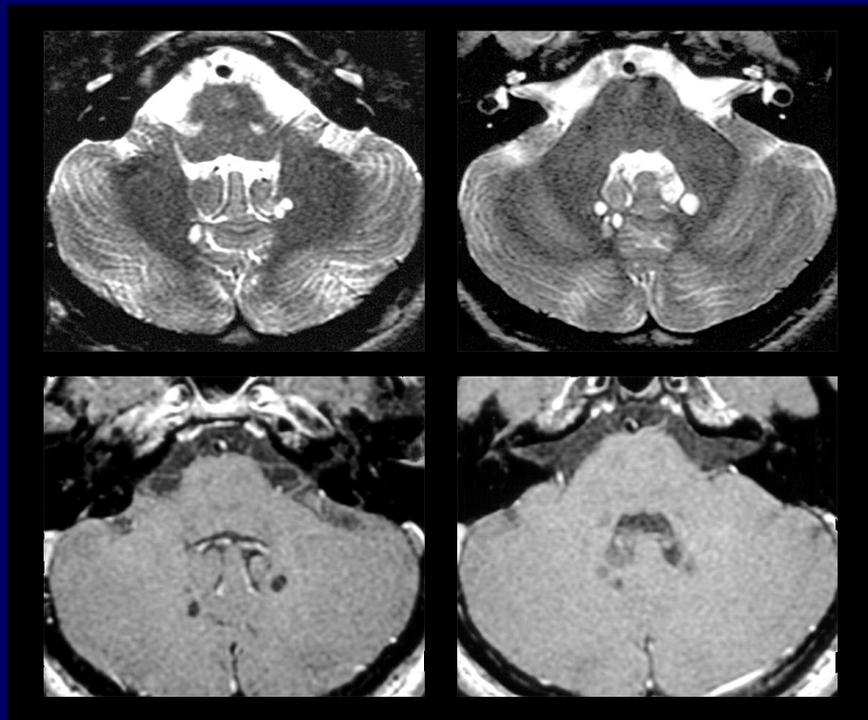
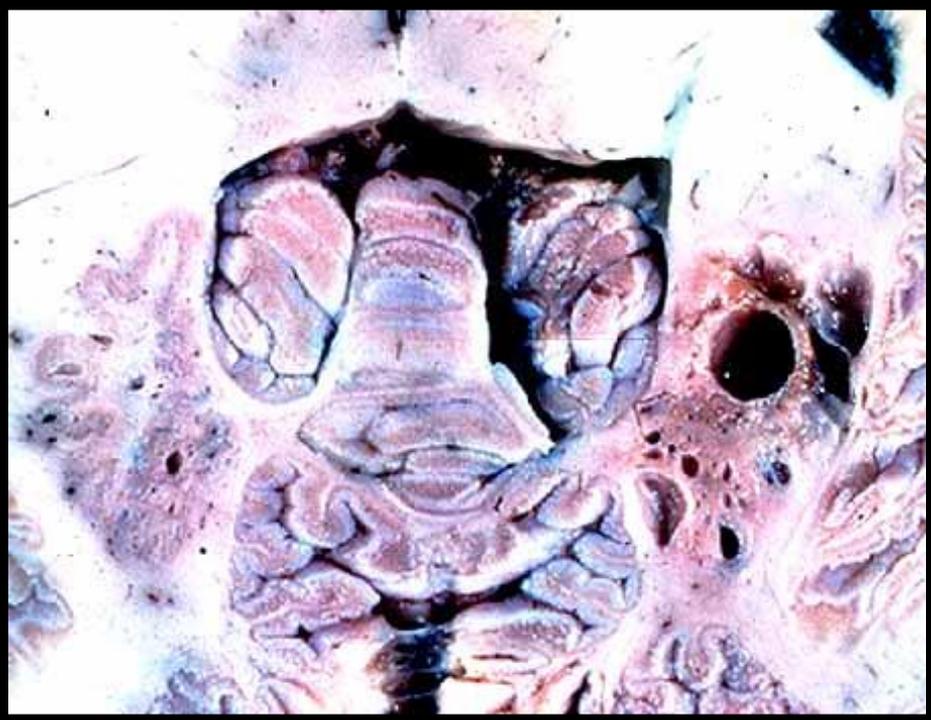
- 极外囊、丘脑



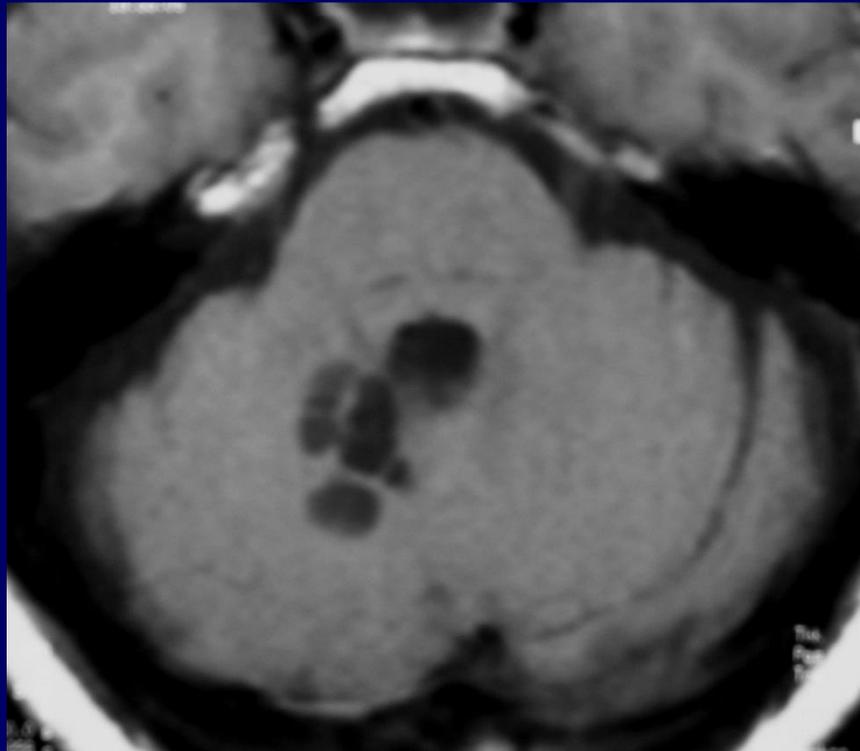


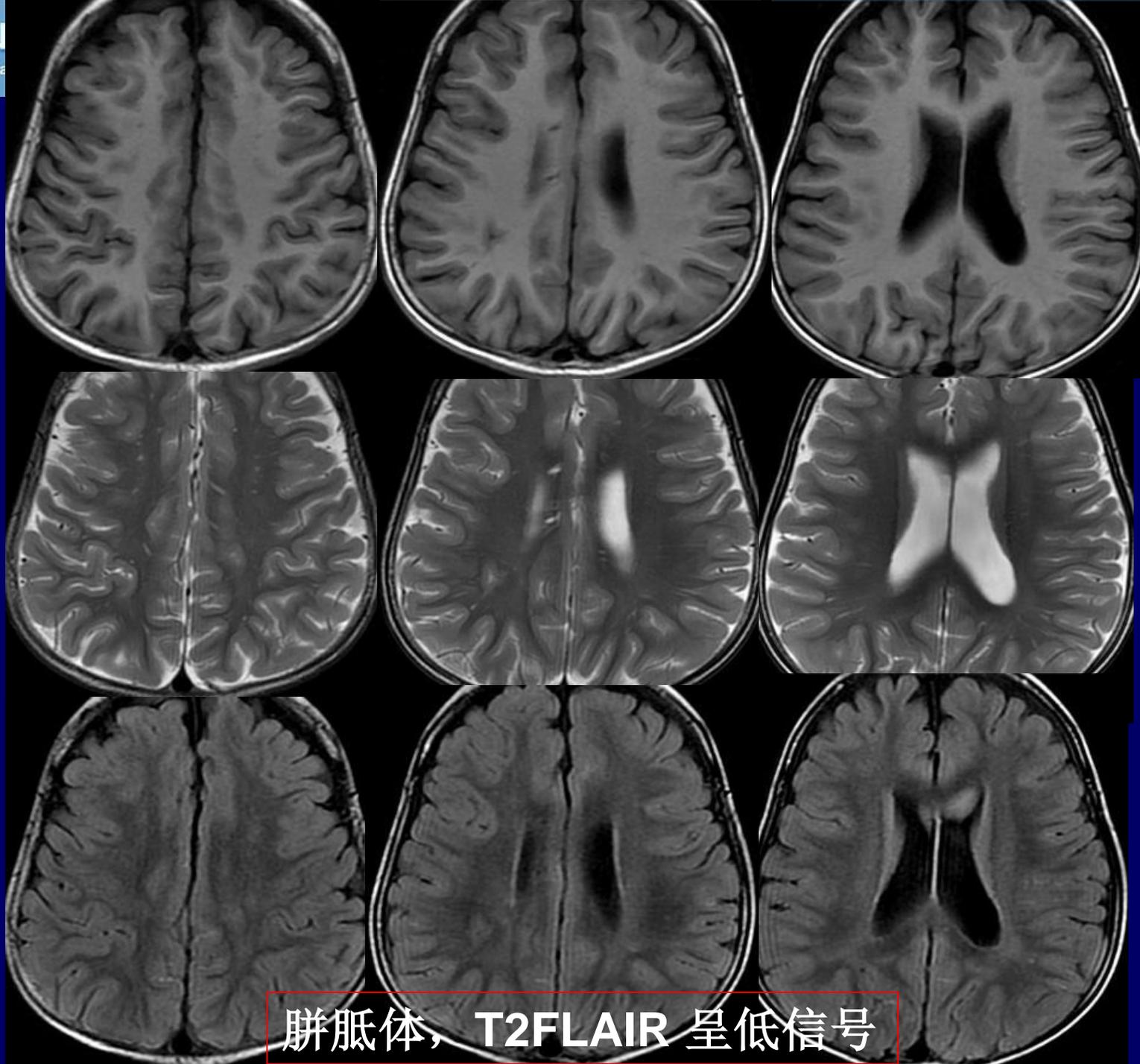
脑干（大脑脚）



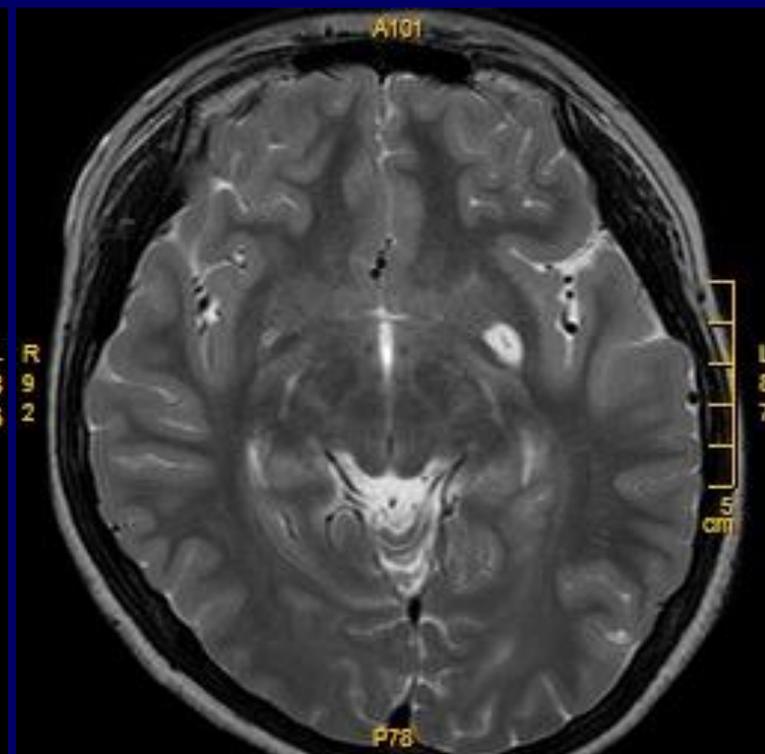
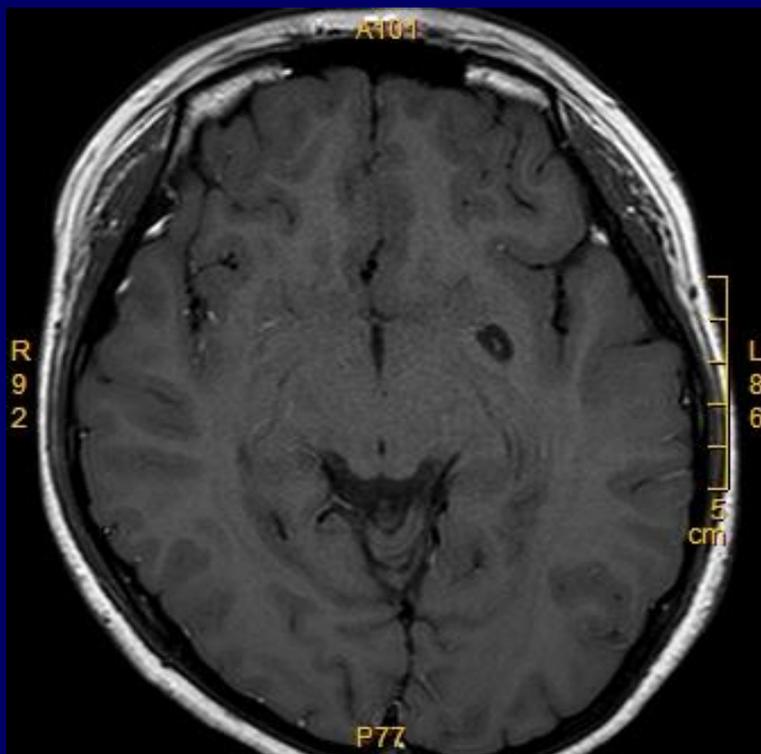


小脑齿状核旁





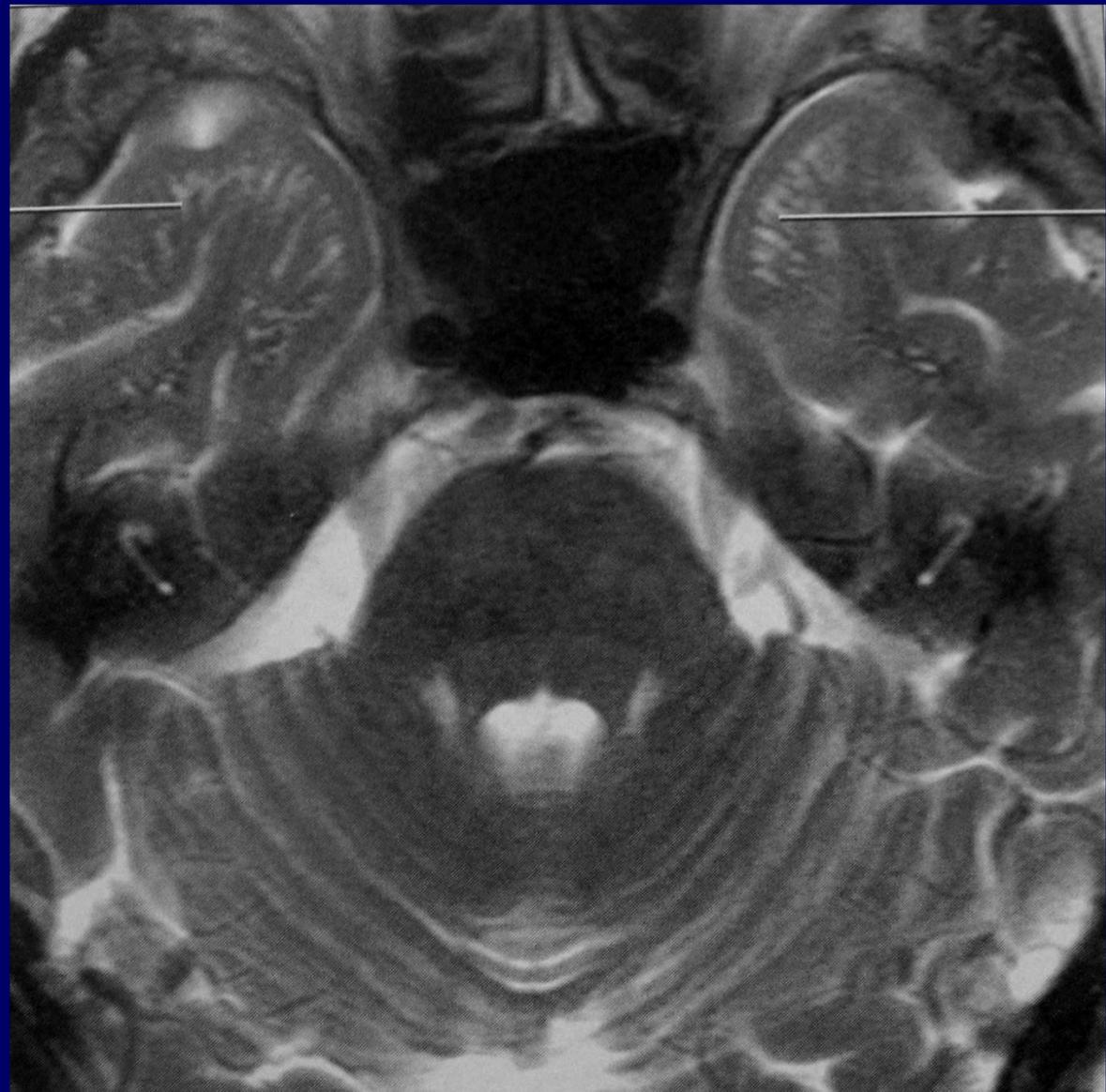
胼胝体，T2FLAIR 呈低信号



间隙内见血管影

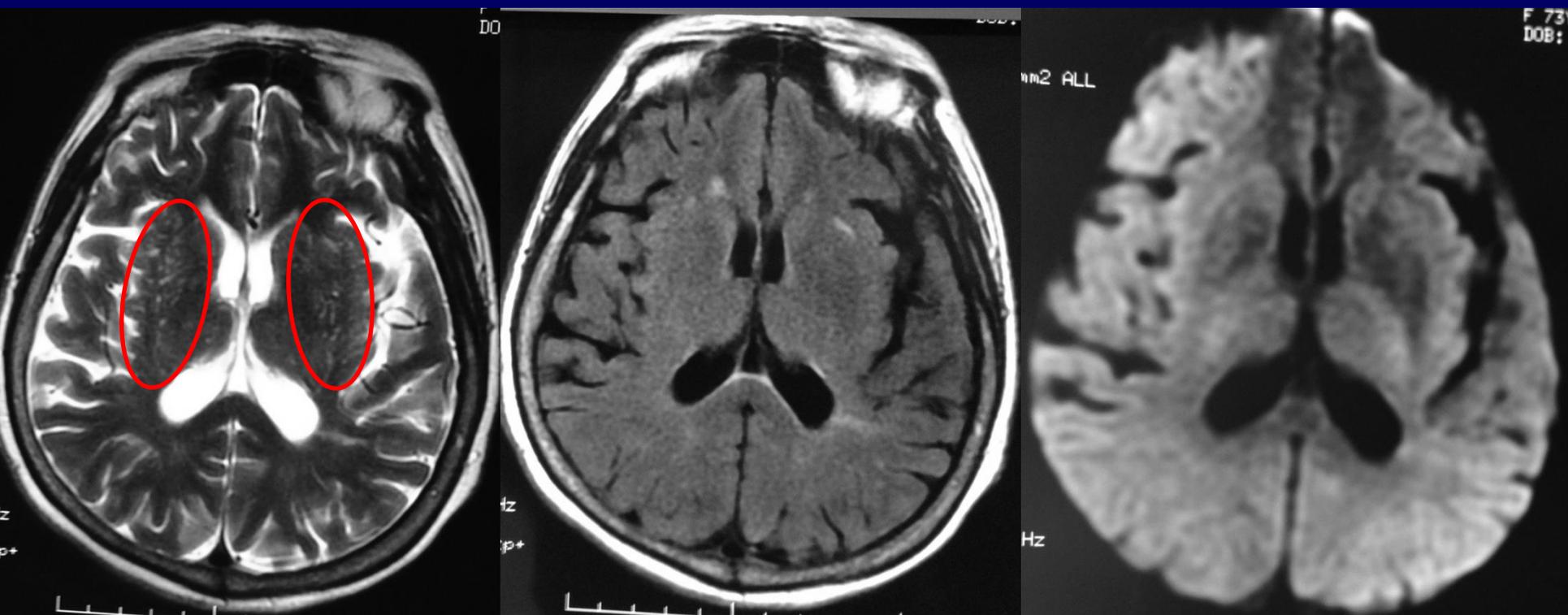


# 少见位置



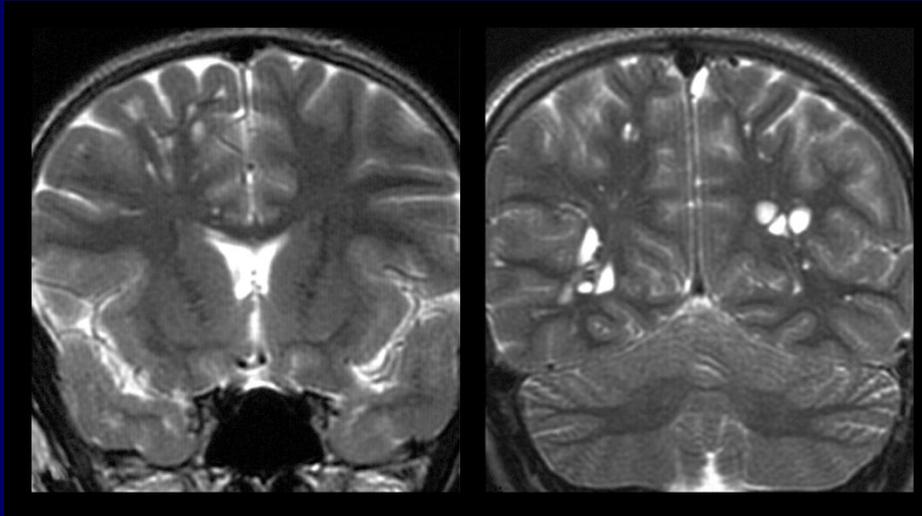


# 双侧基底节区血管周围间隙异常扩张

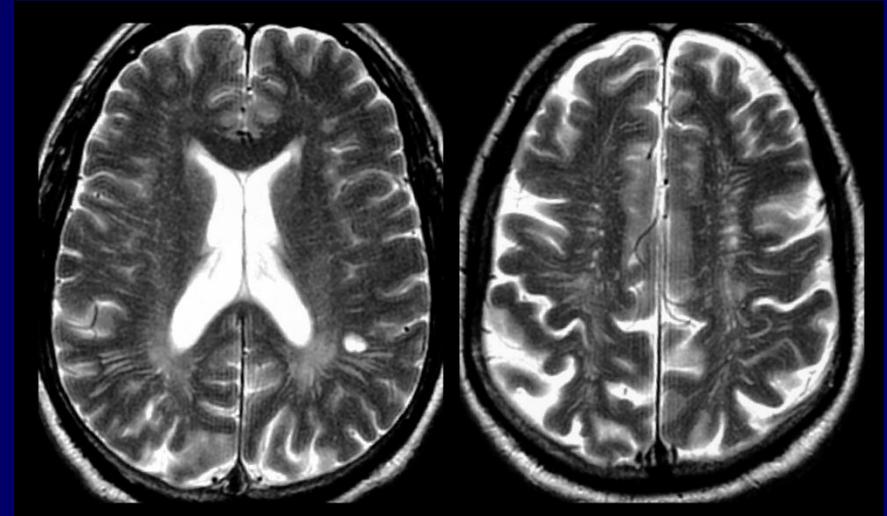




7 yo



57 yo



- 与年龄无明显相关性
- Accentuated PVSs found in 27% of normal children at 1.5T
- PVSs seen on 3T MRs in patients of *all* ages and in *all* typical locations

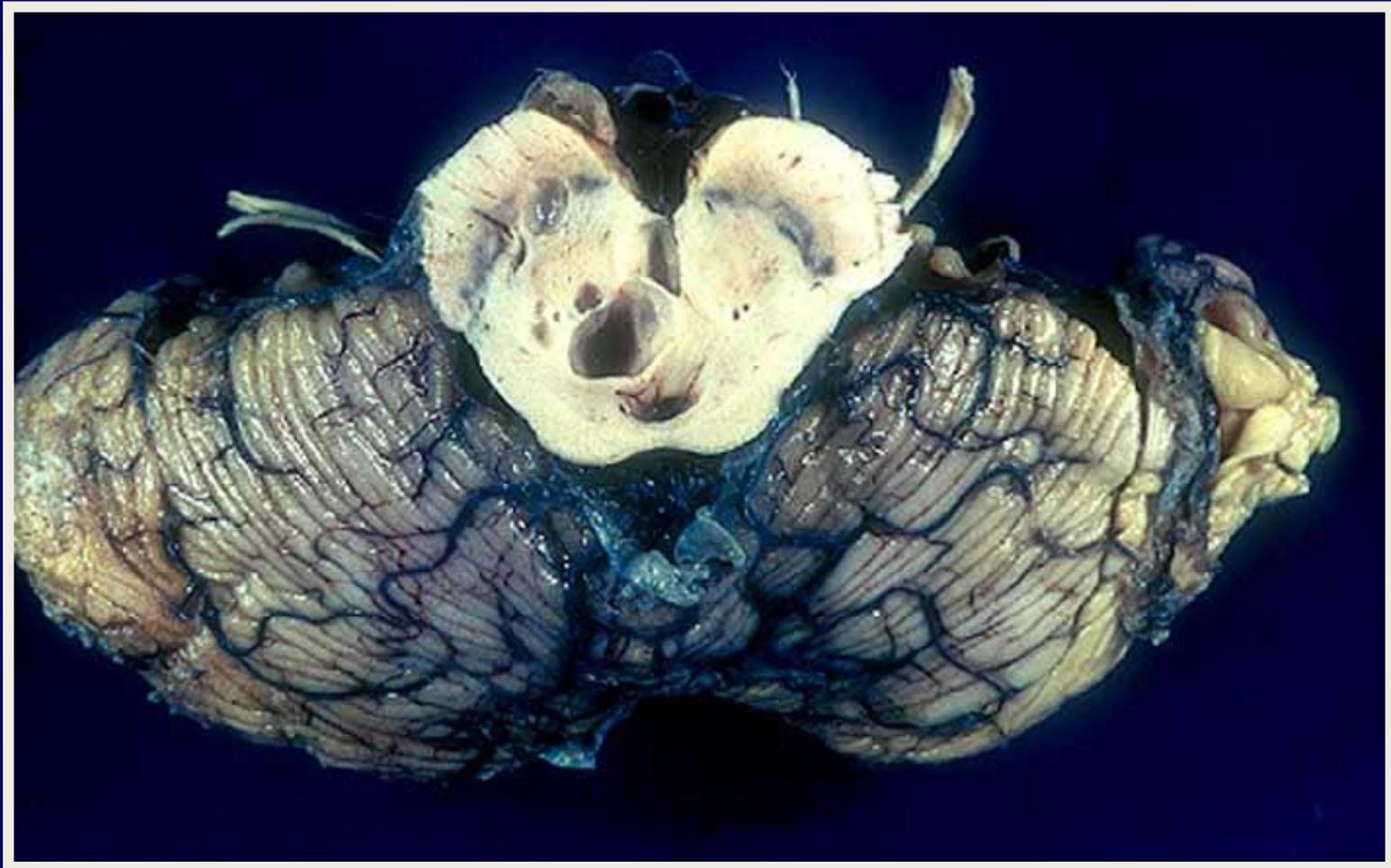


# 大小

- 分为3级
    - I级：直径在2mm以下
    - II级：直径在2 mm ~ 3 mm
    - III级：直径超过3 mm
  - 大血管周围间隙:大于2 mm
  - 小的血管周围间隙见于任何年龄  
各年龄组之间发生率无差异
- 通常 $\leq 5$  mm (多为1-2mm)
  - 通常双侧、多发
  - 巨大血管周围间隙 (可达2-3cm, 少见)



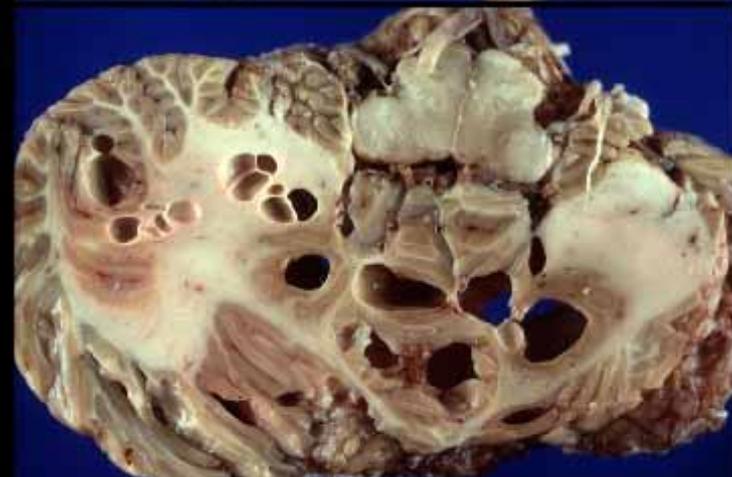
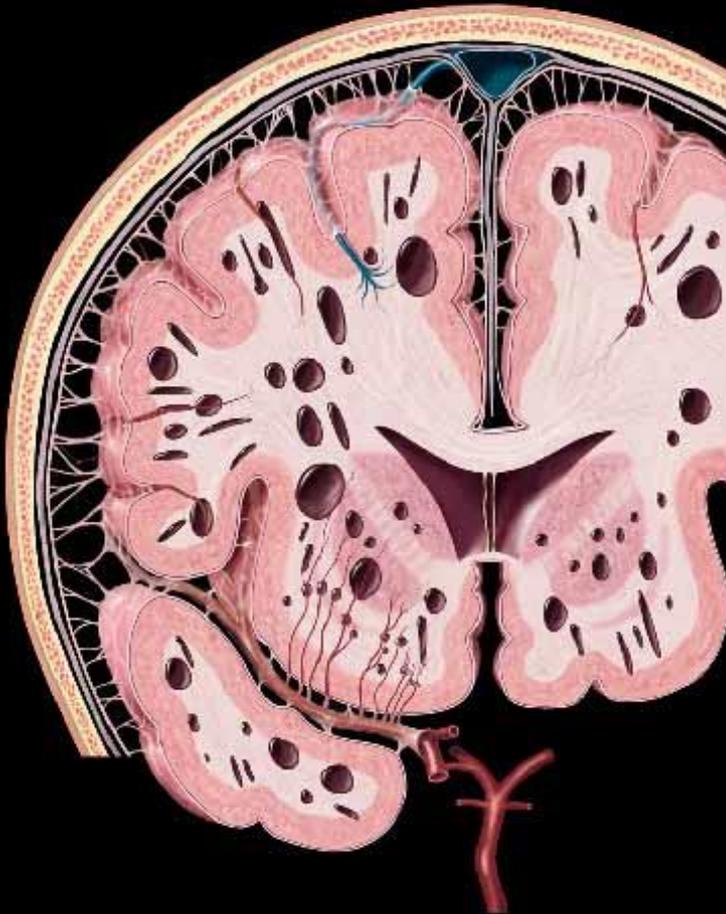
# 巨大血管周围间隙 (XPANDING PVSs) Pathology



- Up to 2-3 cm in size (可达2-3cm)

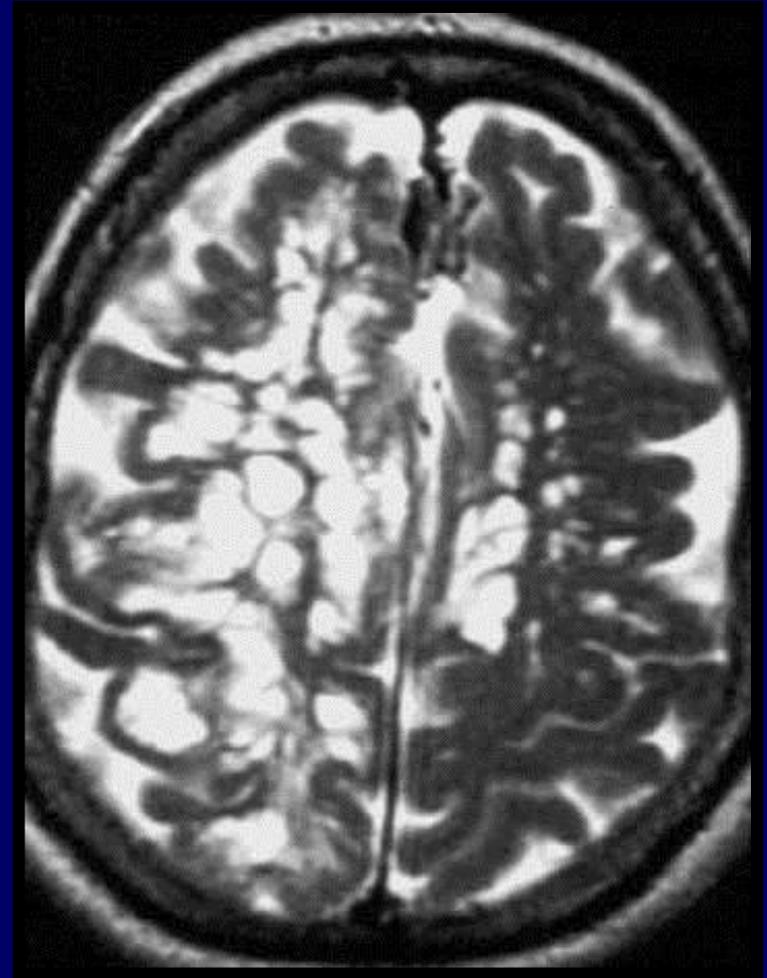


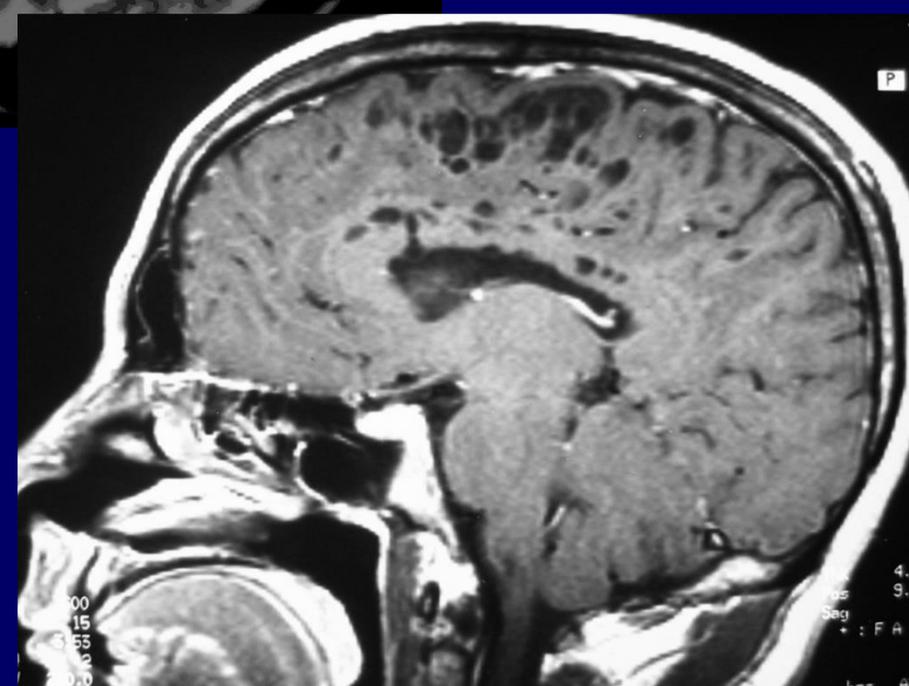
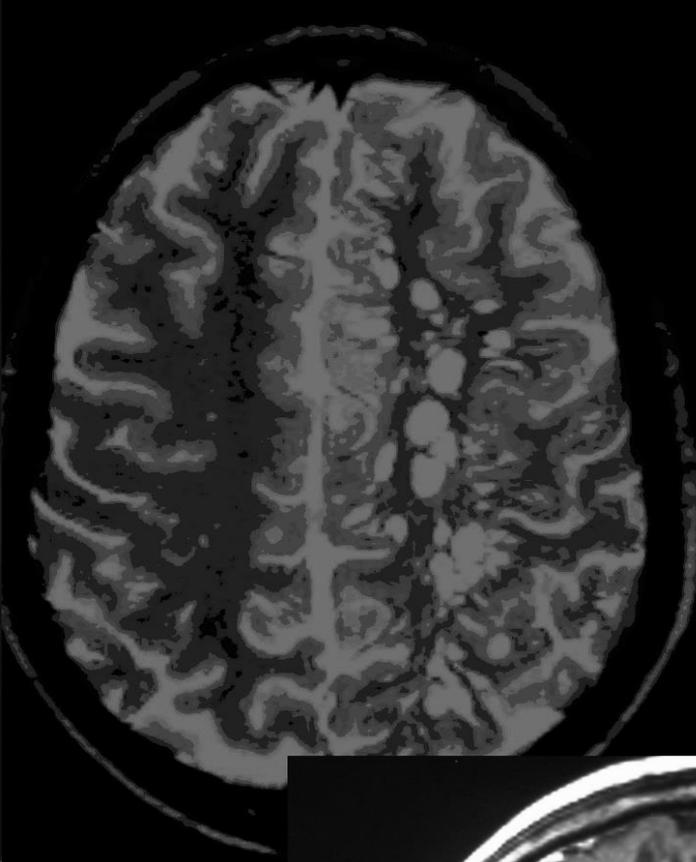
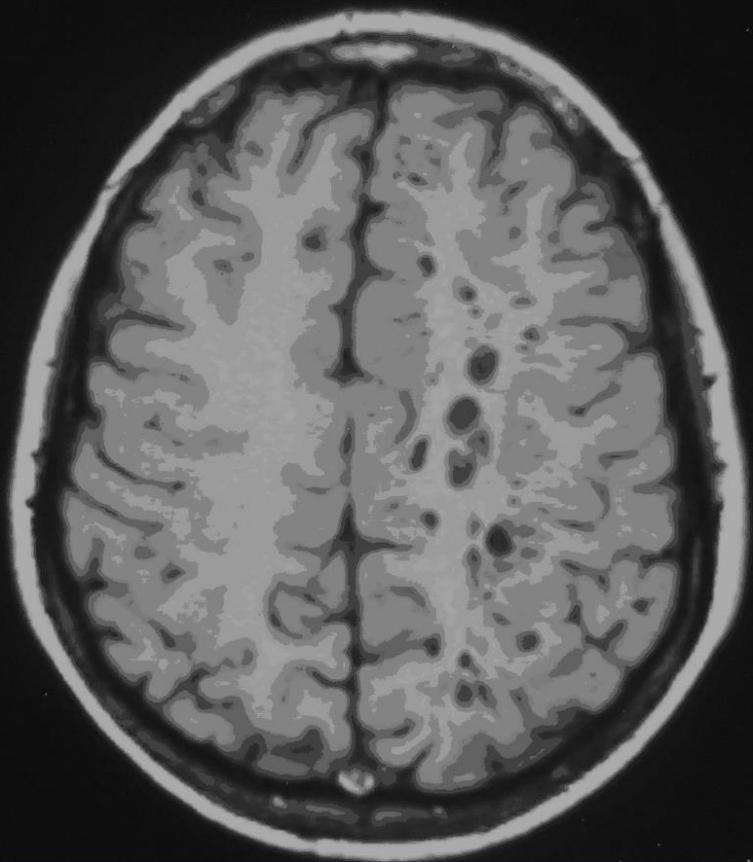
# “GIANT” PVSS: Pathology (Post-mortem Gas Simulates)





# GIANT PVSs: Imaging



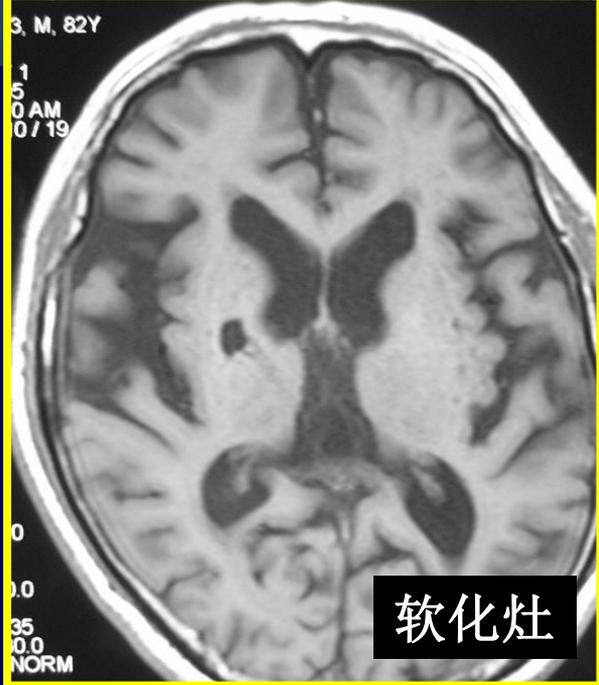




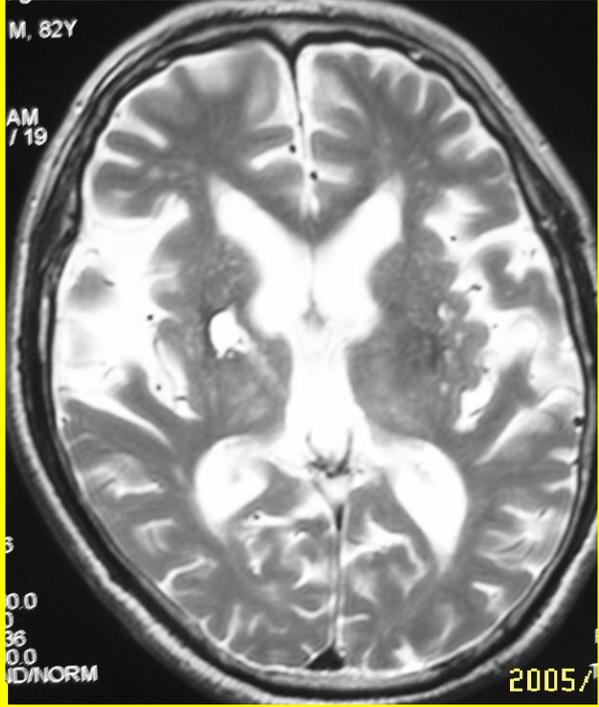
## 软化灶

## 血管周围间隙

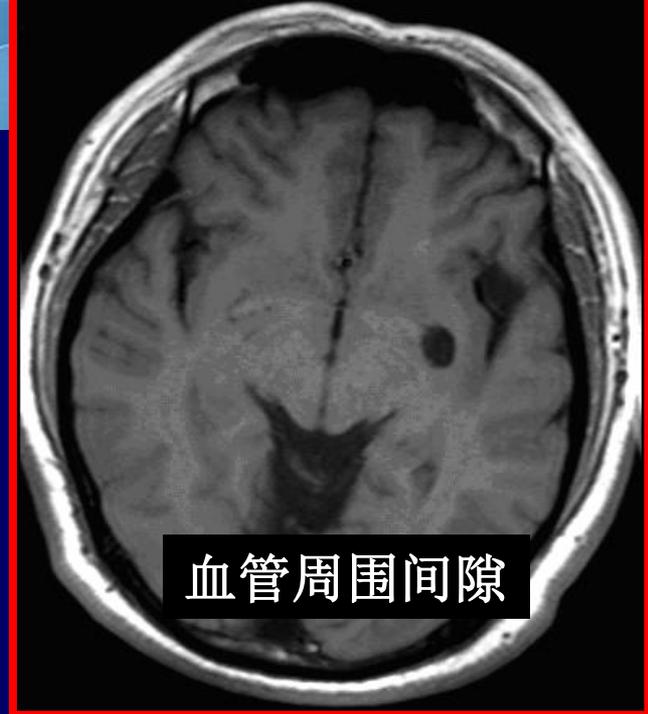
边界	清楚	清晰、光滑、锐利
形态	不规则	(椭)圆形、线形、斑片状
脑组织反应	胶质增生	无
(T1WI,T2-FLAIR环形、条状高信号)		
占位效应	负	无
部位	无规律	好发部位
方向	无规律	多沿纤维走行方向
症状	可有	无



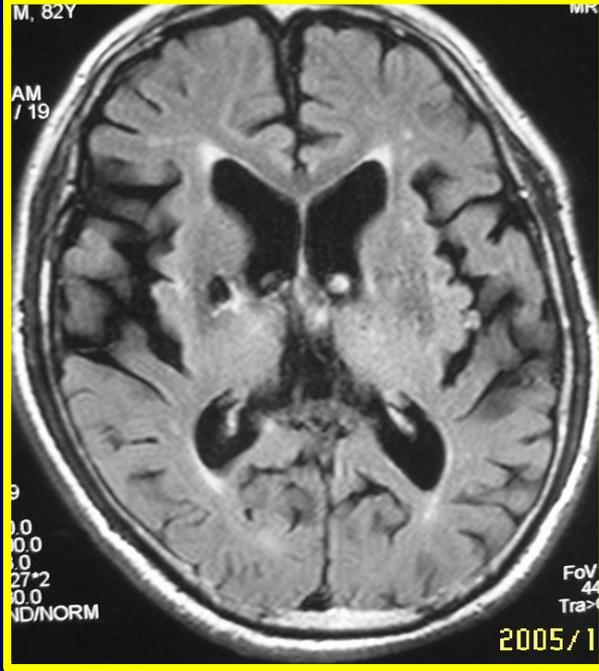
软化灶



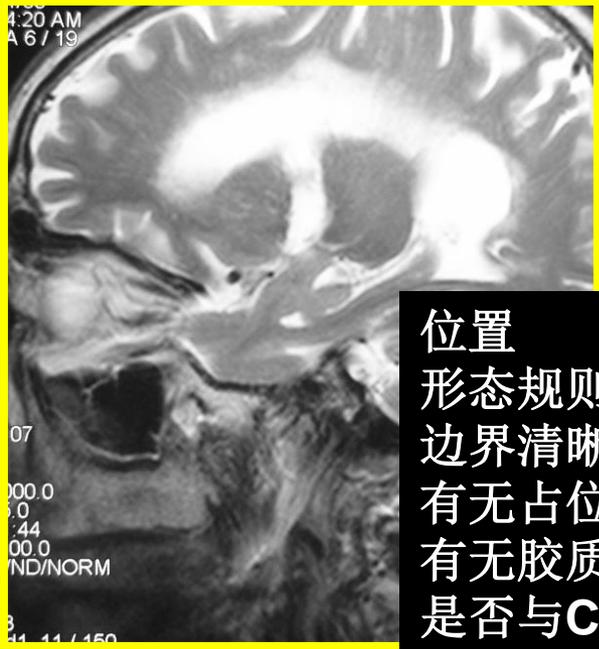
2005/7



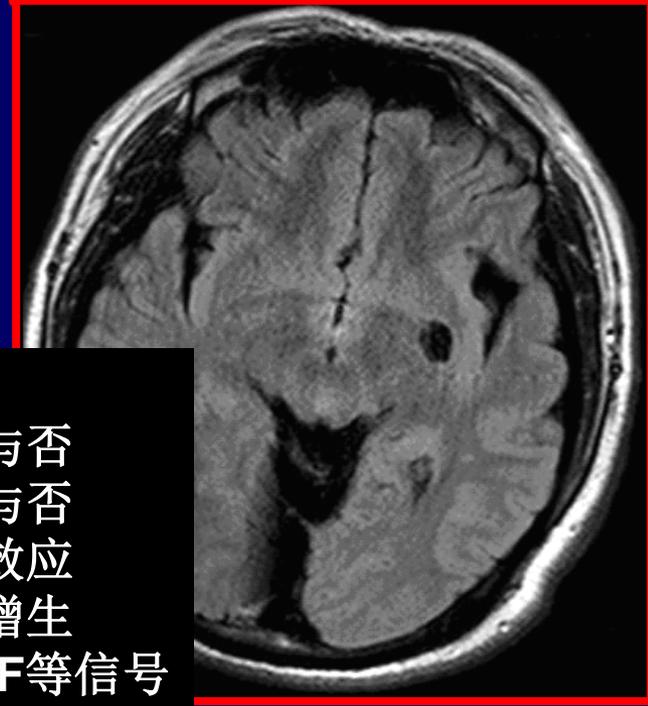
血管周围间隙



2005/1



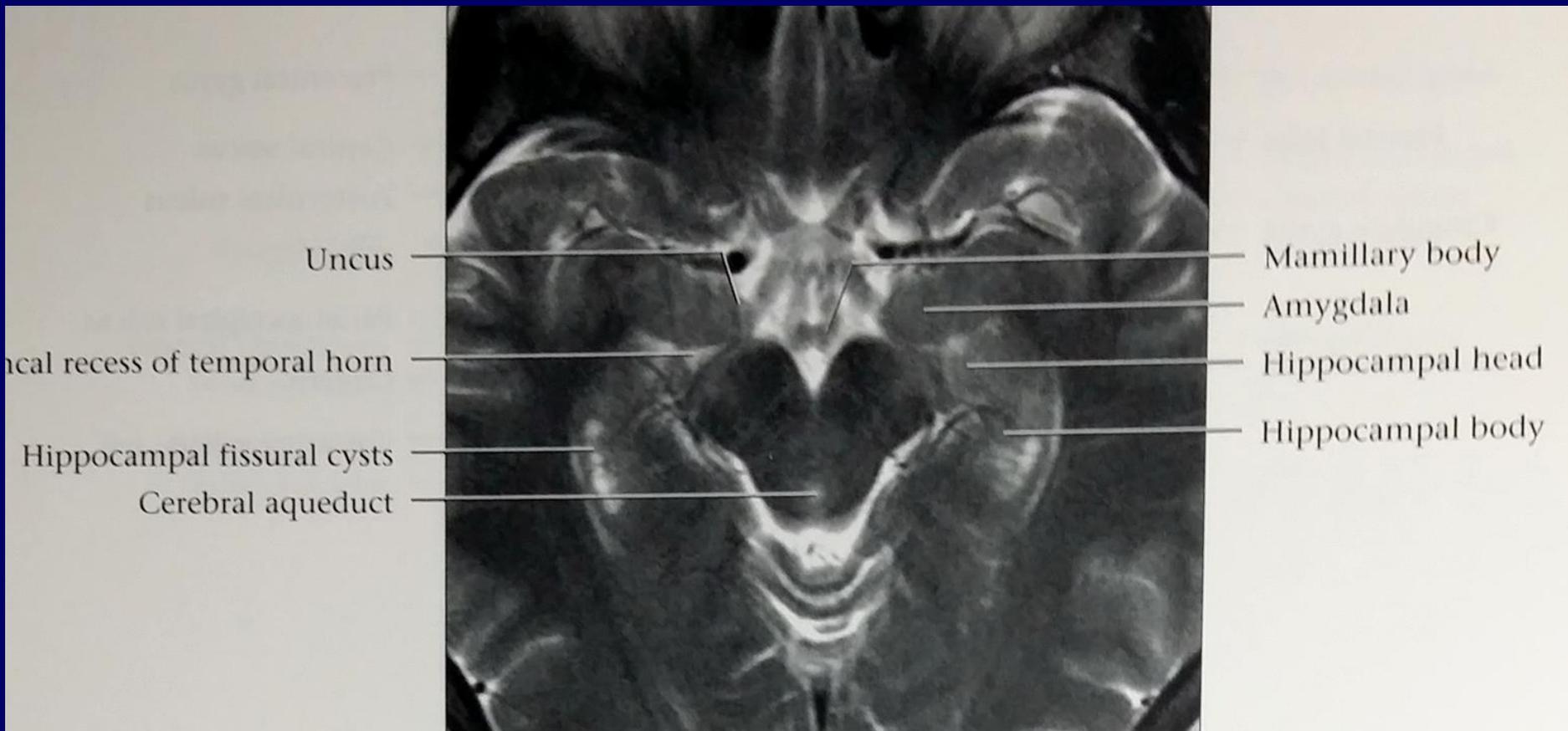
2005/1



位置  
形态规则与否  
边界清晰与否  
有无占位效应  
有无胶质增生  
是否与CSF等信号



海马位于侧脑室颞角后方、内侧，与灰质等信号；海马趾间脑脊液信号





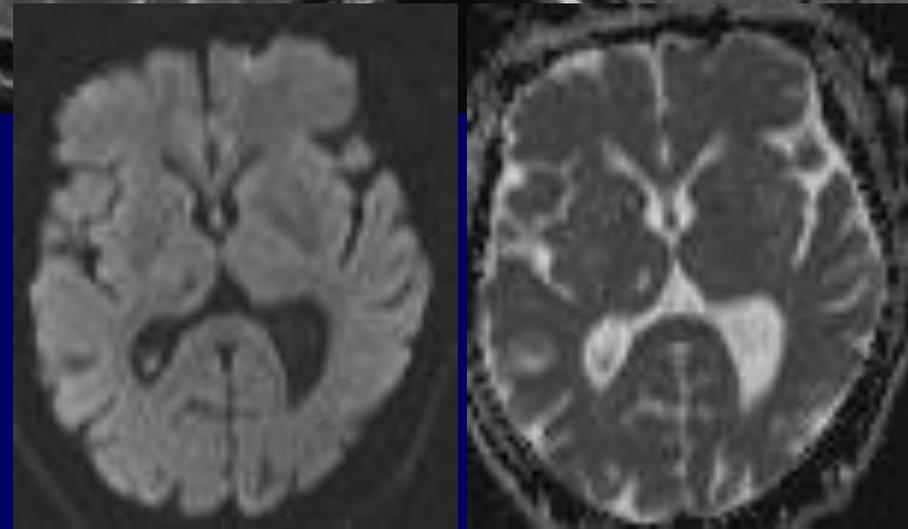
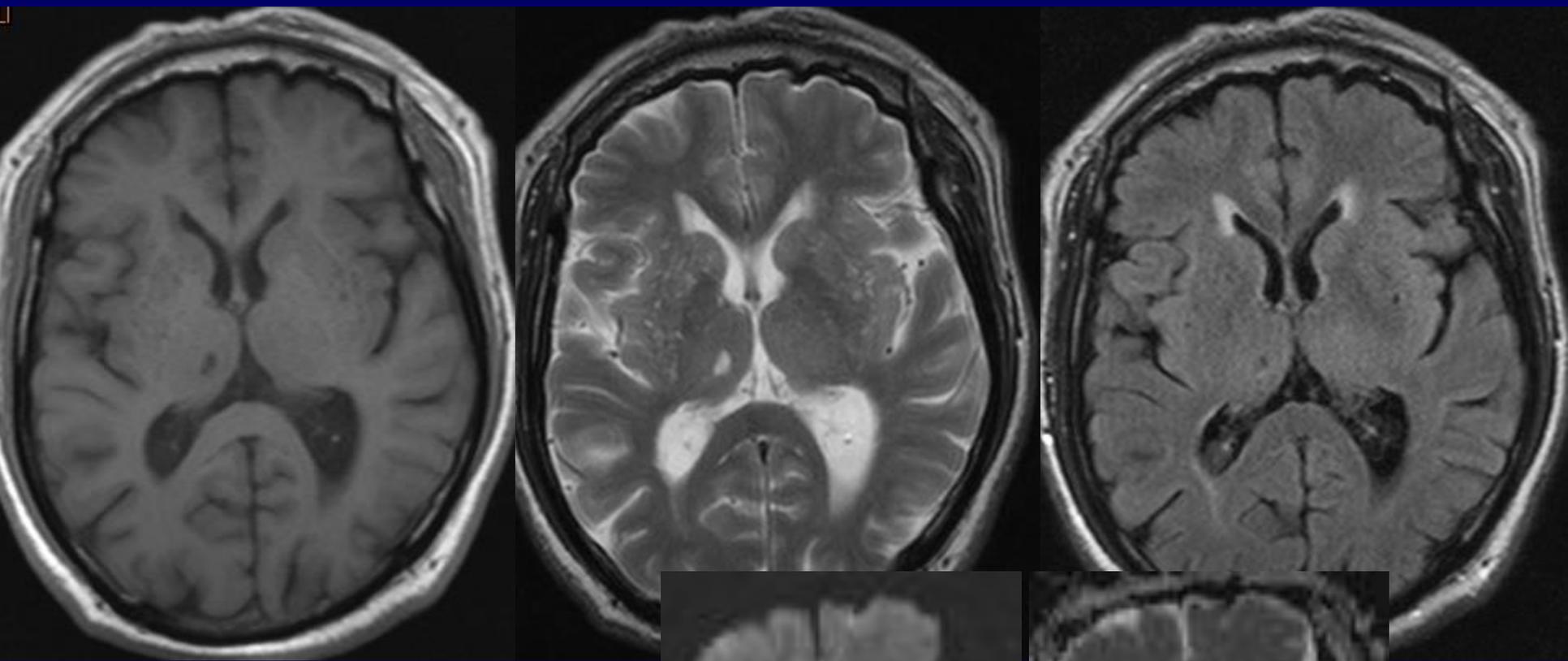
# 血管周围间隙小结

- 软脑膜相关
- 含组织间液
- 见于任何年龄
- 特殊位置、特殊CT/MRI表现
- 皮质内一般无血管周围间隙
- 多数无占位效应、无症状
- 巨大血管周围间隙，偶可有占位效应
- 疾病传播途径

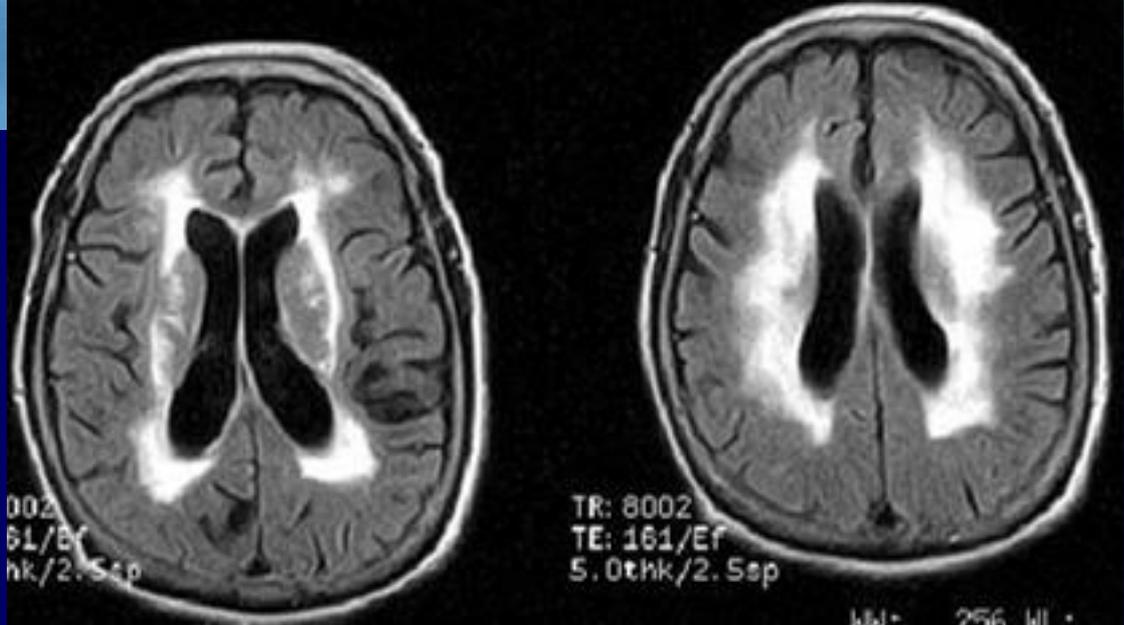




# 侧脑室额角旁异常信号?



侧脑室额角旁（帽征）：  
渗透压异常  
胶质增生



# 脑白质病变

- 皮层下动脉硬化性脑病（Binswanger）：临床术语
- 白质疏松（leukoaraiosis）：影像学术语（1987）
- 白质高信号（white matter hyperintensity, WMH）
- 白质病变（white matter lesion, WML）

属于小血管病



## 皮层下动脉硬化性脑病（Binswanger）

- 1894年Binswanger首先报道
- 临床特点是伴有高血压的中老年人进行性痴呆
- 病理为大片脑白质脱髓鞘而弓形纤维正常、  
**明显的动脉硬化改变**
- 病变在脑室周围深部白质，多伴有腔梗

**缺血性脱髓鞘改变，小血管病**



# 白质疏松 (leukoaraiosis)

- 是由多种不同病因引起的一组影像学所表述的室旁、深部白质、皮层下白质高信号的病变；
- 多见于中老年人群
- 可有或无临床症状
- 确切的临床意义有待探讨
- 为了避免与Binswanger在病理病因上的混淆而提出的概念

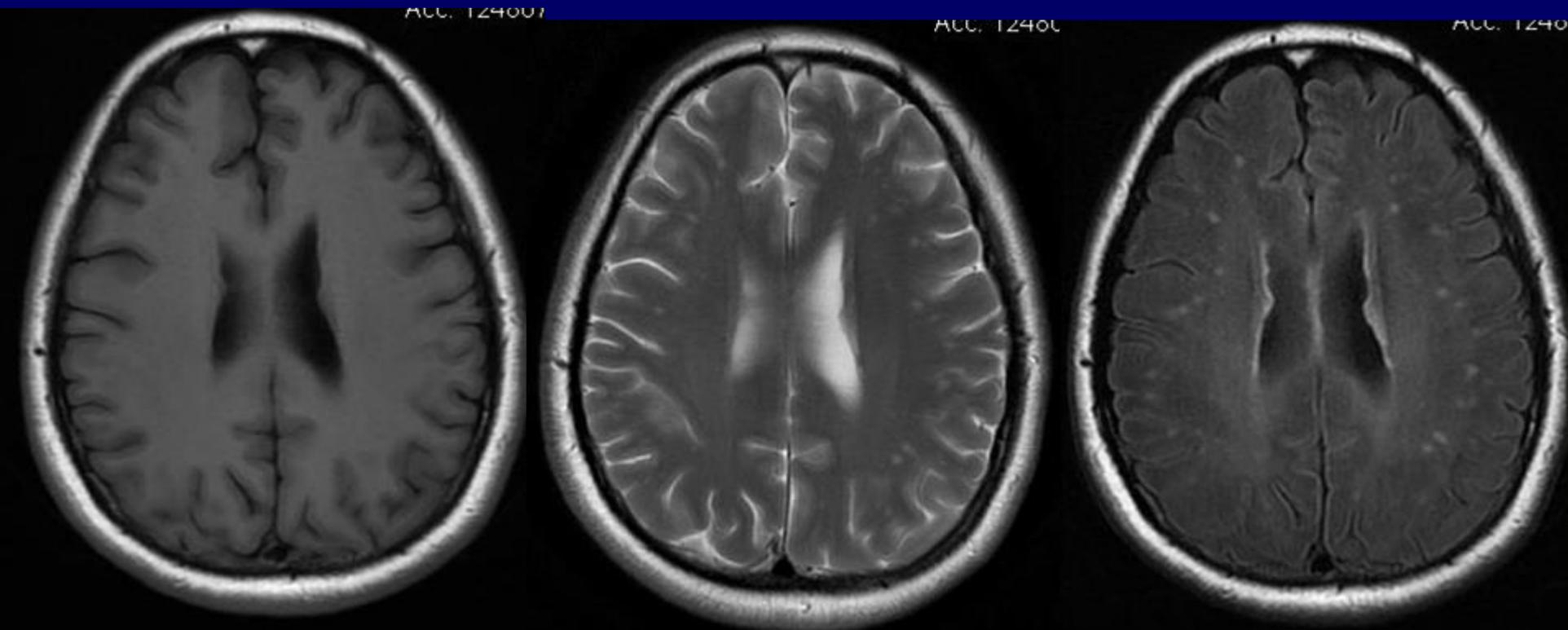


## 脑白质病变改良Fazekas分级

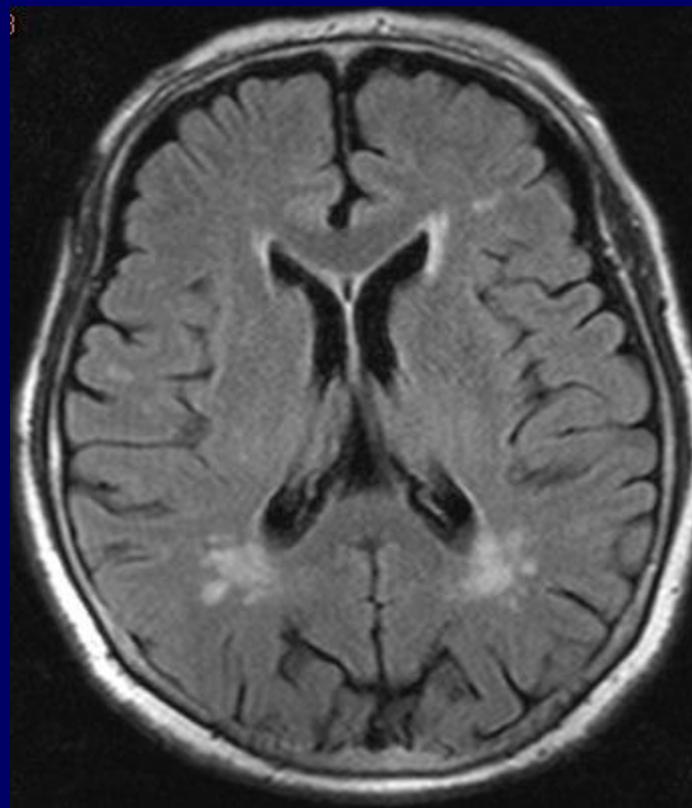
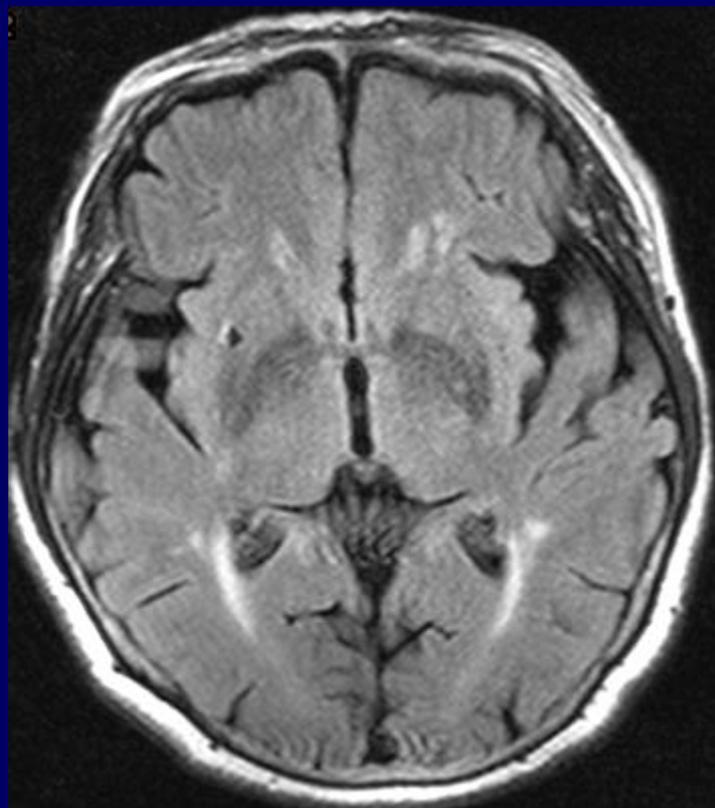
- 0级：阴性
- 1级：斑点样
- 2级：斑块样
- 3级：斑片样



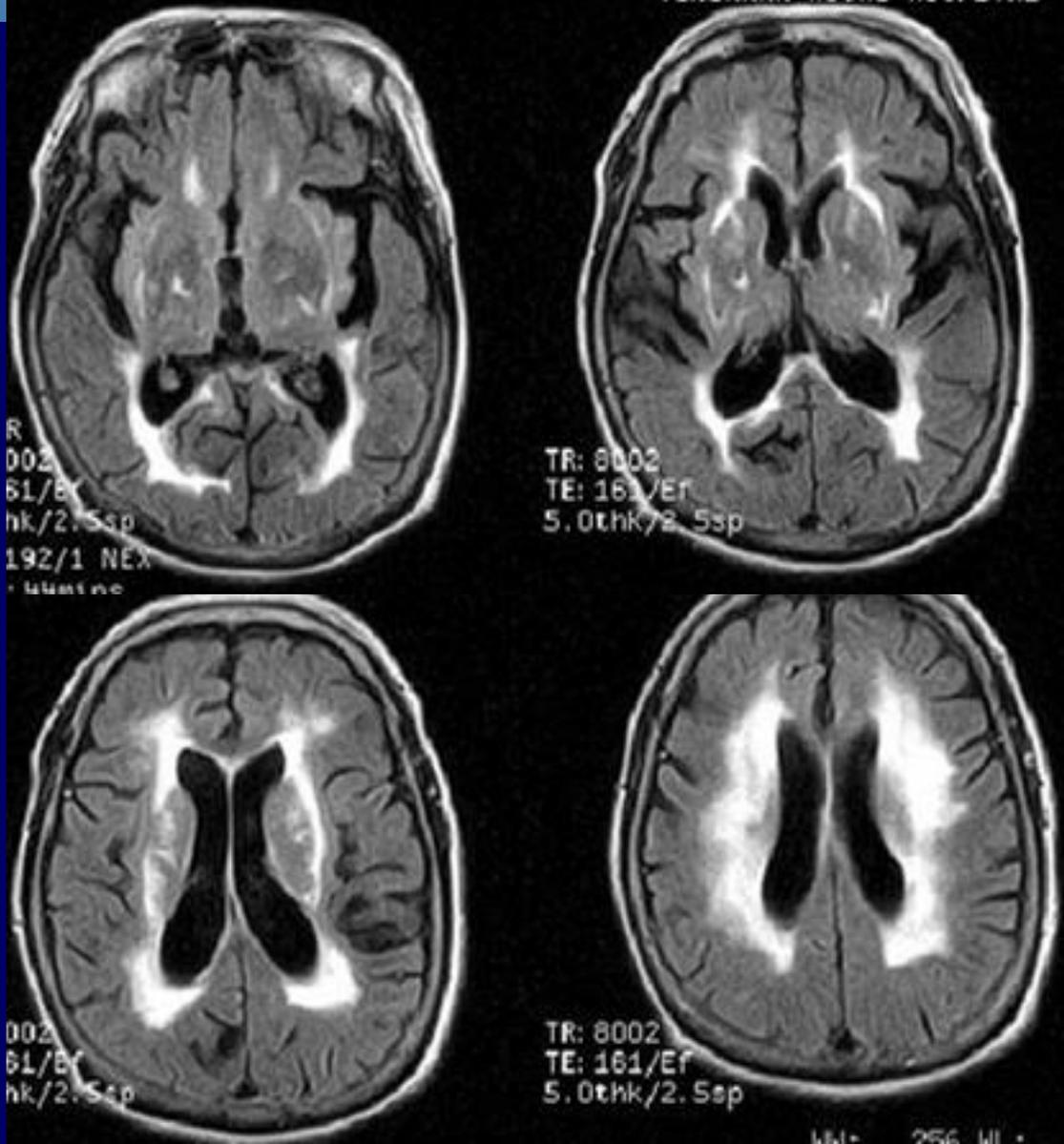
# 改良Fazekas分级：1级，斑点样



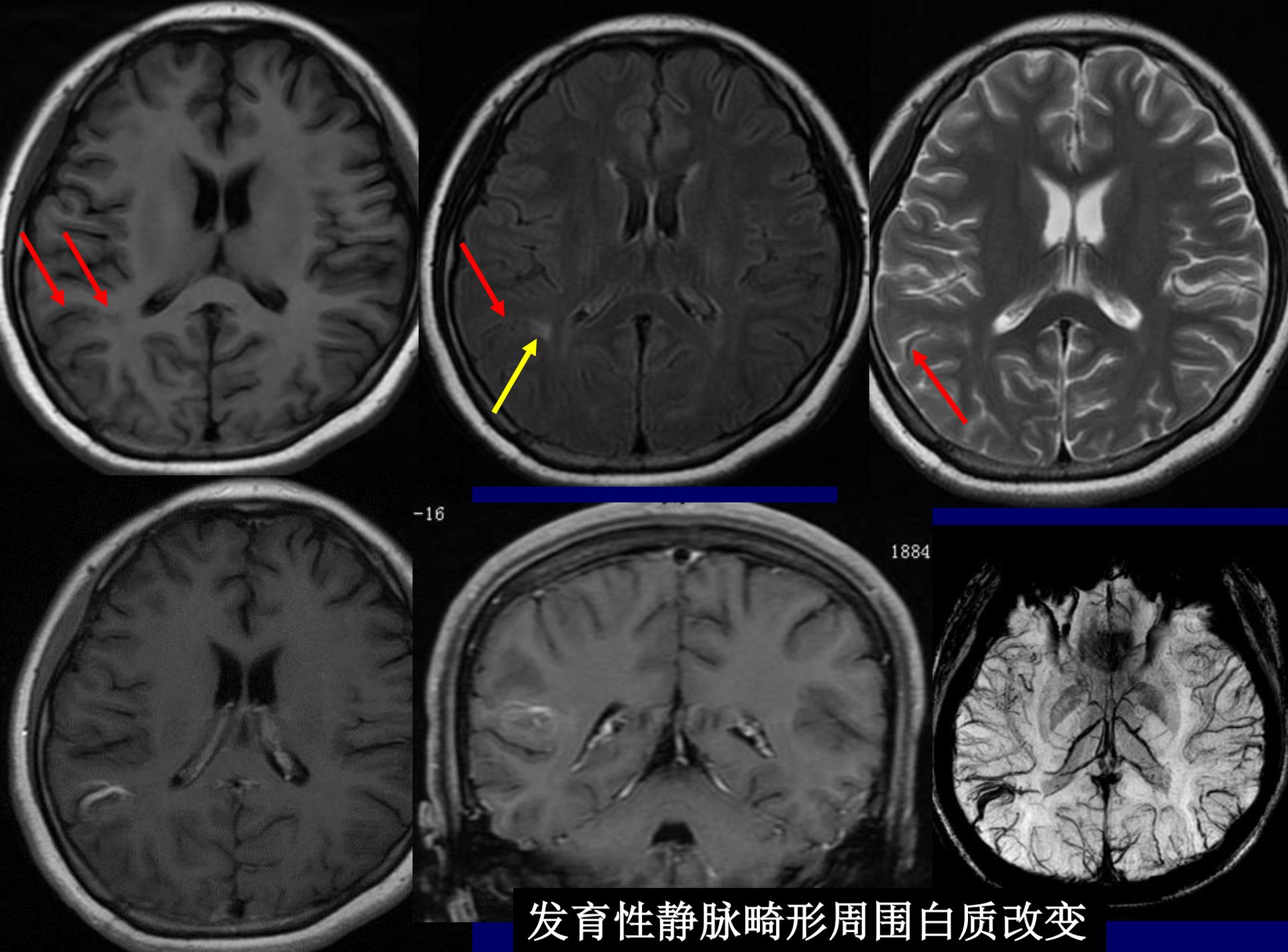
脑缺血灶



改良Fazekas分级：2级，斑块样



Fazekas分级: 3级, 斑片样



-16

1884

发育性静脉畸形周围白质改变



# CADASIL

Cerebral Autosomal Dominant Arteriopathy with  
Subcortical Infarcts and Leukoencephalopathy

伴有皮质下梗死和白质脑病的常染色体显性遗传性脑动脉病

- **Notch3基因突变是CADASIL的分子遗传学基础**
- **小血管病（穿支动脉及柔脑膜动脉平滑肌细胞受累）**
- **嗜铁颗粒**
- **家族性、成年起病（30-40岁以后）**
- **偏头痛、脑卒中、痴呆、精神异常、眼底动脉变细等**

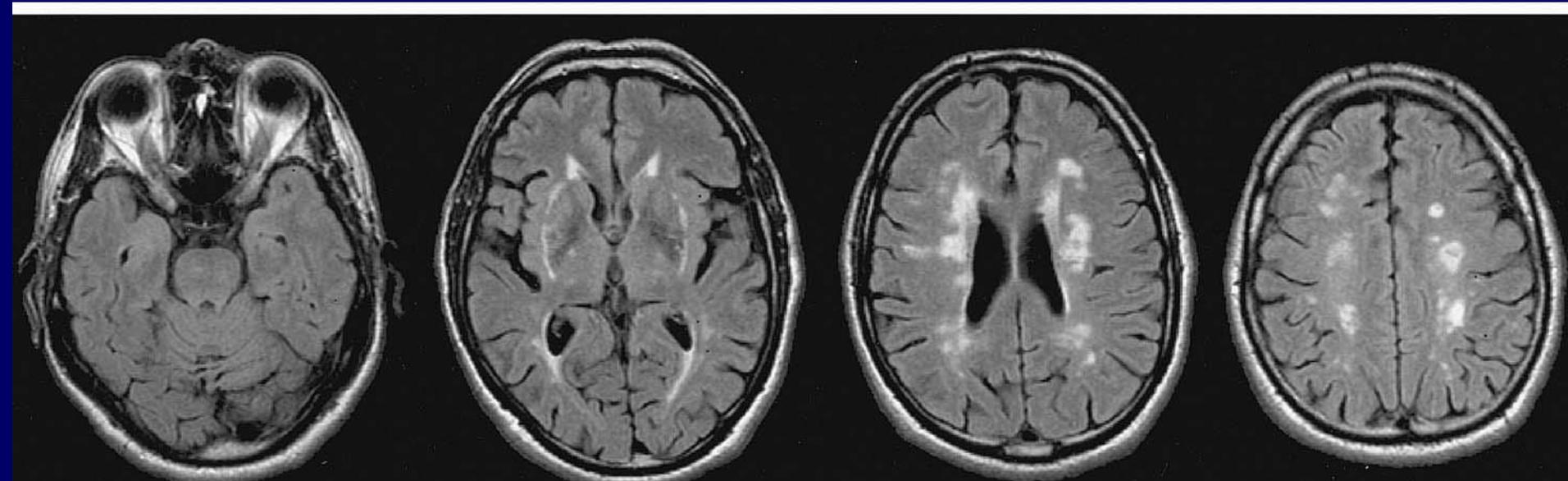
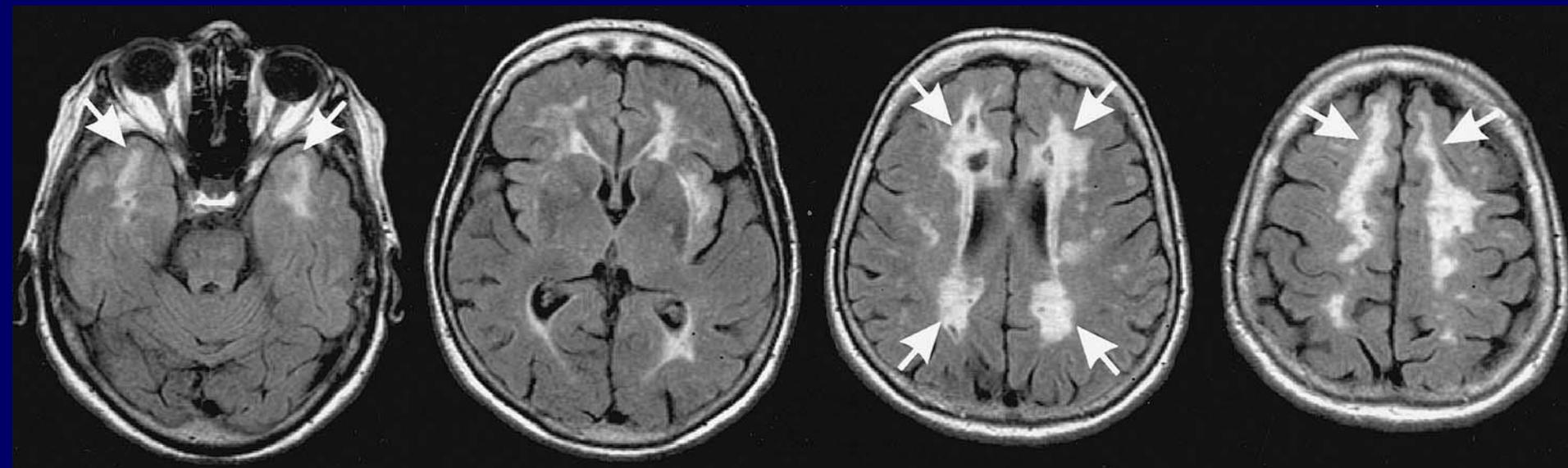


# CADASIL

伴有皮质下梗死和白质脑病的常染色体显性遗传性脑动脉病

## MRI所见

- 基底节多发腔隙性脑梗死
- 皮层下高信号（缺血）
- 脑室周围或深部白质异常高信号  
（20岁即可出现，T2WI、FLAIR）
- 特征改变：颞极白质、外囊高信号





# 小结

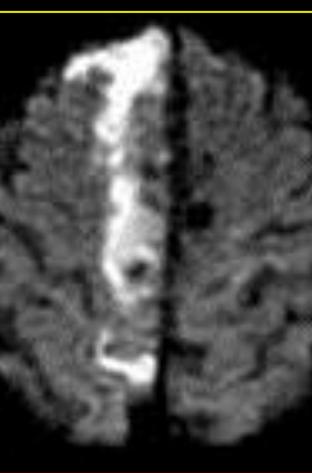
脑缺血 脑梗死 脑软化 间隙 CSF  
(腔梗)

T1WI	等	低	低 (高信号环)	低	低
T2WI	等、略高	高	高	高	高
T2FLAIR	略高	高	低 (高信号环)	低	低

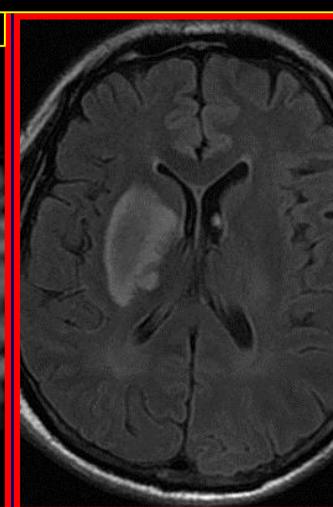
脑白质病变，改良Fazekas分级  
脑白质病变鉴别诊断



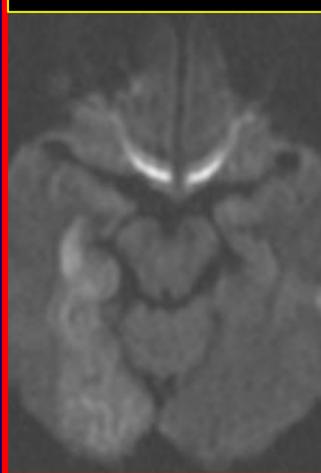
ACA血栓性梗死



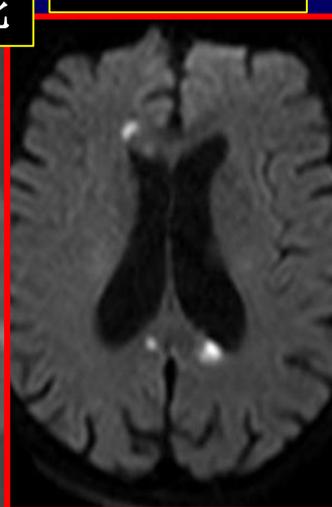
MCA血栓性梗死



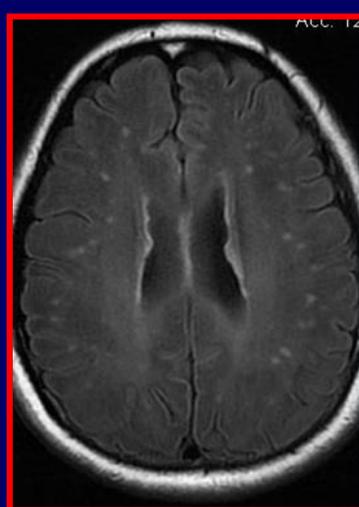
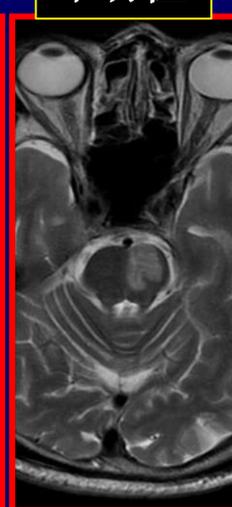
PCA血栓性梗死



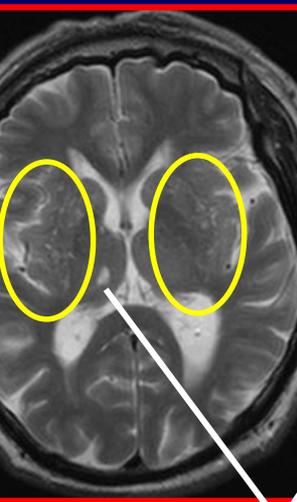
栓塞性梗死



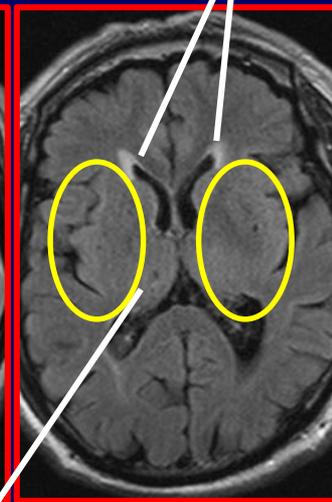
半切征



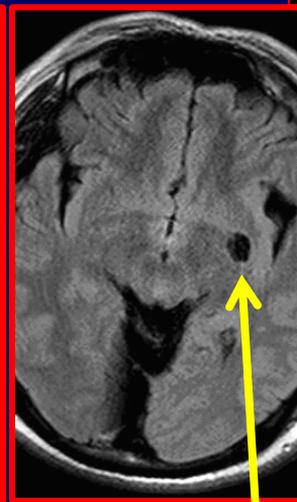
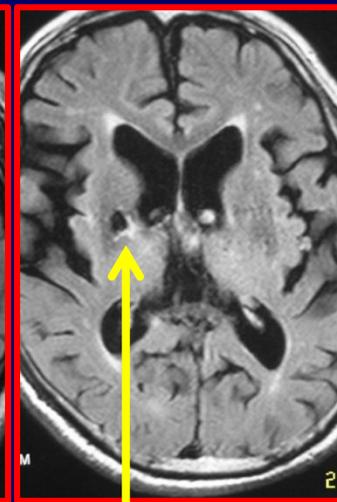
V-R间隙扩张



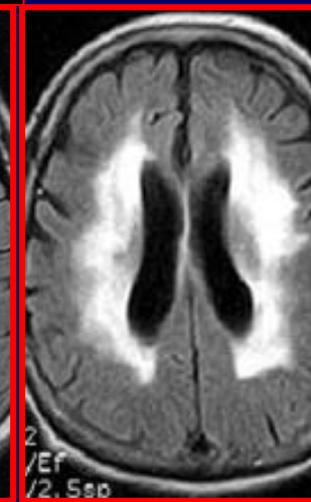
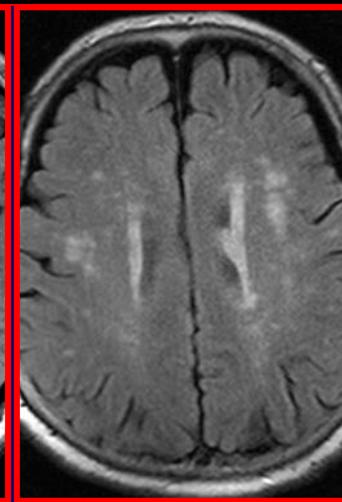
渗透压、胶质增生



改良Fazekas II级



改良Fazekas I级



腔隙性脑梗死（胶质增生、渗血）

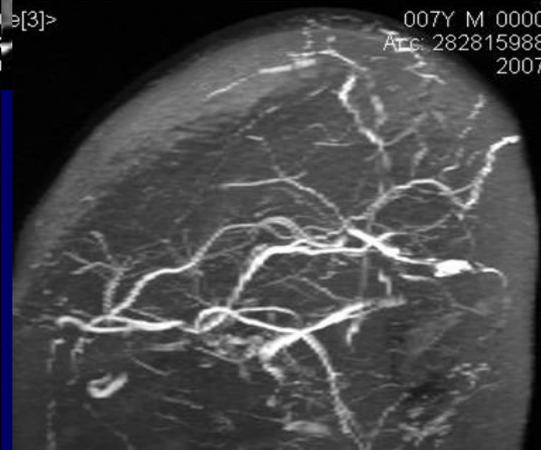
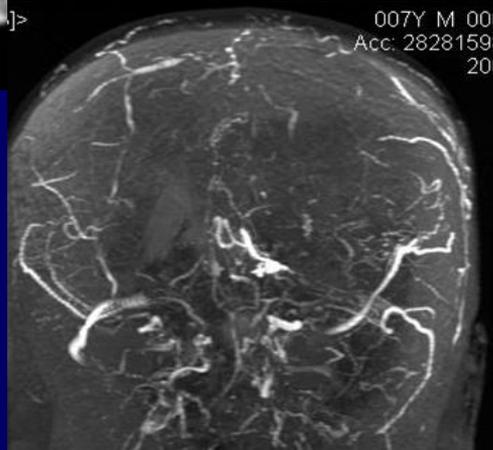
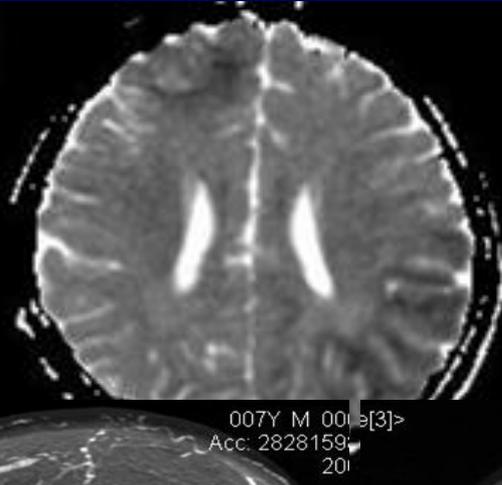
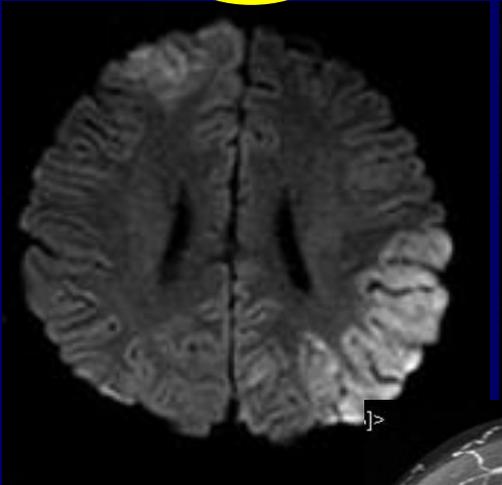
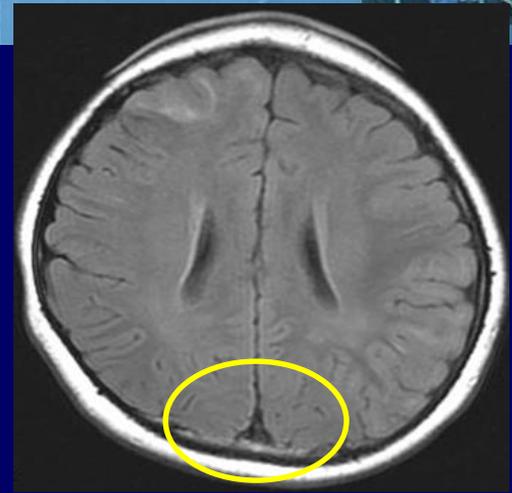
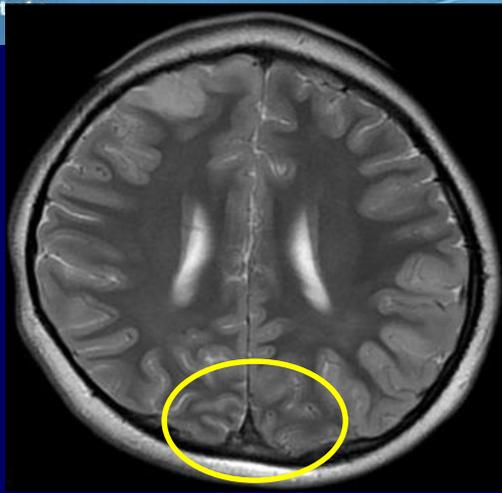
软化灶（胶质增生）

V-R间隙

改良Fazekas III级



男，21，肾炎，头痛，意识模糊



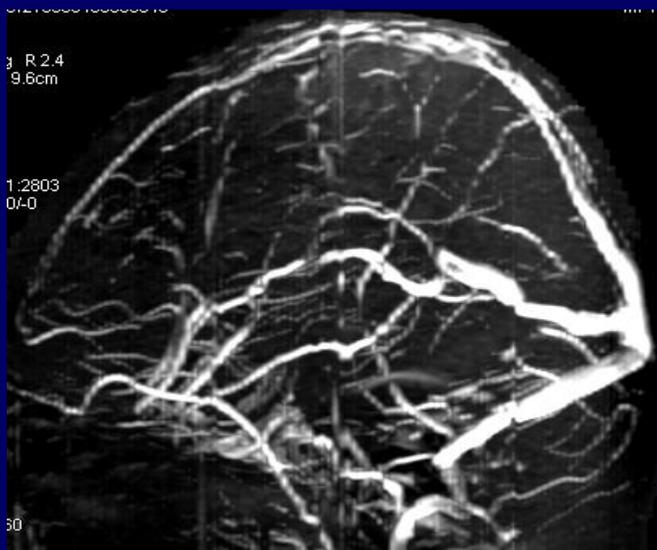
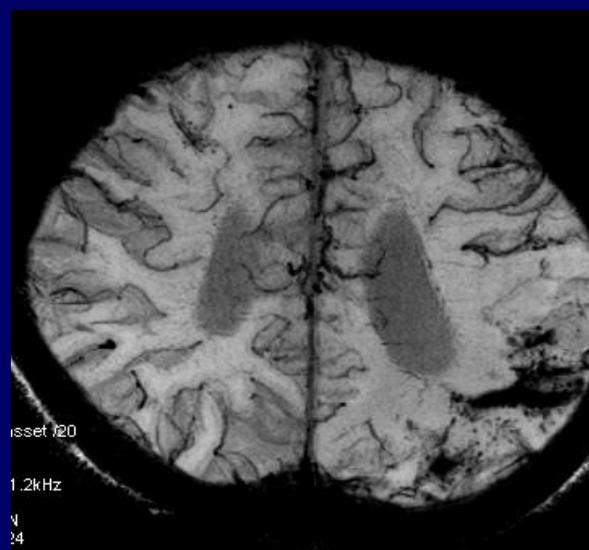
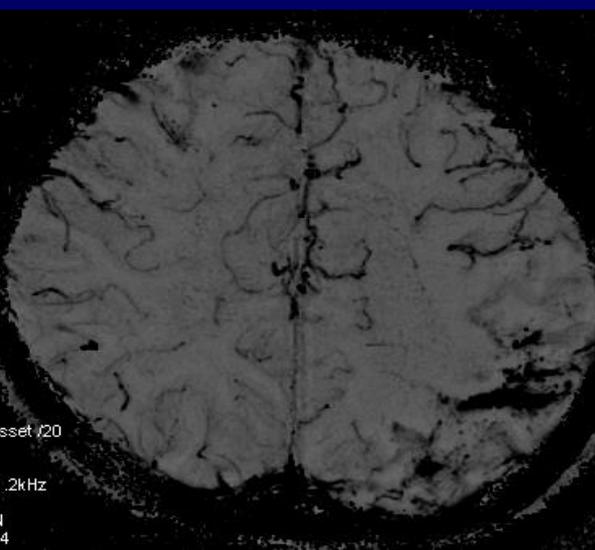
静脉窦栓塞  
静脉性梗死

007Y M 0013[3]>  
Acc: 2828159;  
201

007Y M 0000  
Acc: 282815988  
2007



# 静脉窦栓塞， 静脉性梗死后出血





山东省医学影像学研究所

Shandong Medical Imaging Research Institute

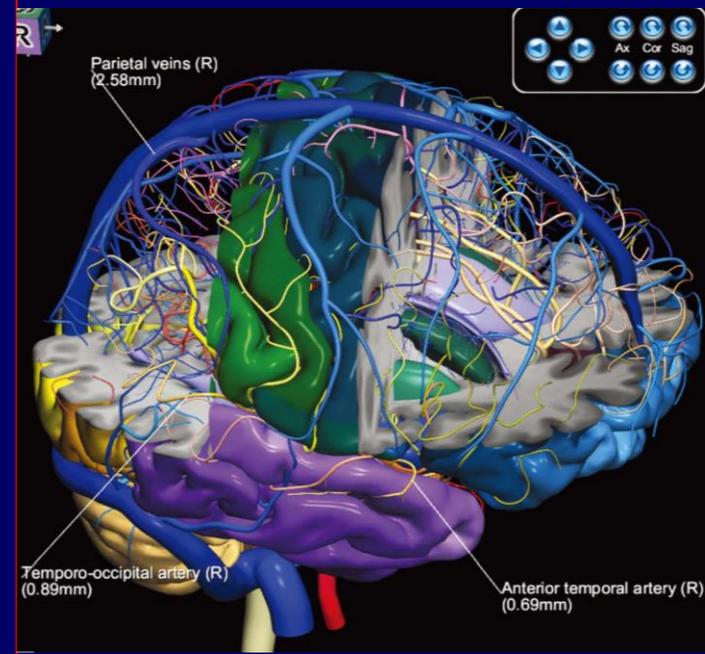


# 颅脑静脉解剖及疾病诊断



# 脑静脉解剖特点

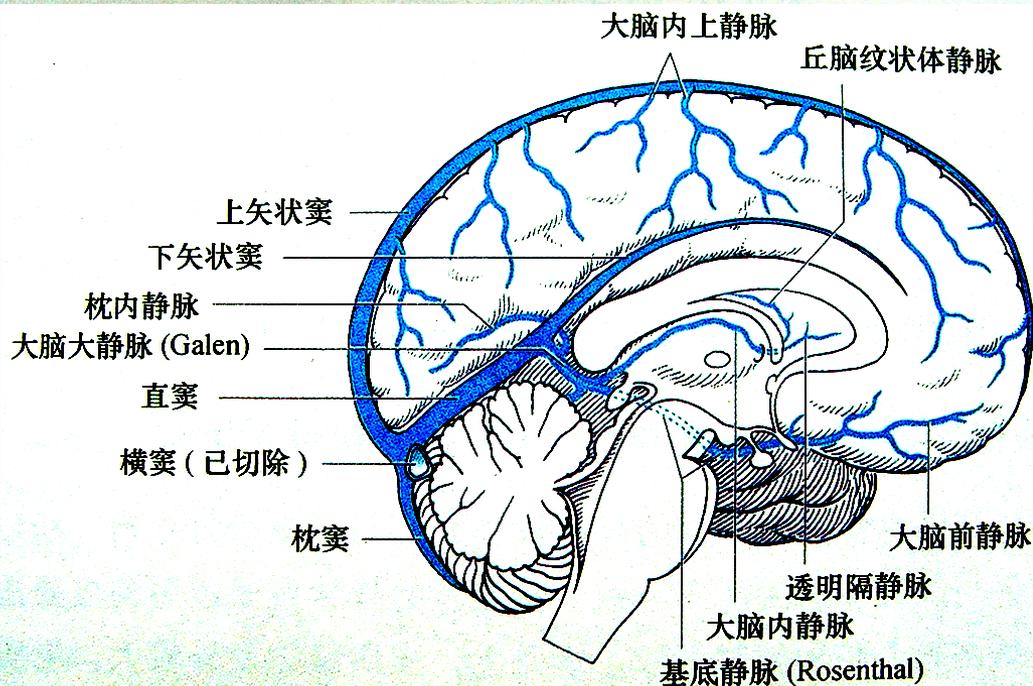
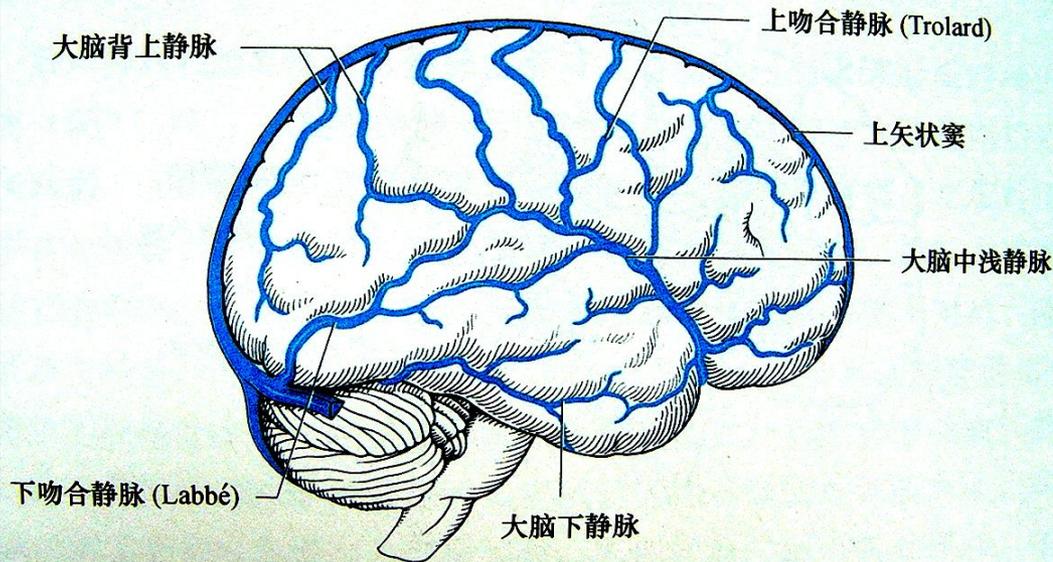
- 多不与动脉伴行  
(大脑中静脉、大脑前静脉伴行)
- 没有瓣膜
- 壁薄无肌层组织
- 穿过蛛网膜和硬膜内层
- 开口于静脉窦
- 软脑膜处形成静脉丛 (吻合支多)
- 变异多





# 组成

- 大脑浅静脉：大脑上静脉  
    大脑中（浅）静脉（Sylvian静脉）  
    大脑下静脉  
    枕内静脉  
    脑底静脉  
  
    （大脑前静脉、大脑中深静脉、纹体下静脉）
- 大脑深静脉：大脑大静脉（Galen静脉）  
    大脑内静脉  
    基底静脉（Rosenthal静脉）
- 硬膜窦：上、下矢状窦，直窦，横窦，乙状窦，海绵窦，  
    岩上、下窦，蝶顶窦，枕窦



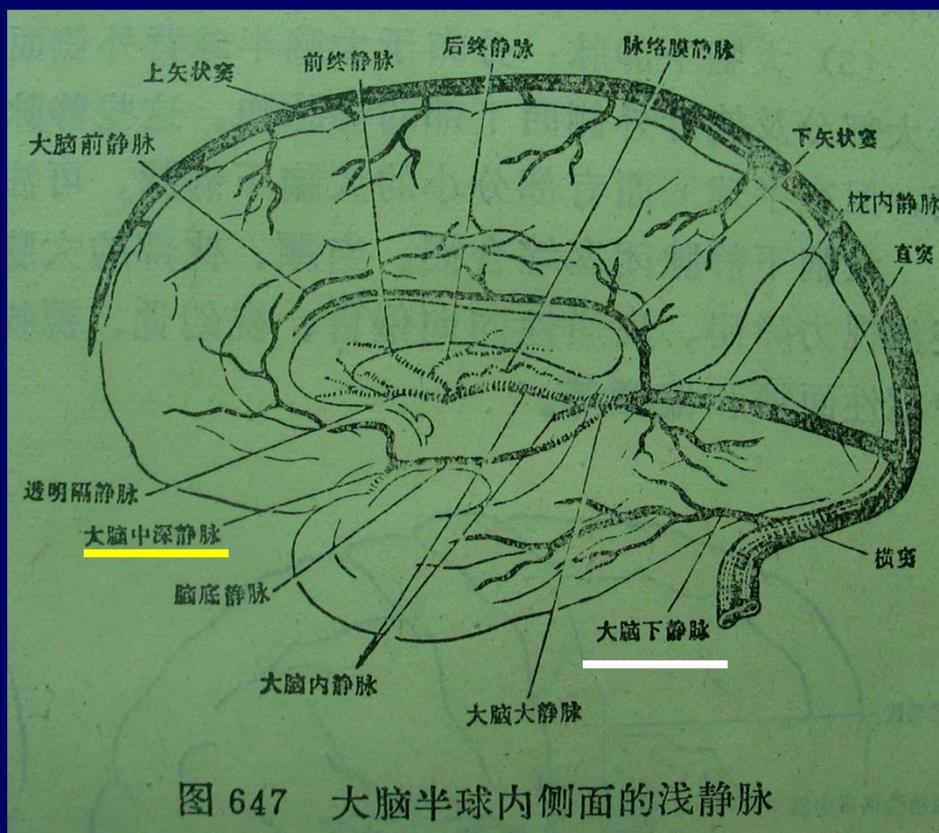
## 大脑浅静脉:

- 大脑上静脉 (背上、内上)
- 大脑中 (浅) 静脉 (Sylvian 静脉)
- 大脑下静脉
- 枕内静脉
- 脑底静脉:

大脑前静脉  
大脑中深静脉  
纹体下静脉

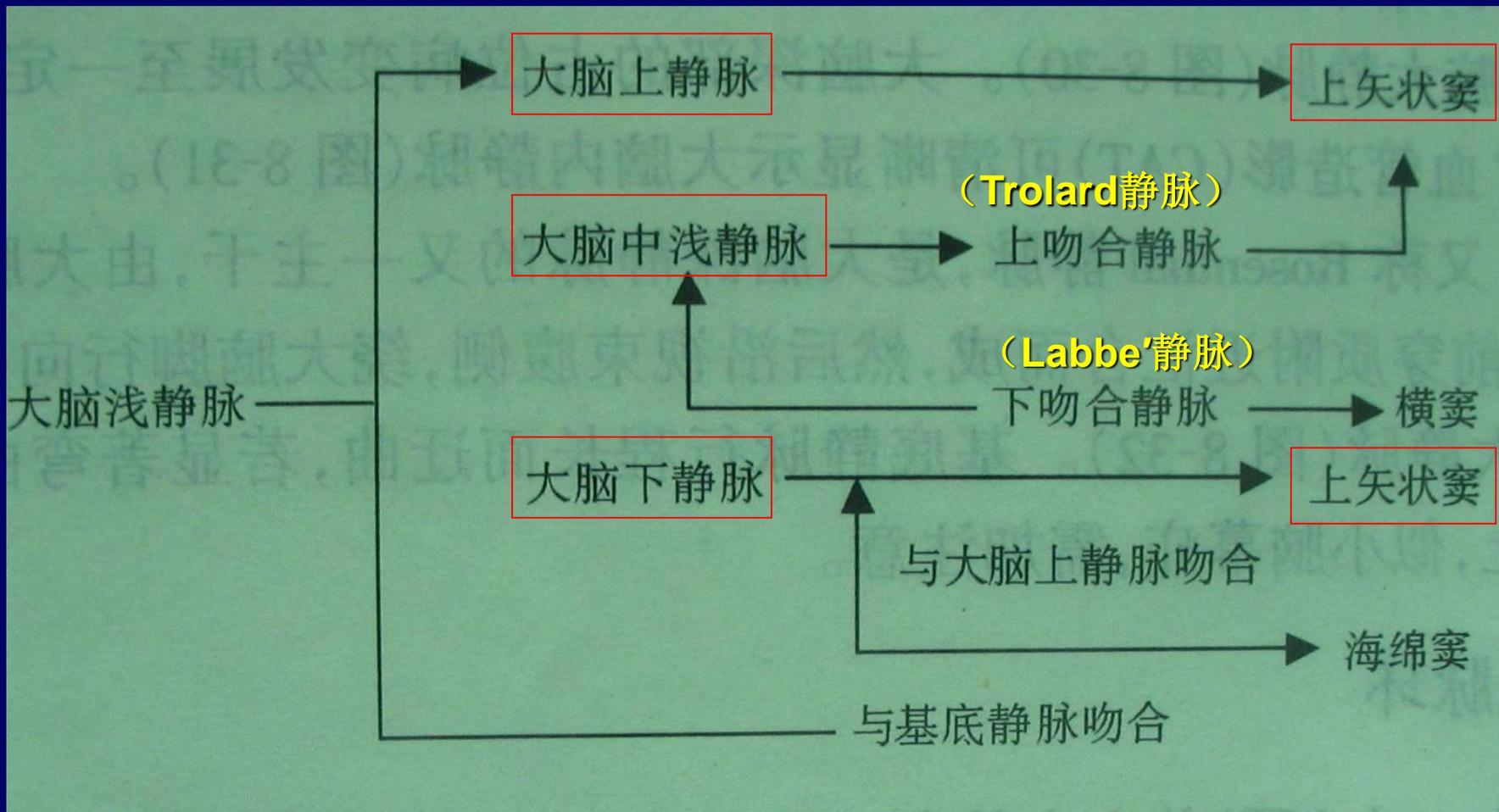
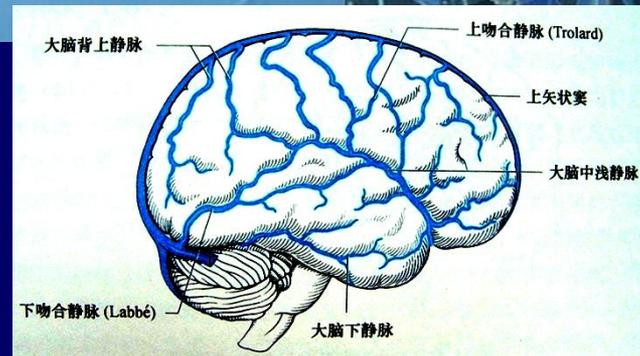


## 大脑中深静脉





# 大脑浅静脉回流示意图



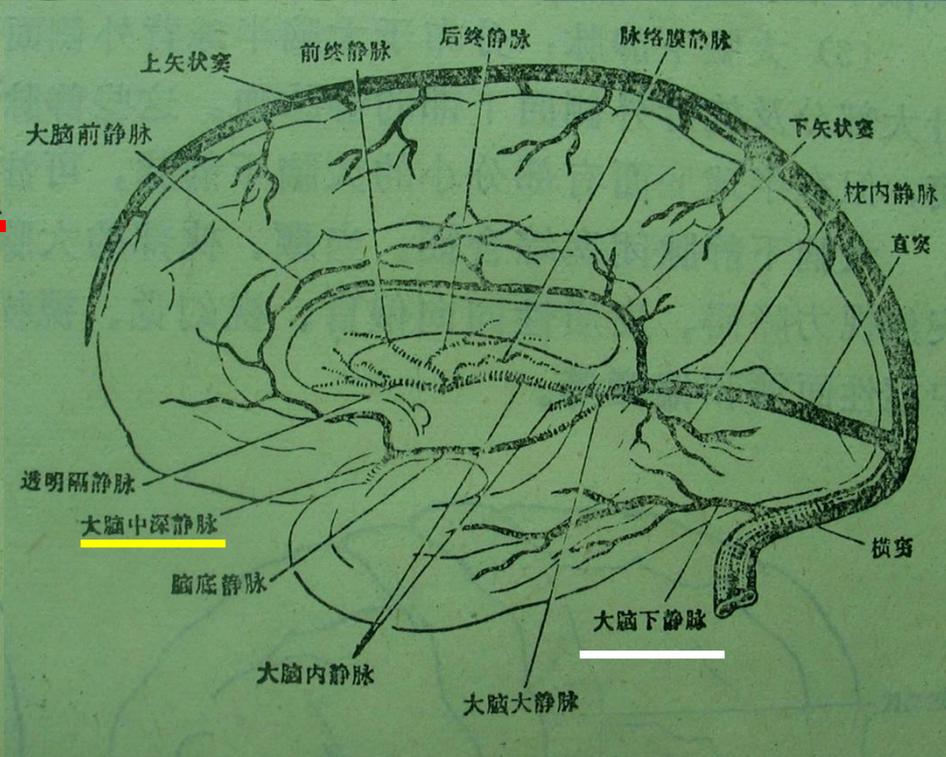
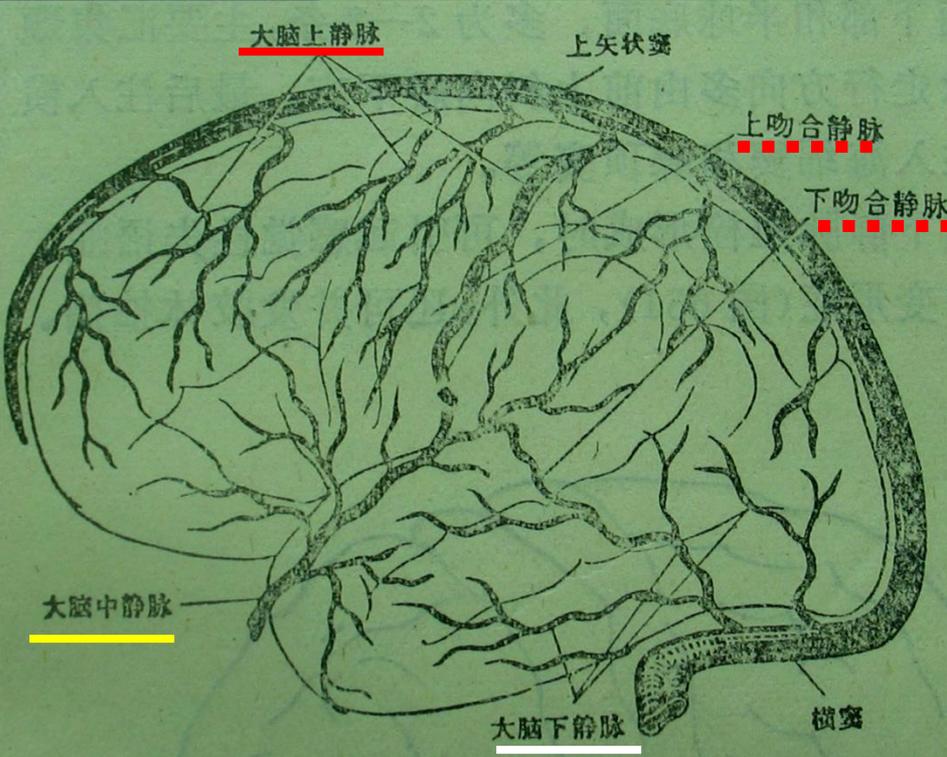
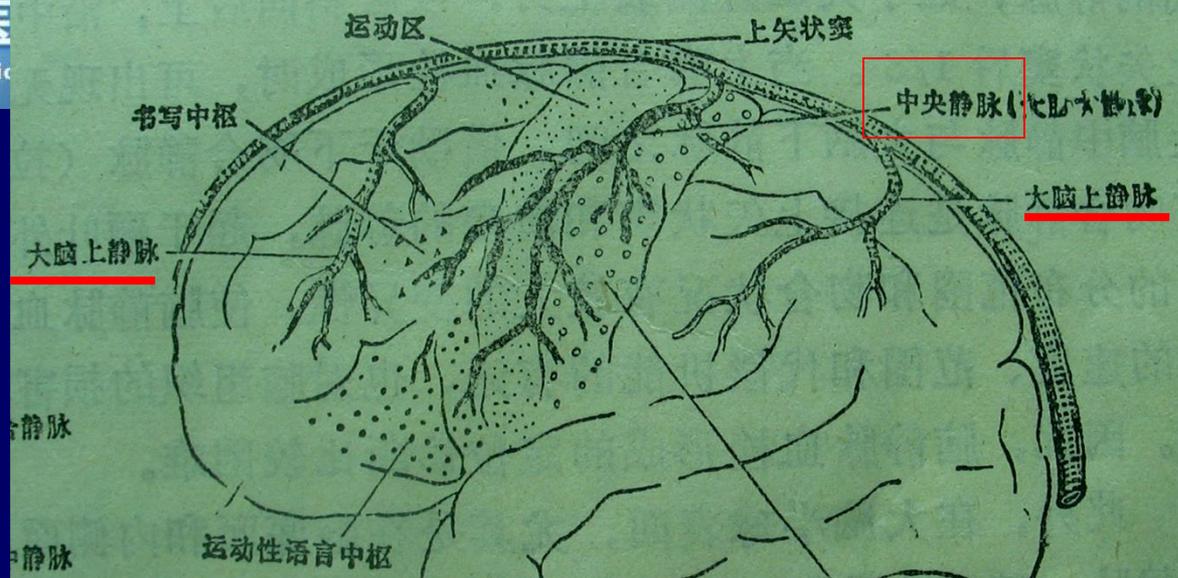
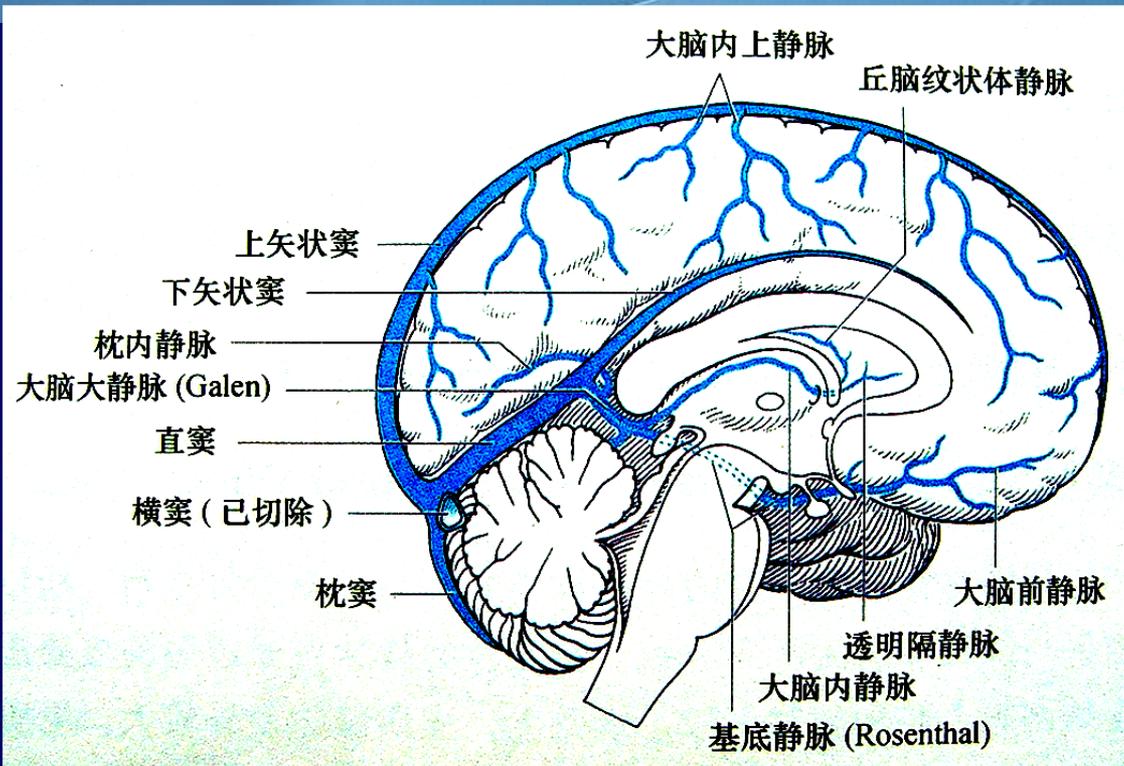


图 646 大脑半球背外侧面的浅静脉

图 647 大脑半球内侧面的浅静脉



## 大脑深静脉:

- 大脑内静脉:

  - 丘脑纹状体静脉 (前终静脉、后终静脉)

  - 透明隔静脉

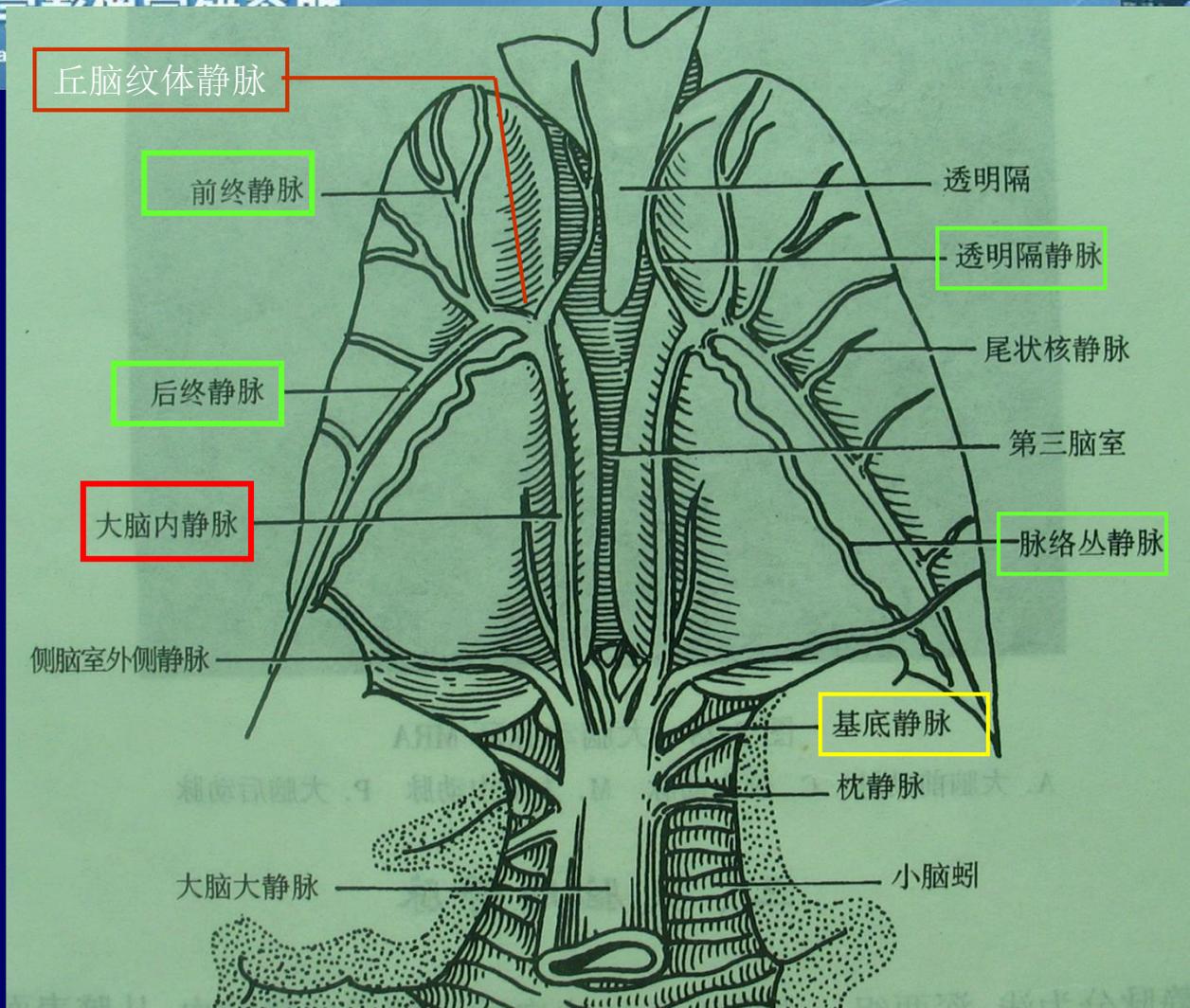
  - 脉络膜静脉

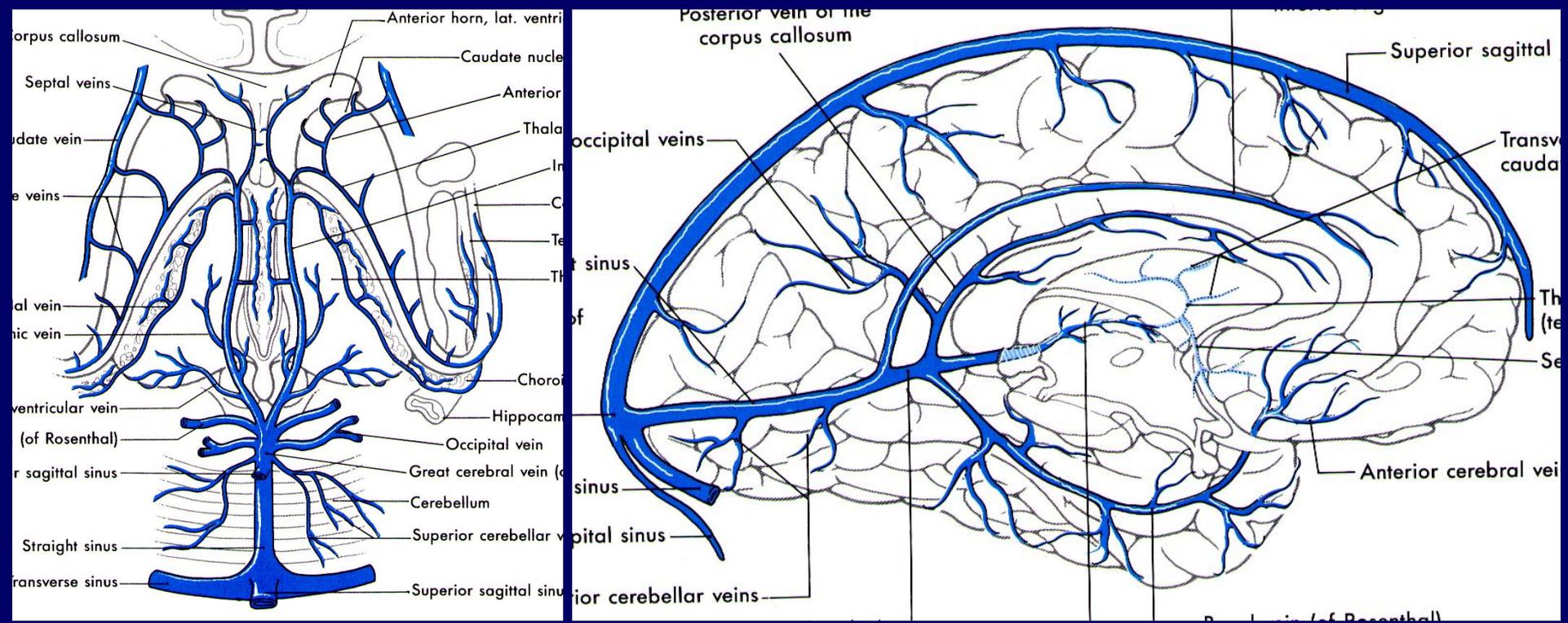
- 大脑大静脉 (Galen静脉)

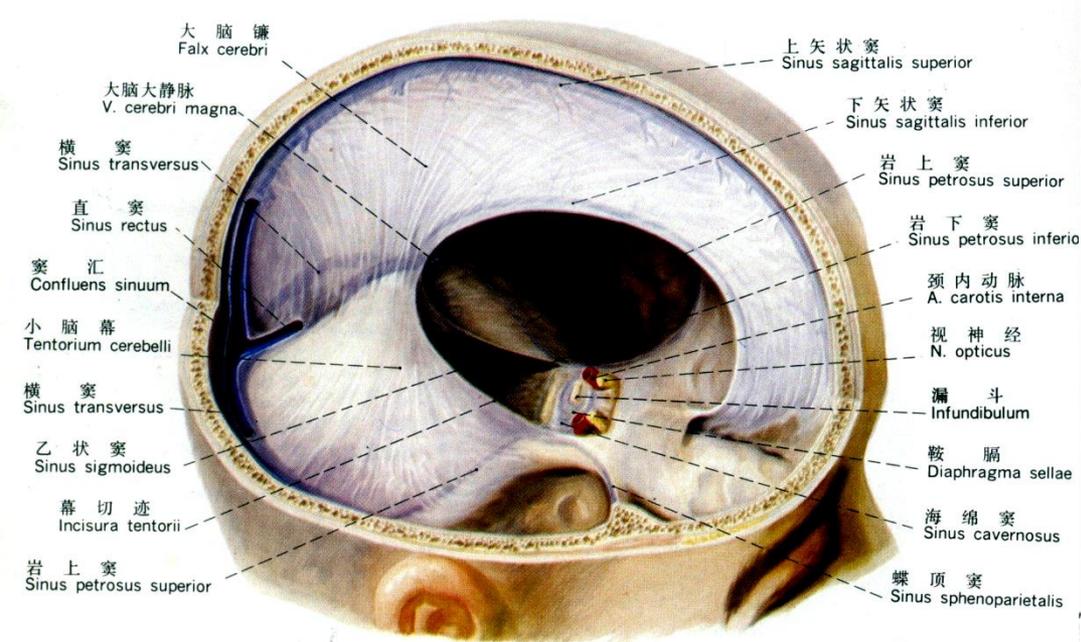
- 基底静脉 (Rosenthal静脉)



# 深静脉回流示意图







右侧面观  
Right lateral aspect

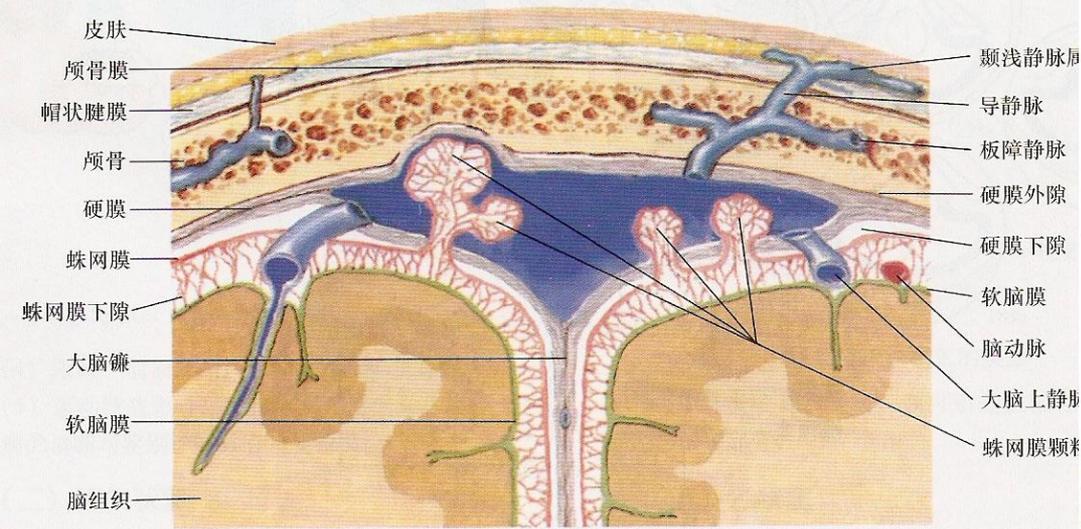
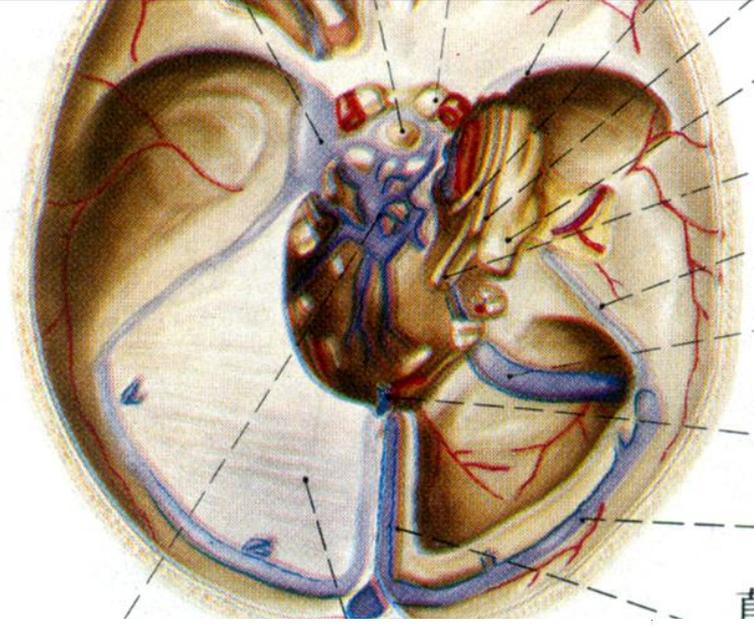
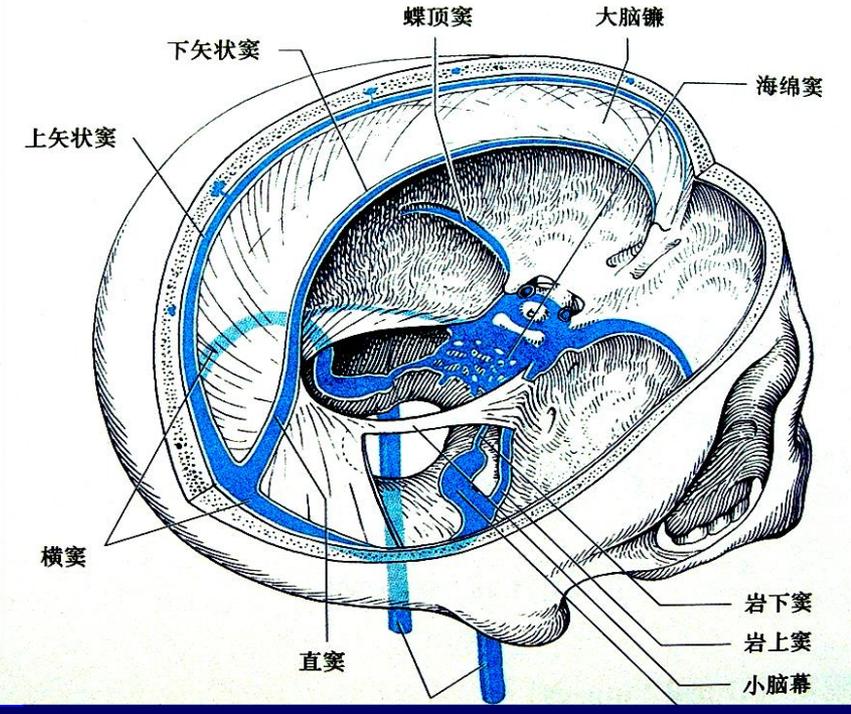


图 13-206 硬膜窦的组成

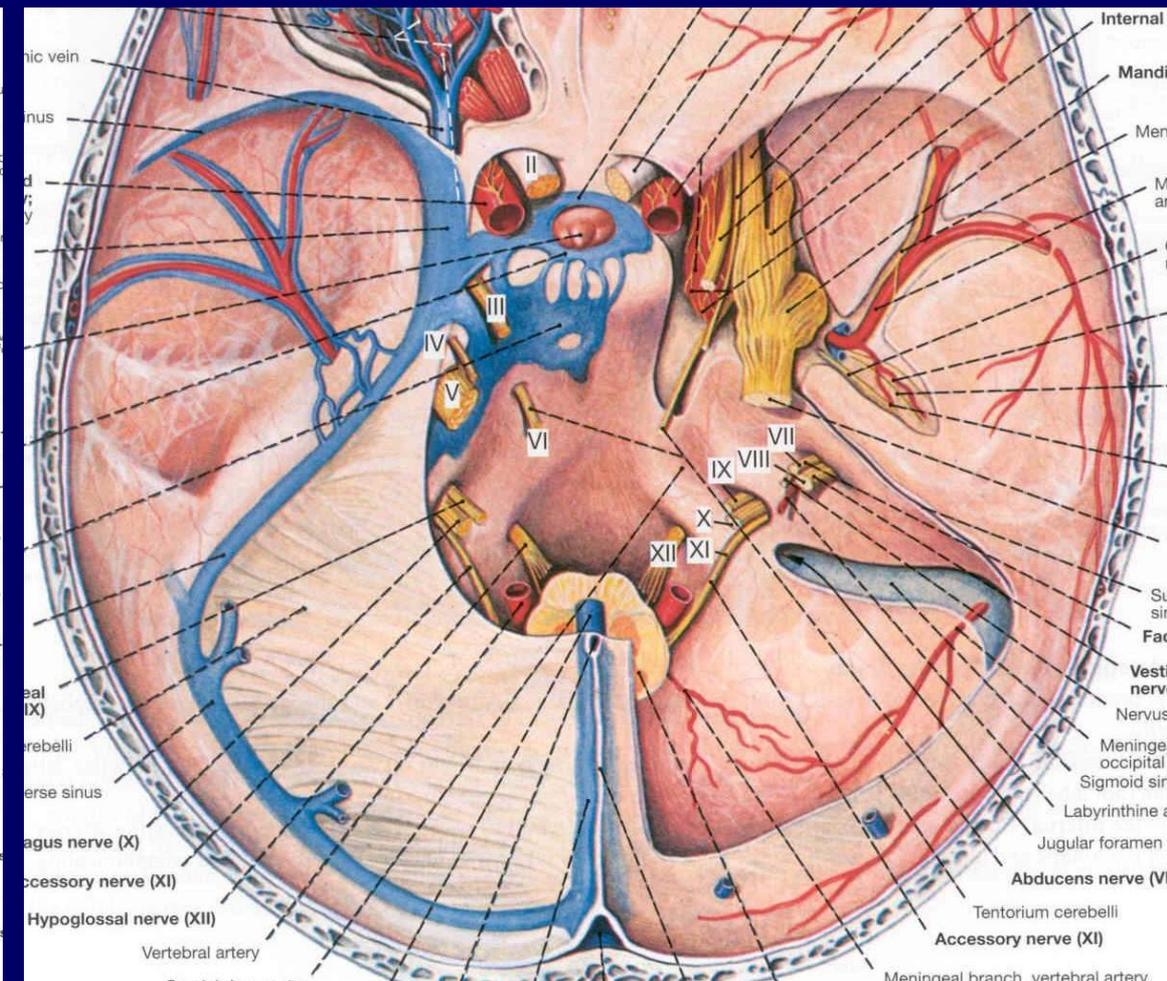
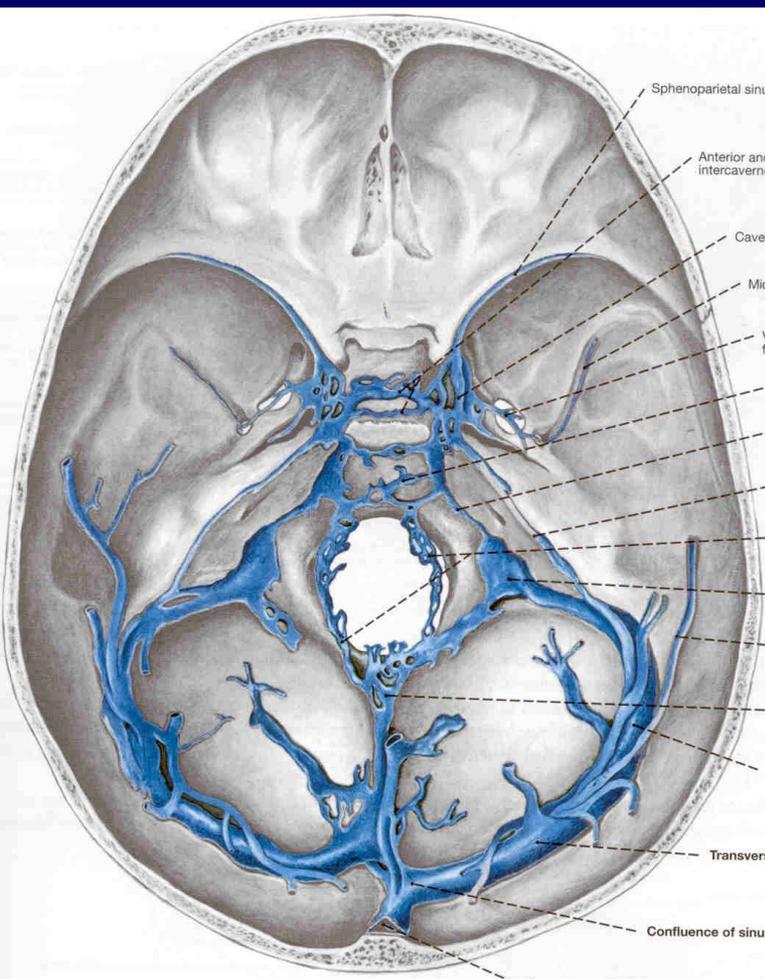


静脉窦：上、下矢状窦，直窦，横窦，乙状窦，岩上、下窦，海绵窦，蝶顶窦，枕窦



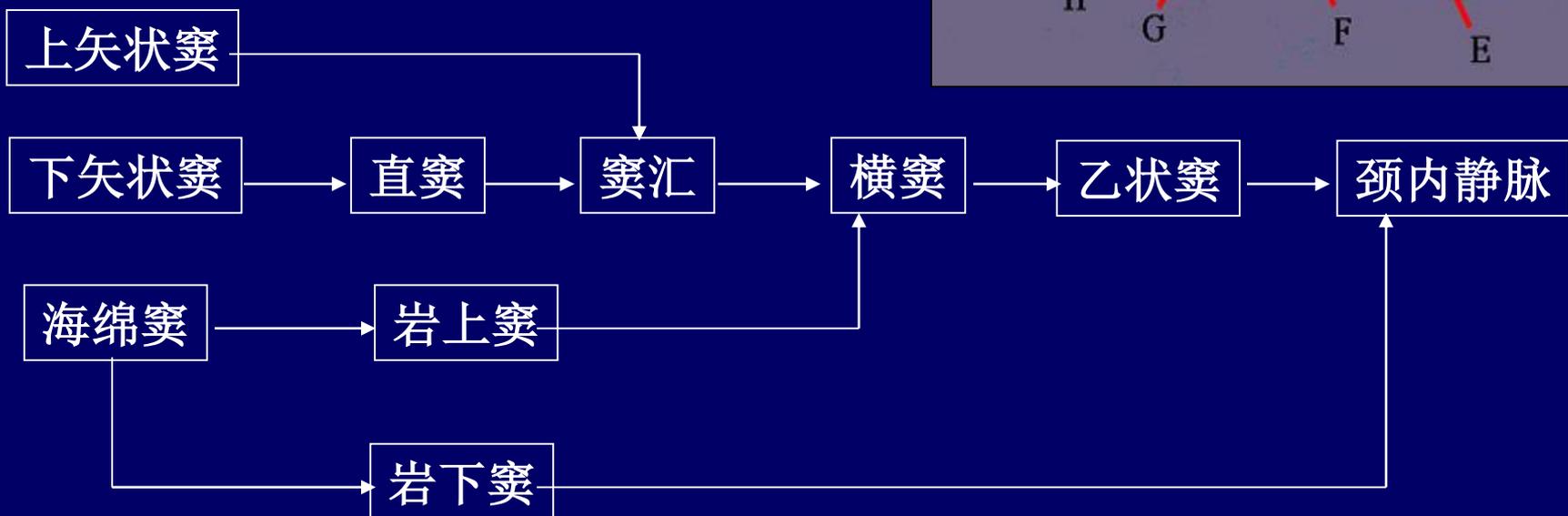
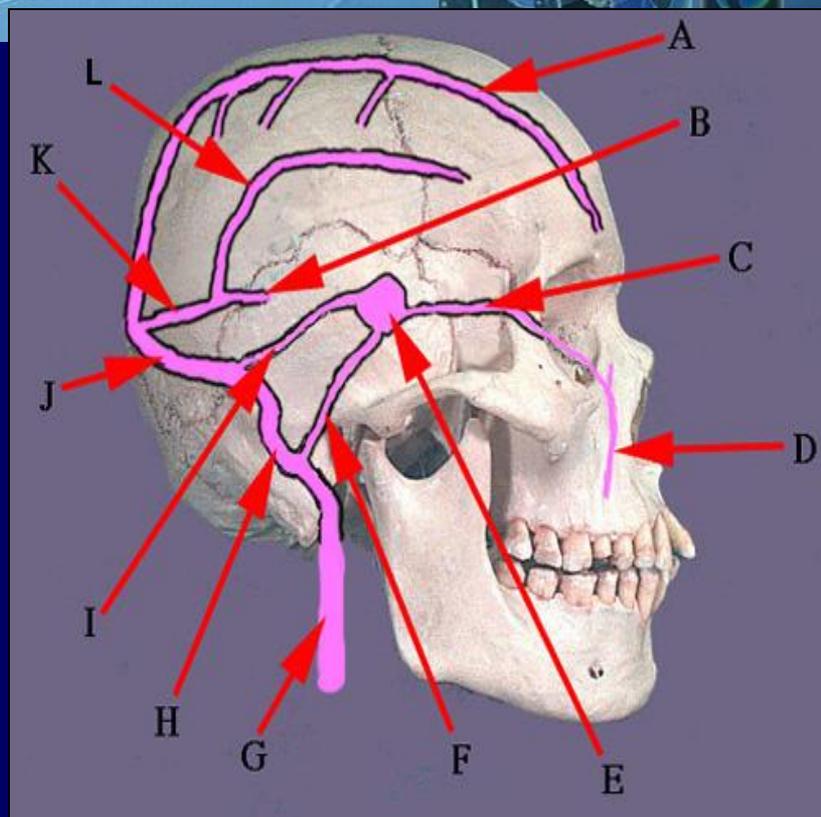
# 山东省医学影像学研究所

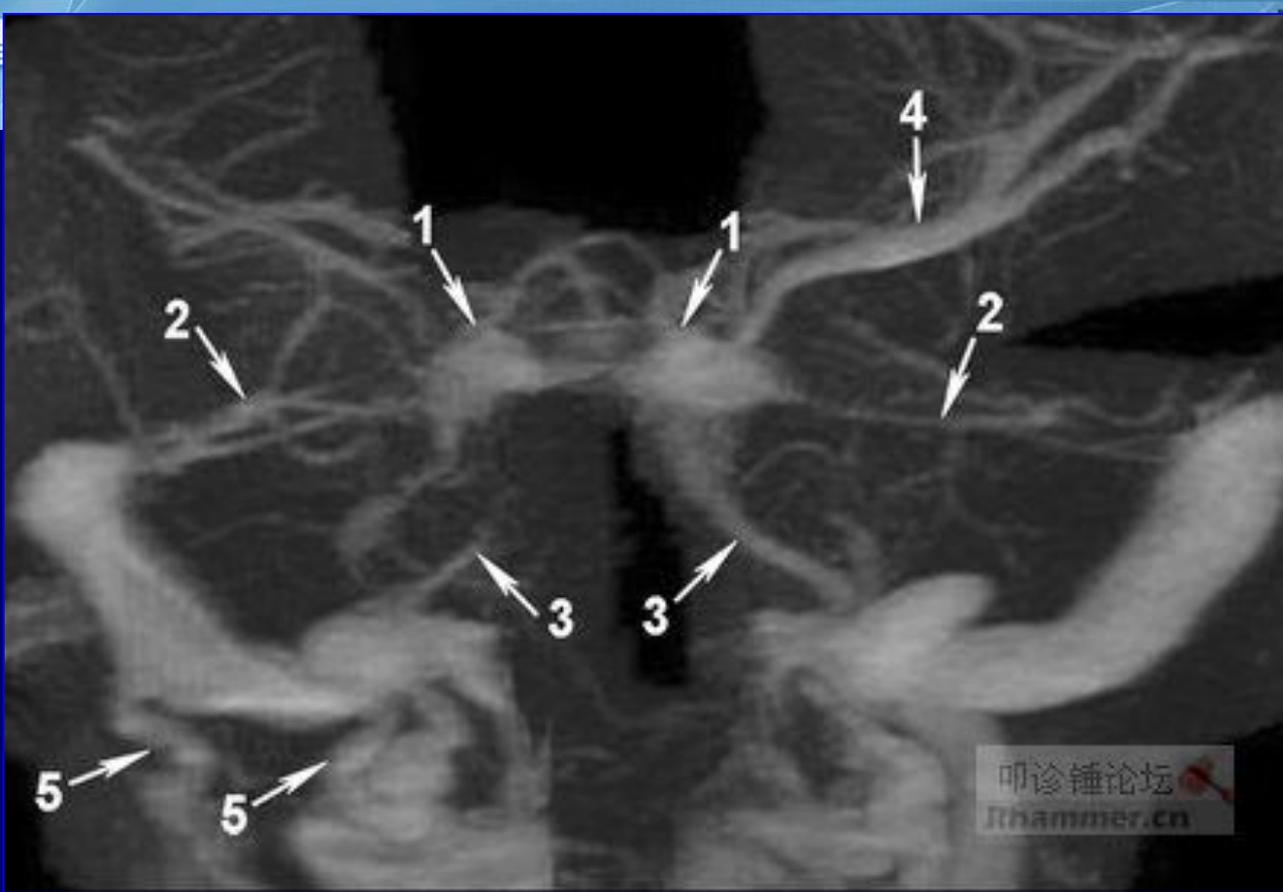
Shandong Medical Imaging Research Institute





# 静脉窦回流示意图





基底硬脑膜窦（为更好显示，去除了深浅静脉）

- 1、海绵窦
- 2、岩上窦
- 3、岩下窦
- 4、大脑中（浅）静脉
- 5、导静脉与枕静脉丛



# 脑底静脉环 (Rosenthal环)

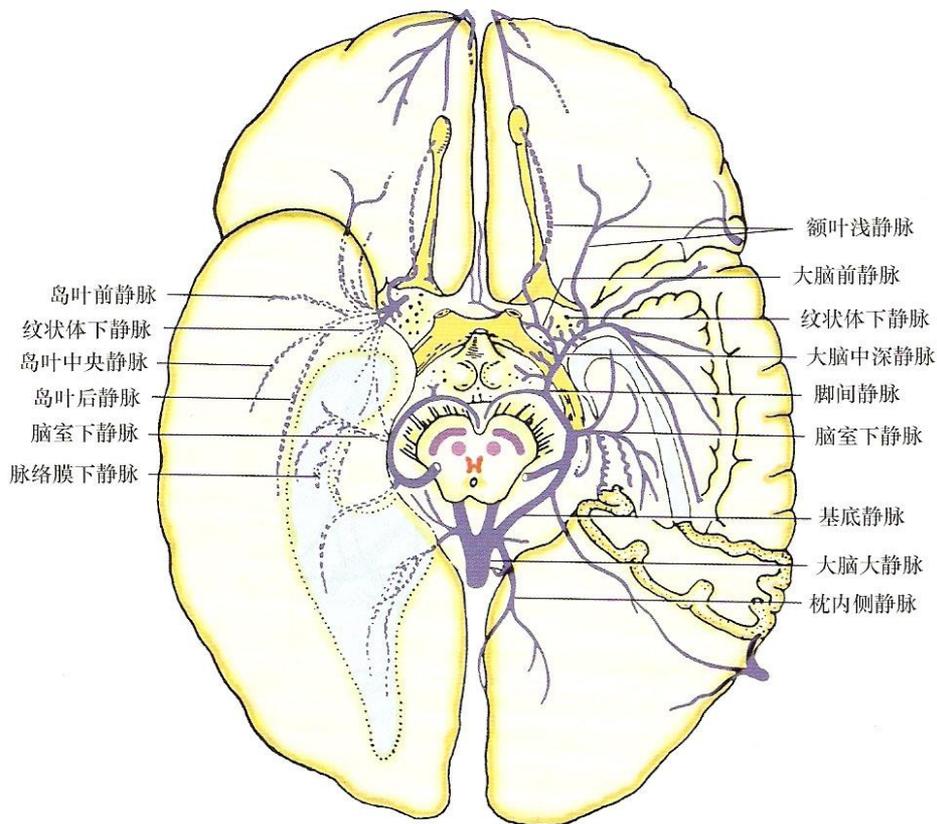
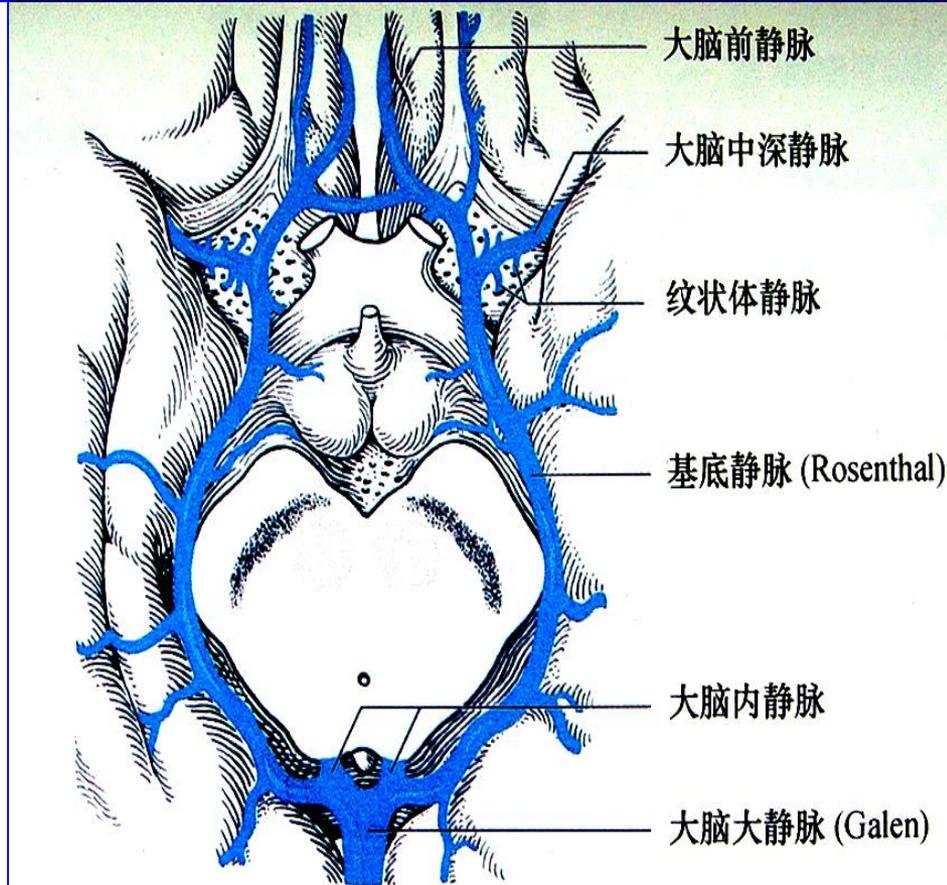


图 13-205 基底静脉系 (脑底面)



前方：前交通静脉连接左、右大脑前静脉  
后方：后交通静脉连接左、右大脑脚静脉  
两侧：基底静脉



## 脑的浅深静脉吻合

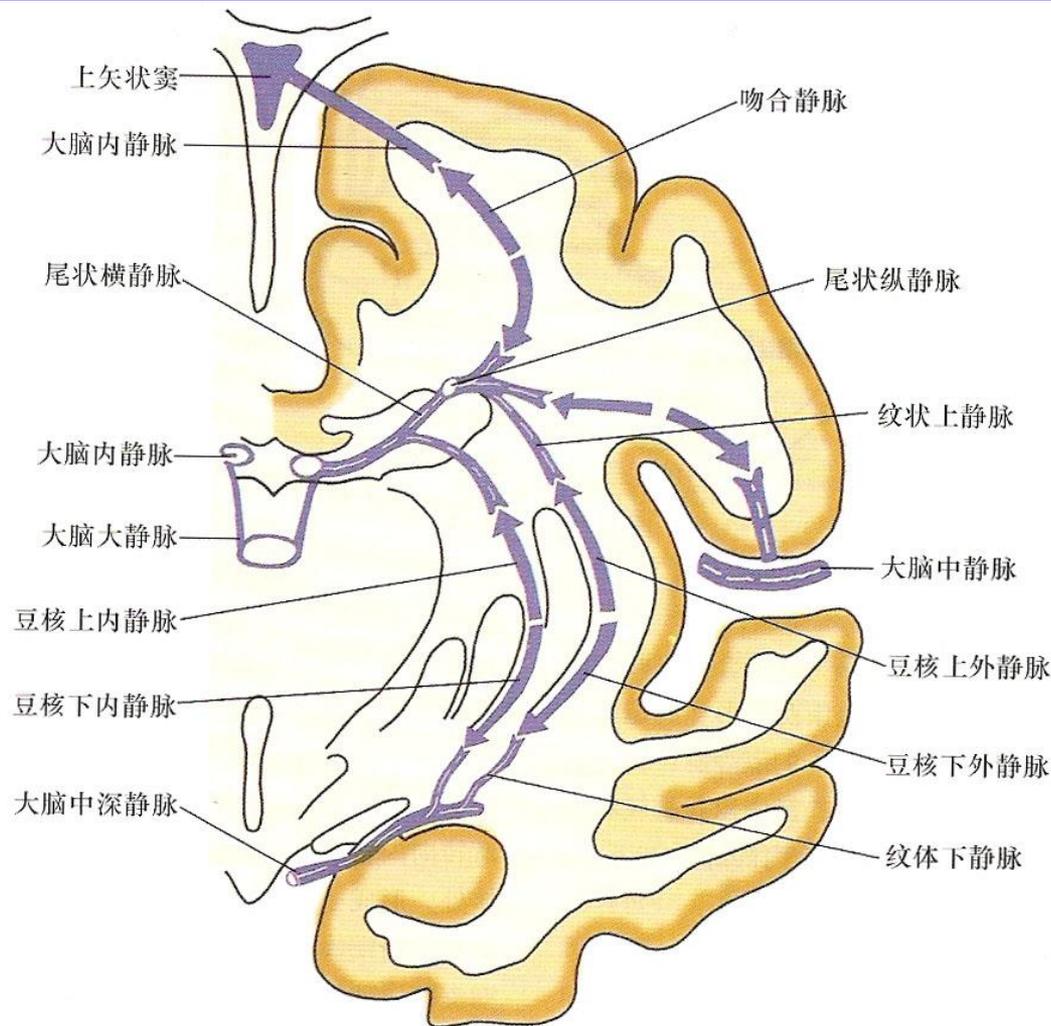
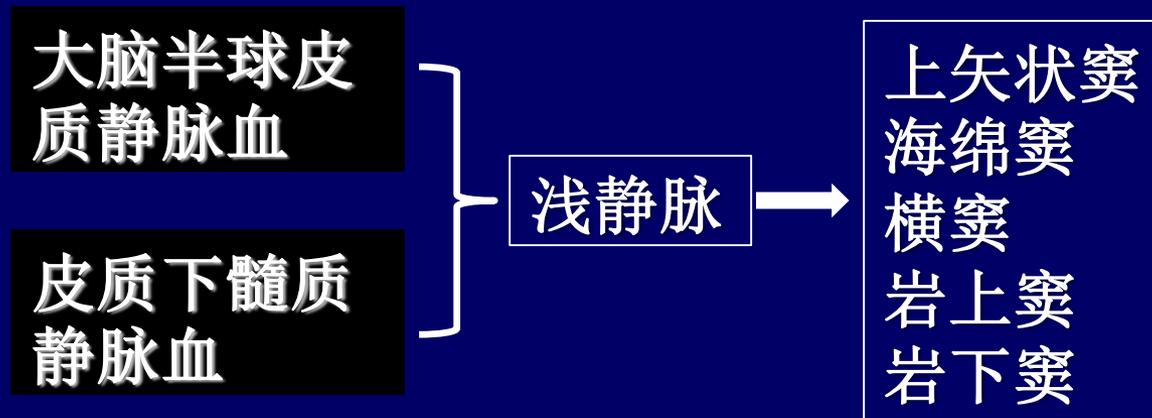


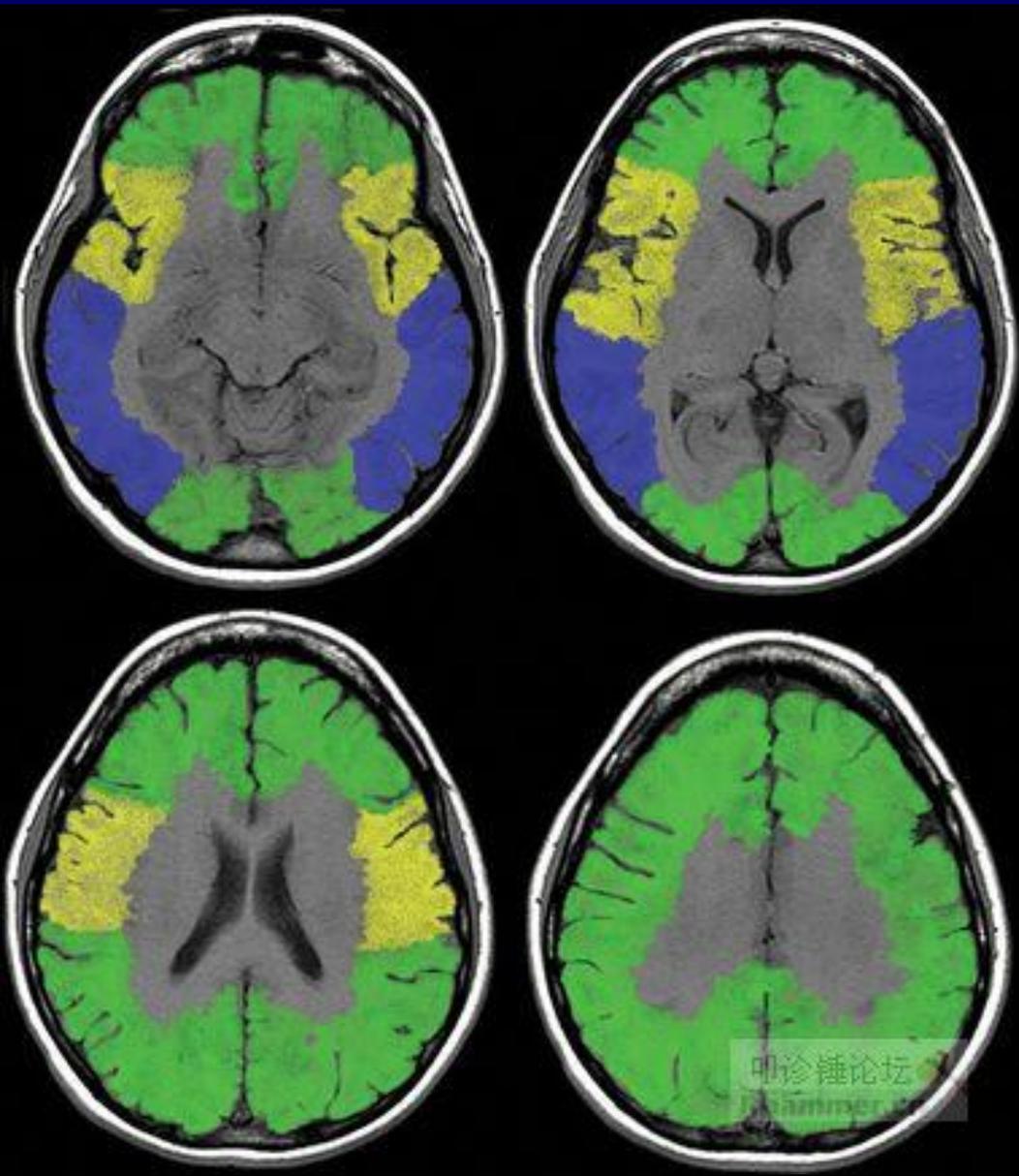
图 13-198 大脑浅、深静脉吻合 (额状切面)



# 浅静脉引流区域

- **浅静脉**收集皮质及皮质下髓质的静脉血





皮层引流静脉的引流区域：

- ◆绿色：汇入上矢状窦
- ◆黄色：汇入蝶顶窦再至海绵窦
- ◆蓝色：汇入横窦



蝶顶窦至海绵窦

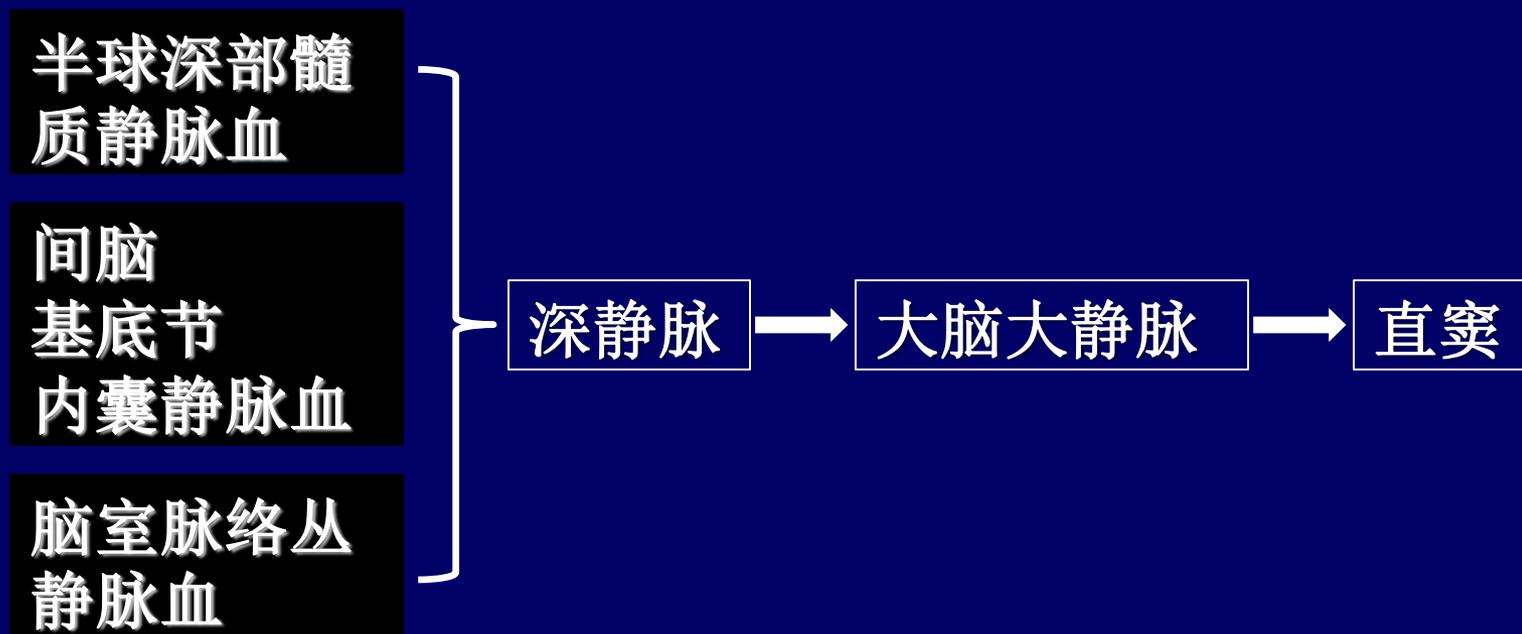
Labbe静脉  
至横窦

大脑上静脉  
至SSS



# 深静脉引流区域

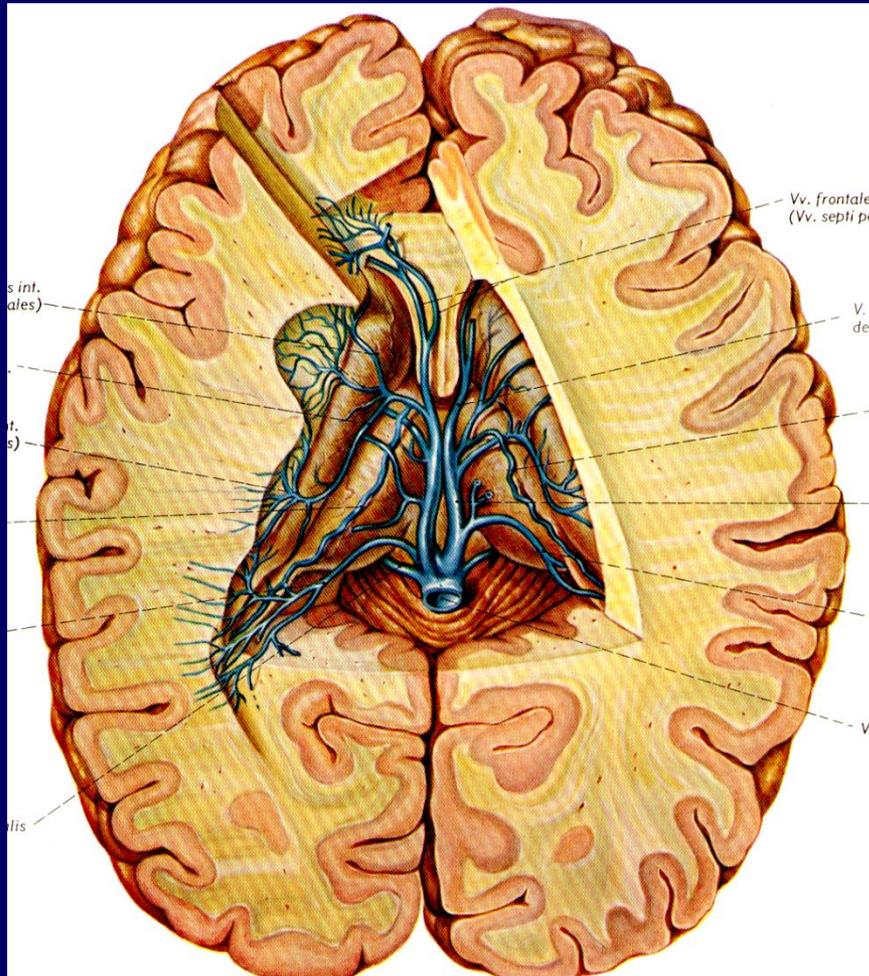
- 深静脉收集深部髓质、基底核、内囊、间脑、脑室脉络丛静脉血，最后汇成一条**大脑大静脉**汇入**直窦**





## 深部静脉的引流区域:

- 紫色: 大脑内静脉  
**Galen静脉**
- 蓝色: 髓静脉





蝶顶窦至海绵窦

Labbe静脉  
至横窦

- 髓静脉、室管膜下静脉至颈内静脉；
- 大脑中深静脉至基底静脉

大脑上静脉  
至SSS



# 脑静脉影像学检查方法

## ● 非创伤性检查方法

头颅X线平片（CR、DR，价值小）

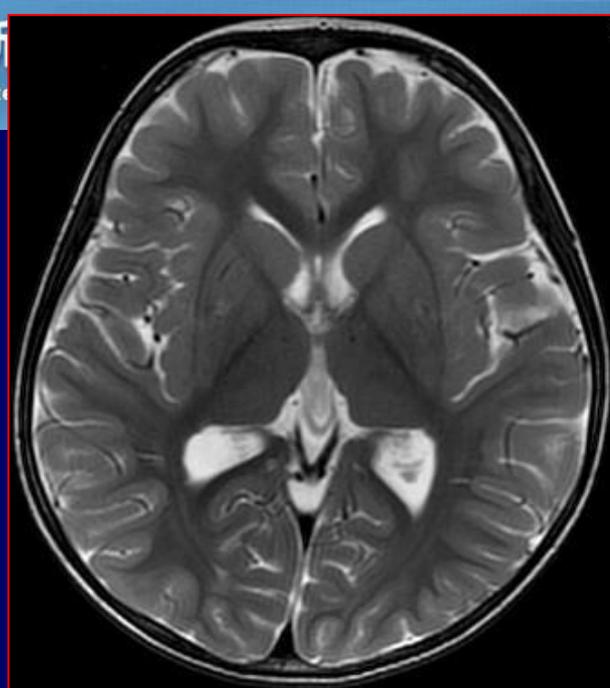
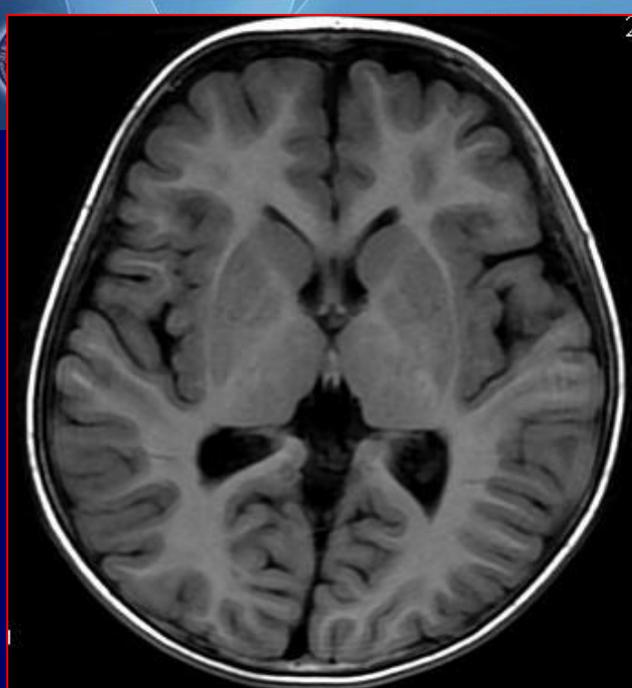
CT（平扫CT、增强CT、CTV）

MRI（平扫MRI、增强MRI、MRV）

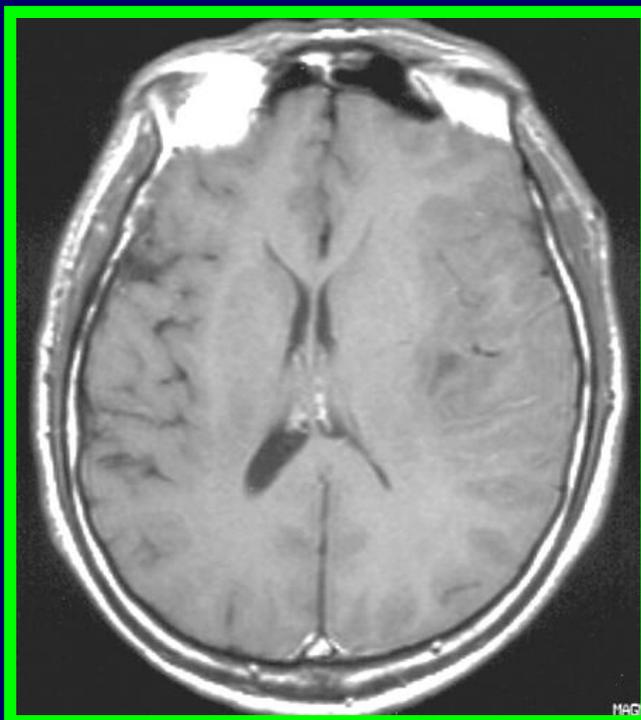
## ● 创伤性检查方法

数字减影血管造影（DSA）

**MRI+MRV ≥ DSA > CT > X线**



MR平扫：  
流空效应

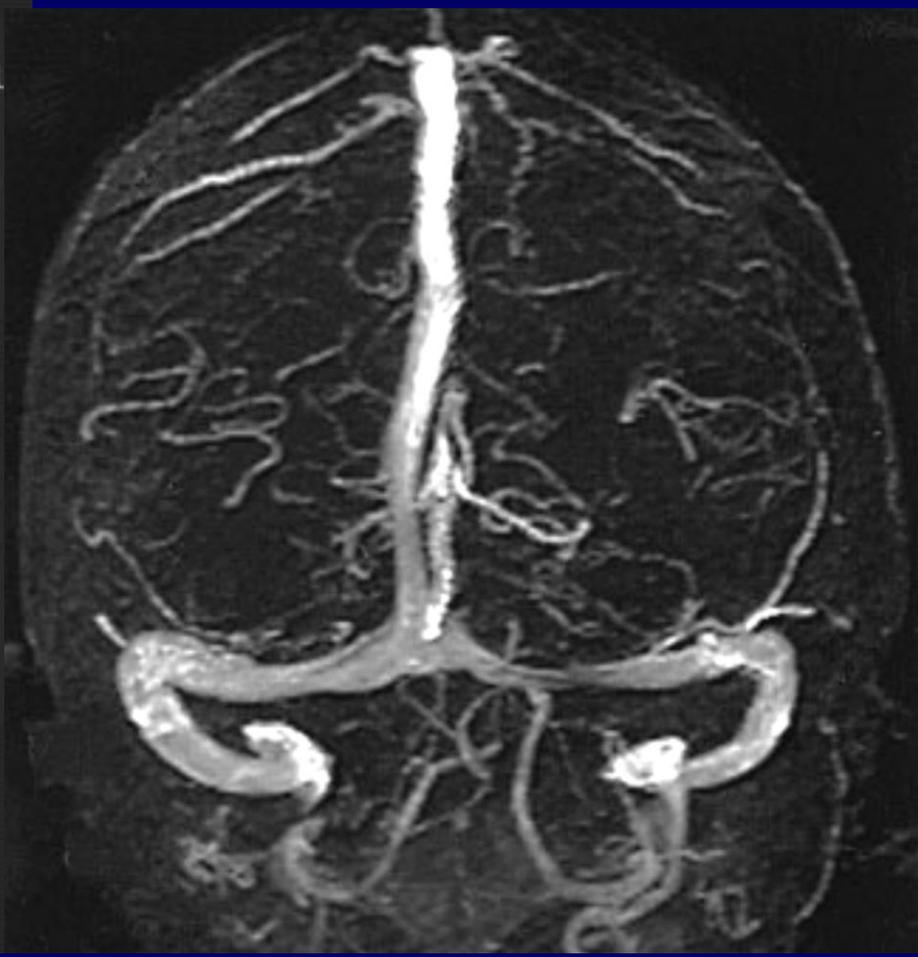
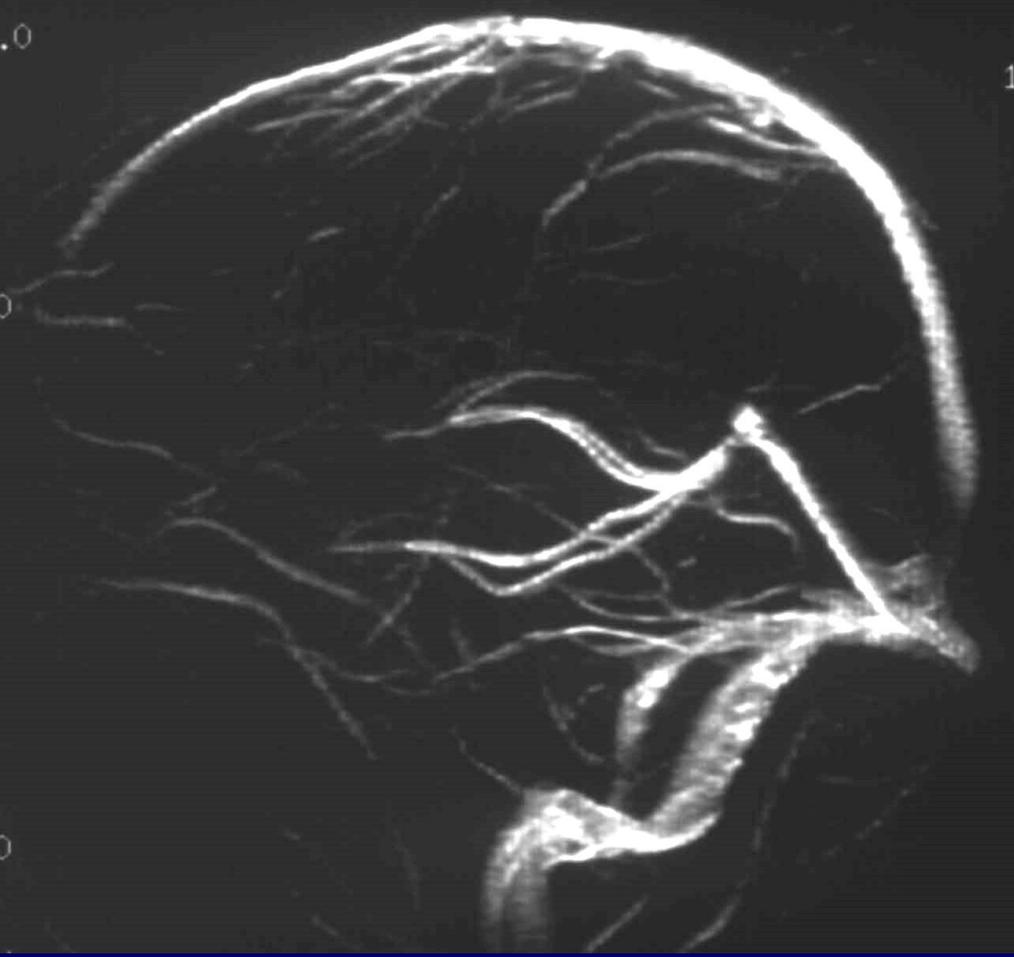


增强扫描：  
均匀强化



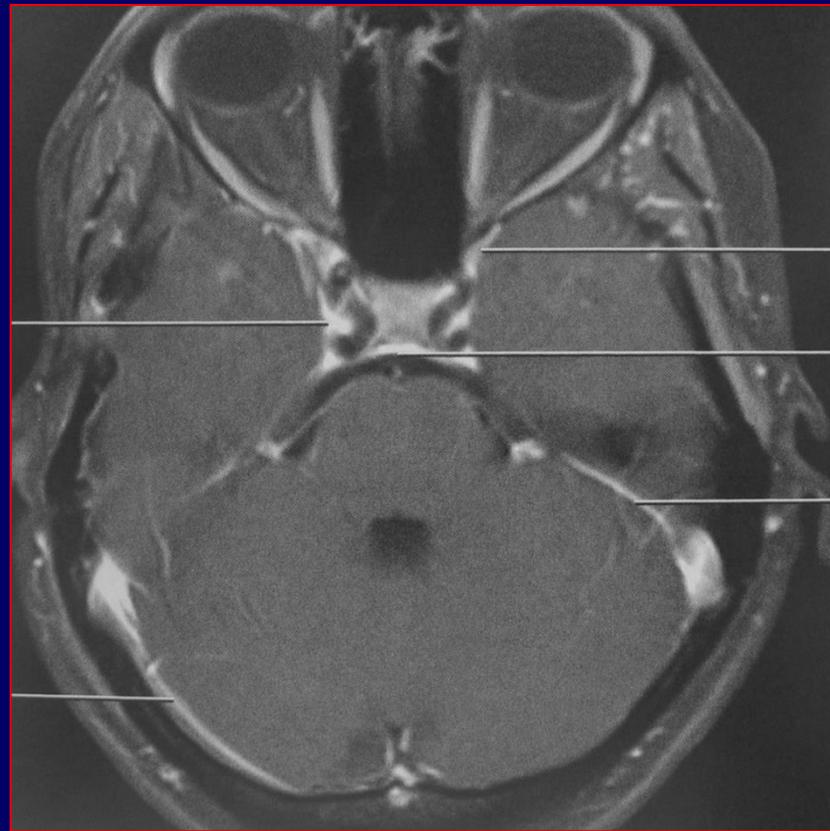
# MRV

## 下矢状窦显示率低





# 优势引流



- 鉴别点：
- 1.引流区域脑组织有无肿胀、出血、梗死；
  - 2.静脉有无异常增多，**C+**更宜于观察；
  - 3.静脉窦流空效应是否存在？有无血栓？  
**C+**有无充盈缺损？（自然、通畅）



# 疾病诊断



搏动性耳鸣



颈静脉球高位可影响到中耳结构，导致传导性耳聋。也可以合并内耳畸形，而产生内耳功能障碍：传导性耳聋、血管性耳鸣等





# 右侧乙状窦憩室

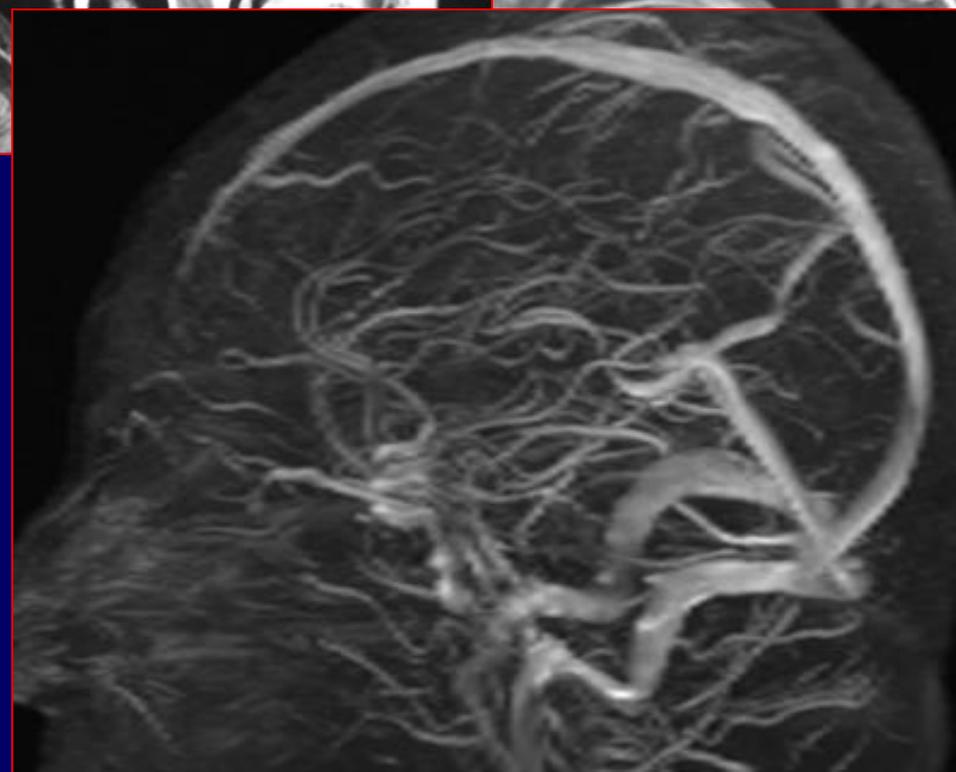
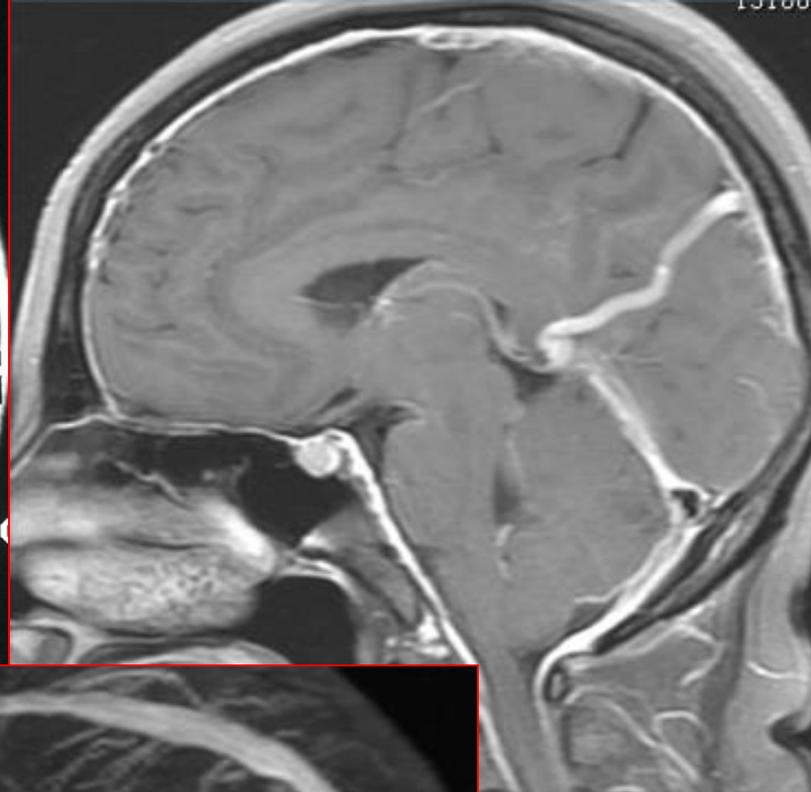


男，45y，右耳搏动性耳鸣7-8年



LSE/M  
SI 10

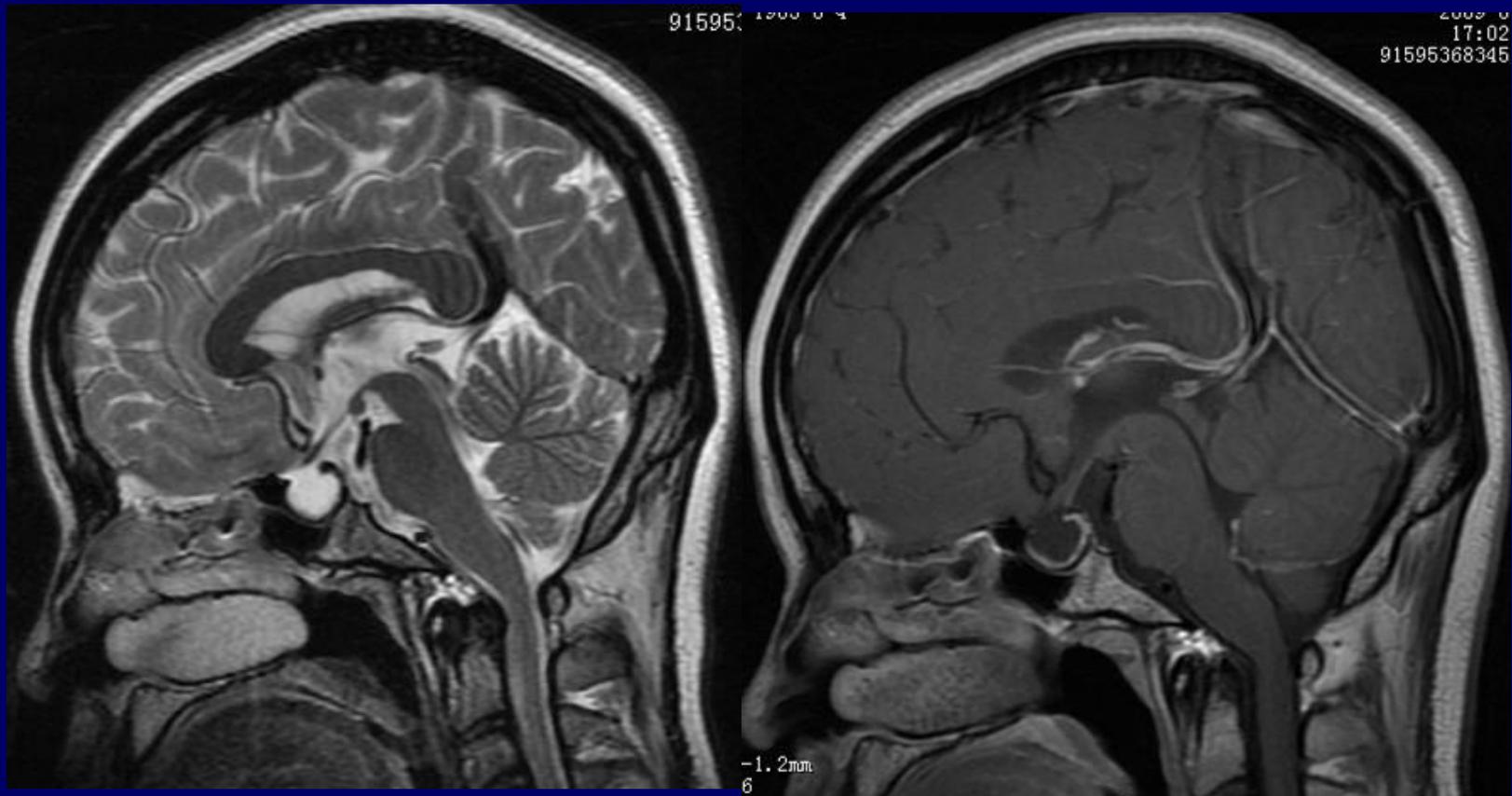
13180

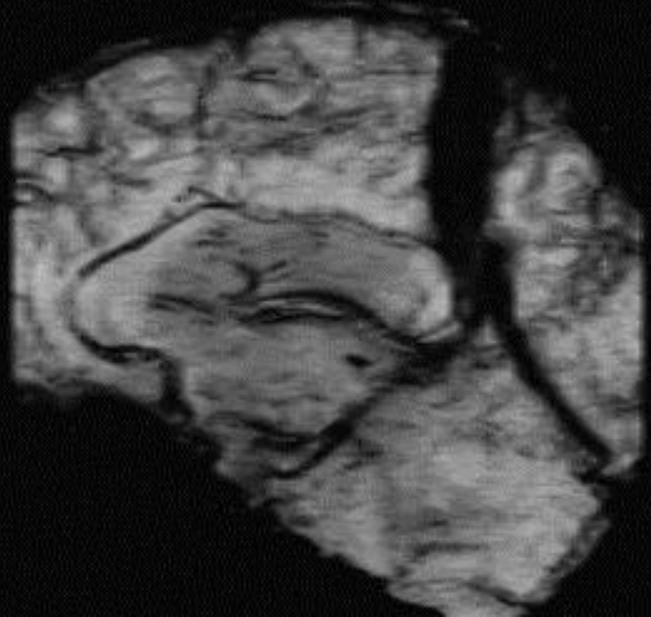
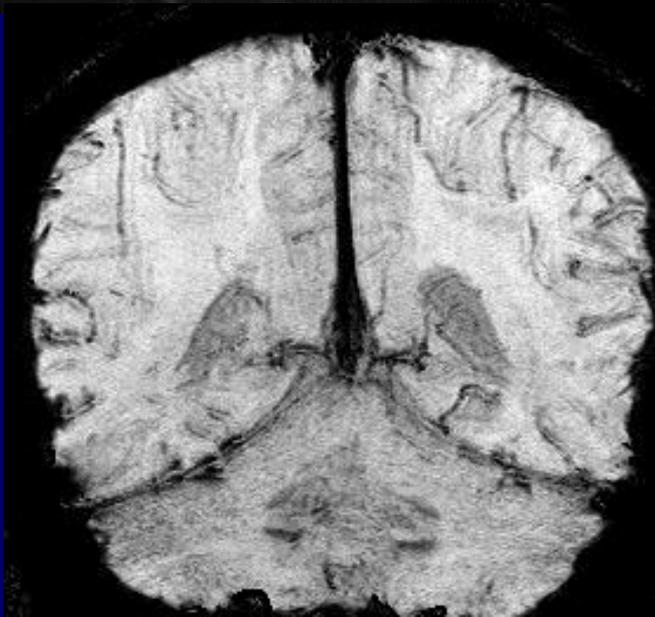
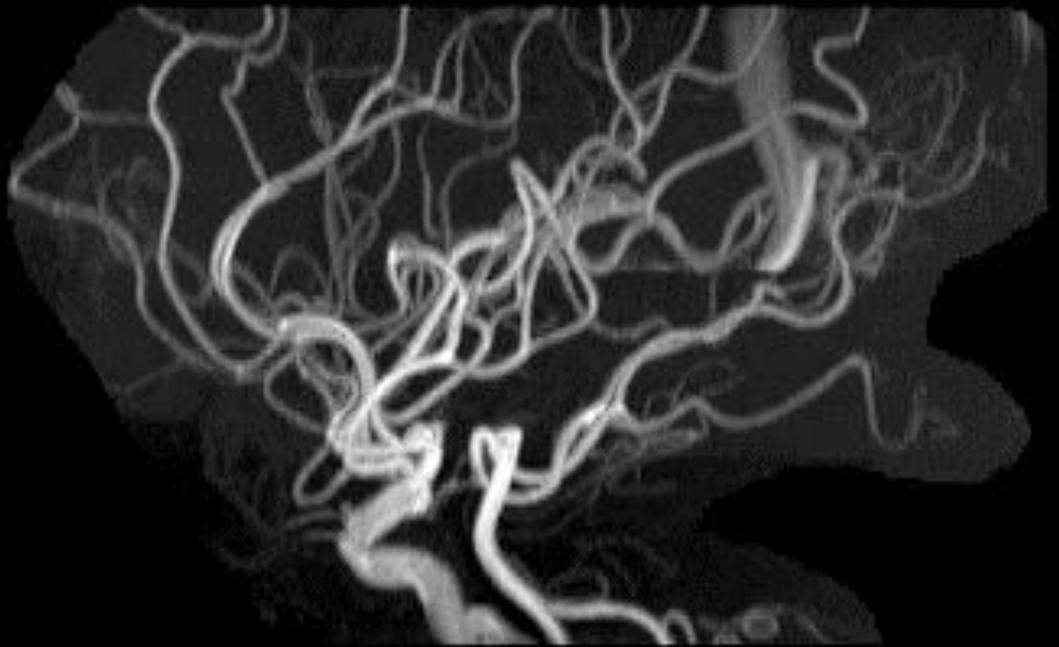




# 永存镰状窦(falcine sinus)

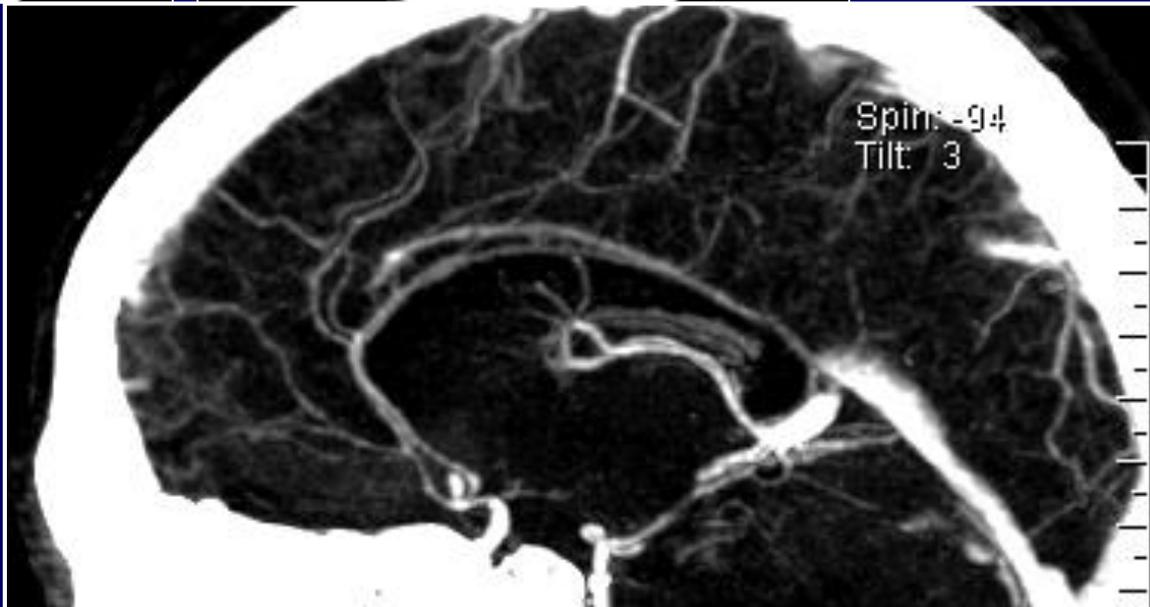
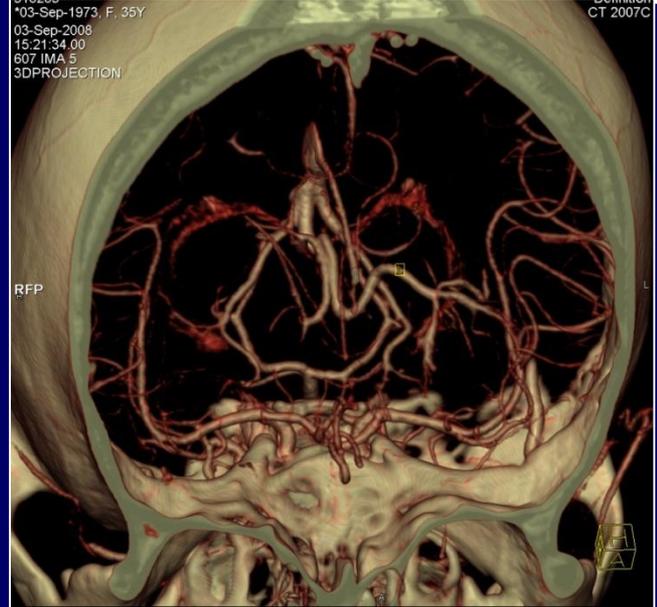
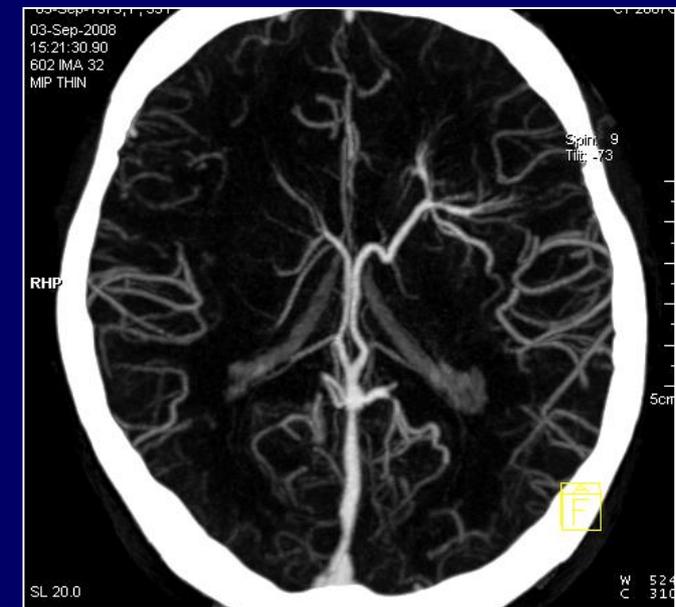
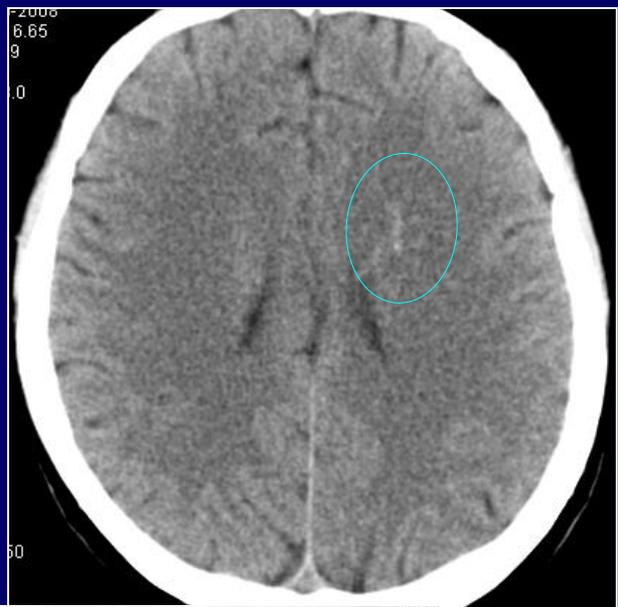
- 胎儿期颅内正常的静脉窦, 连接**大脑大静脉** (vein of galen) 与**上矢状窦后份**之间的硬脑膜静脉通道, 由2层硬脑膜构成
- 正常情况出生后即关闭, 如果持续存在至出生后, 称为永存镰状窦, 常伴随大脑大静脉异常







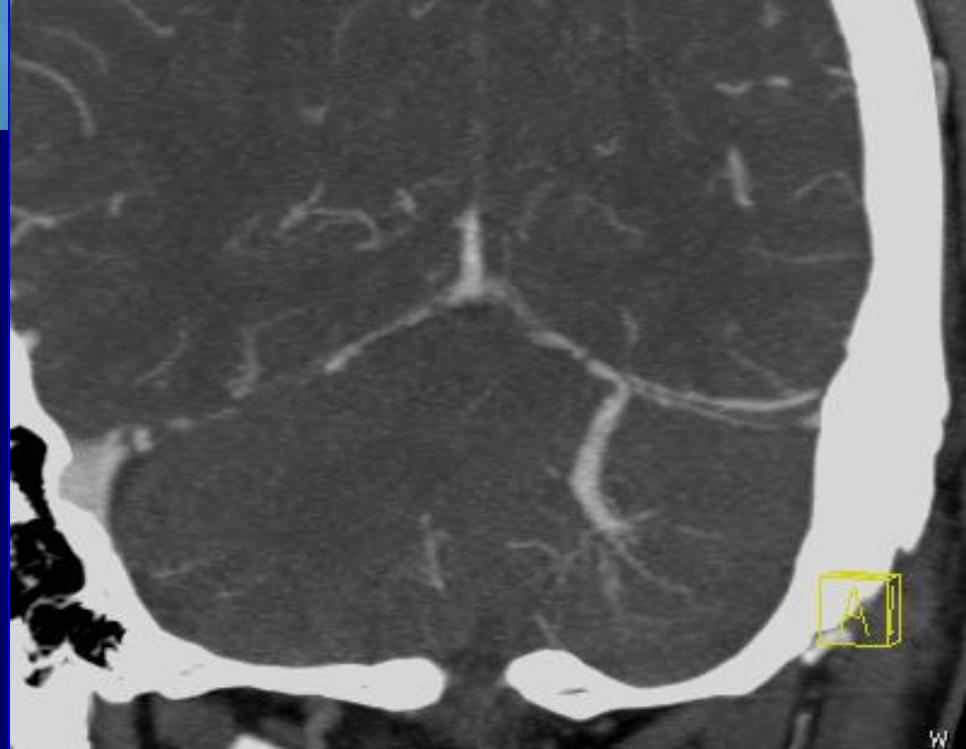
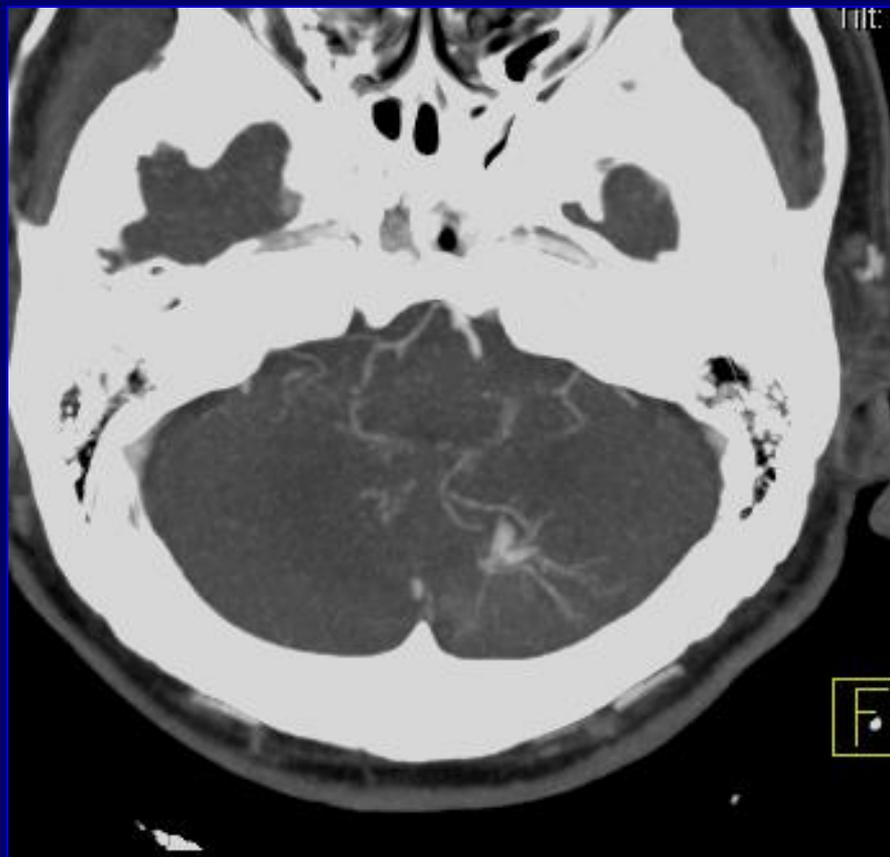
# 静脉瘤，发育性静脉畸形





## *Developmental venous anomalies (also known as venous angiomas)*

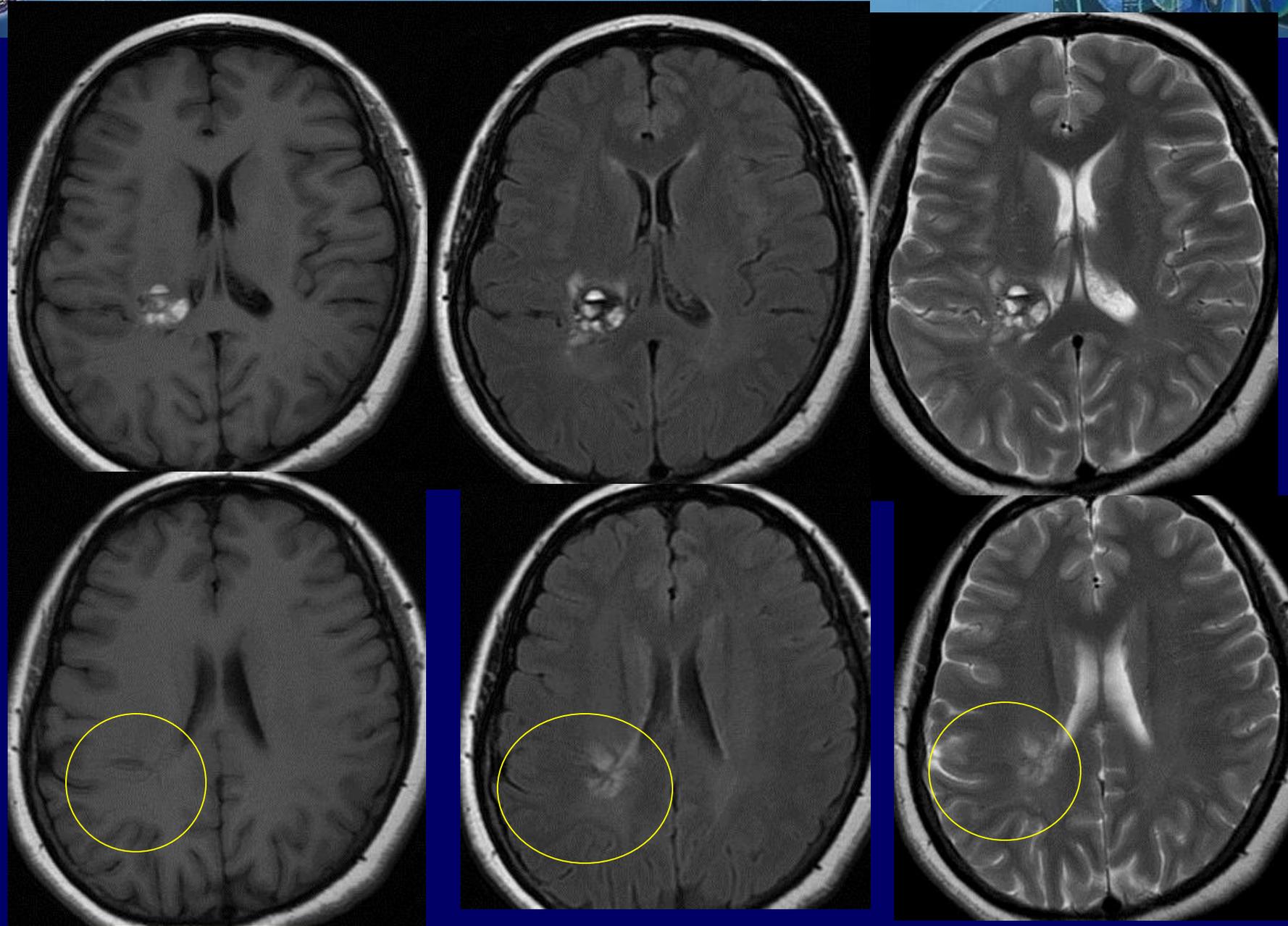
- a congenital vascular malformation with mature venous elements.
- dilated anomalous medullary veins located within the deep white matter (so-called “Medusa head”)
- The enlarged, umbrella like primitive veins always converge on dilated collector veins that drain into an ependymal vein or enter into the dural sinus.

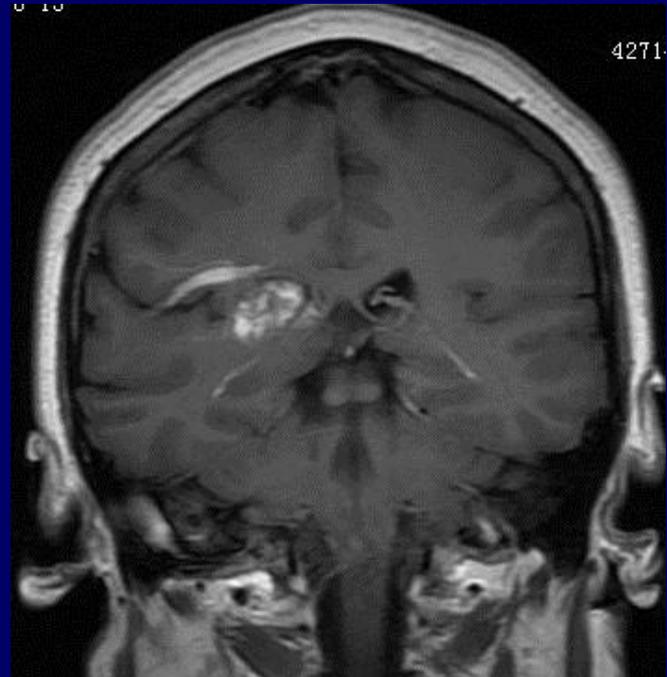
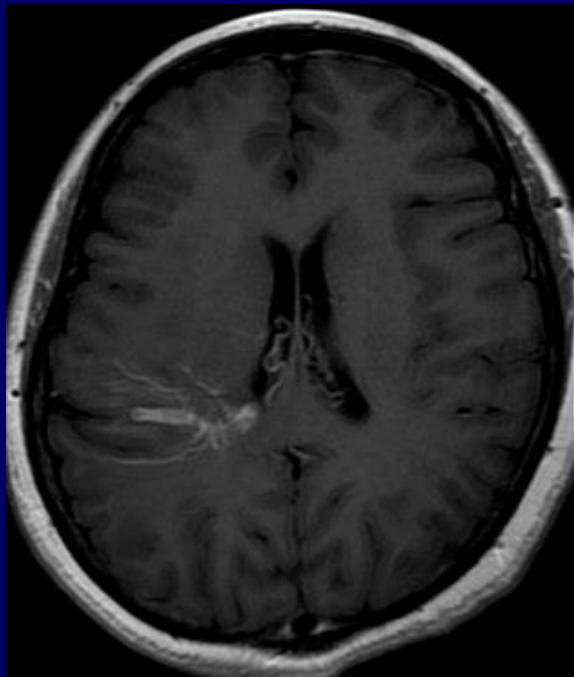
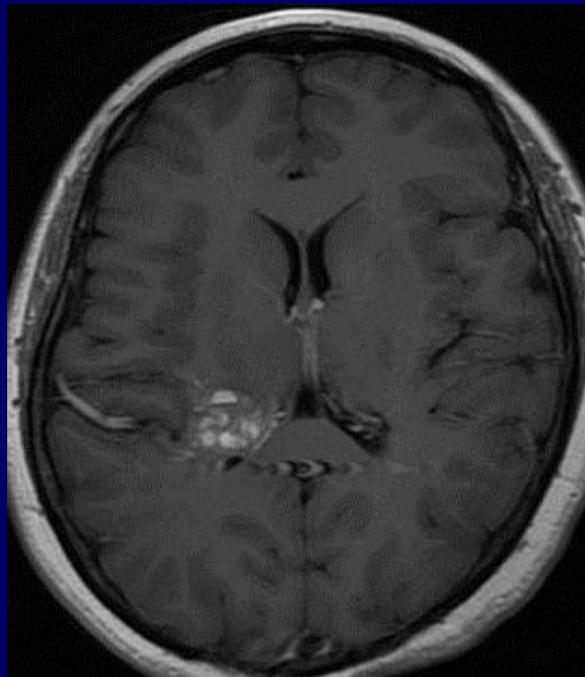


Rong Qing Lin in 307  
112008  
\*22-Aug-1957, M, 50y  
22-Aug-2007  
14:34:02.12  
603 IMA 10  
MIP 21

SHANDONG MED. IMA. INST.  
Definition  
CT 2007C

Spinc: -90  
Tilt: 0

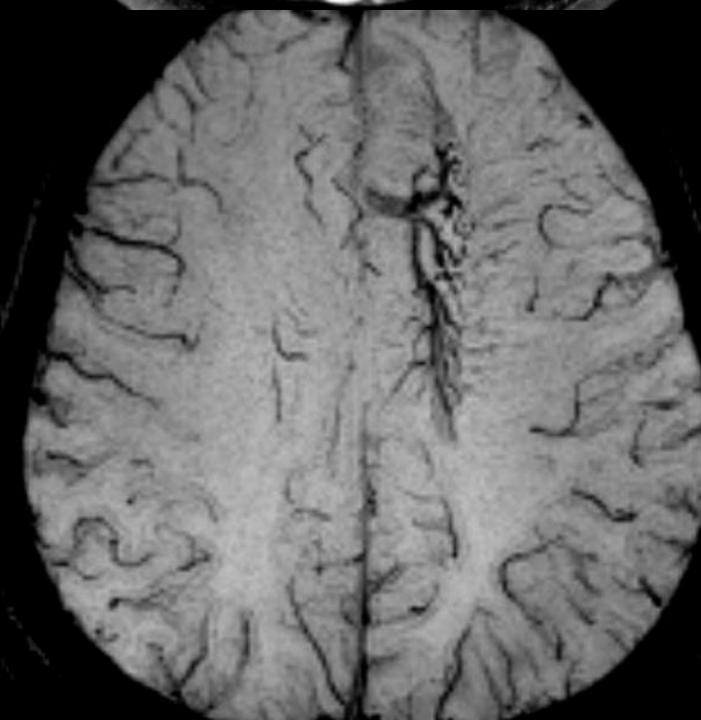
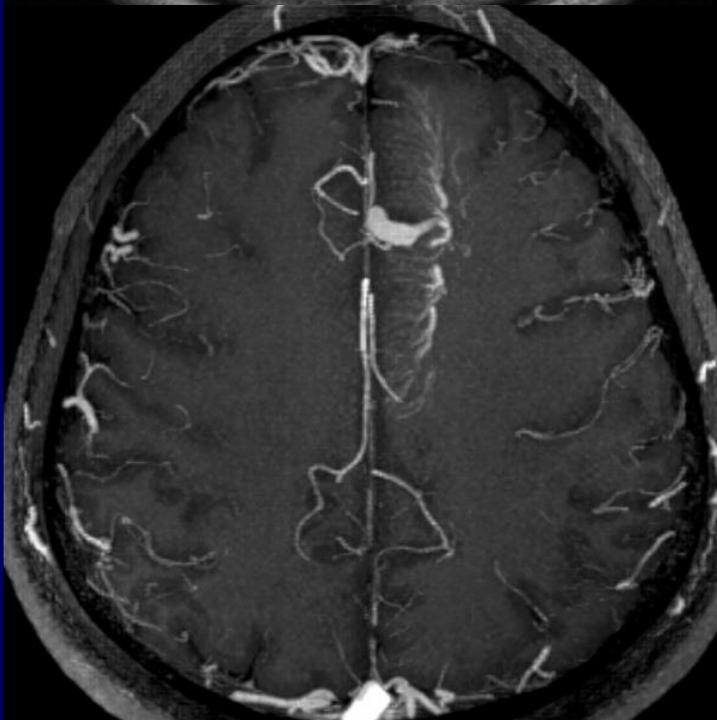
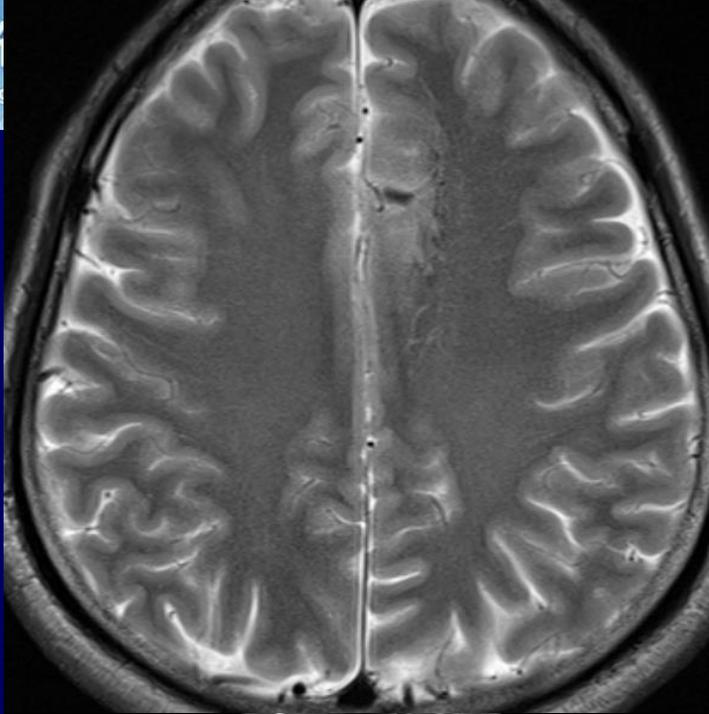






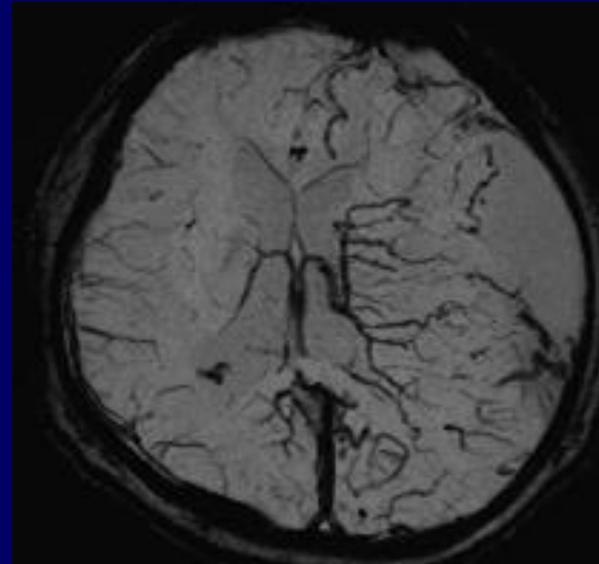
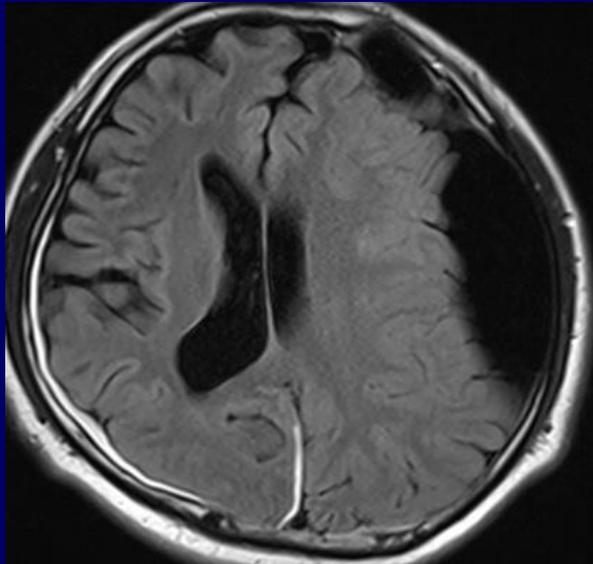
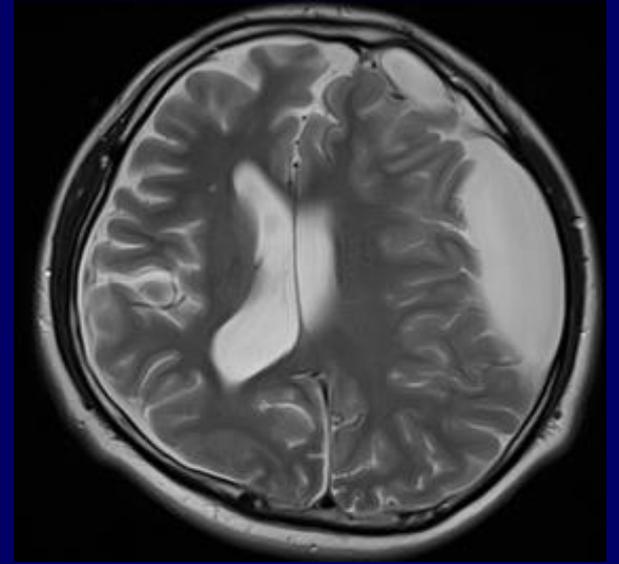
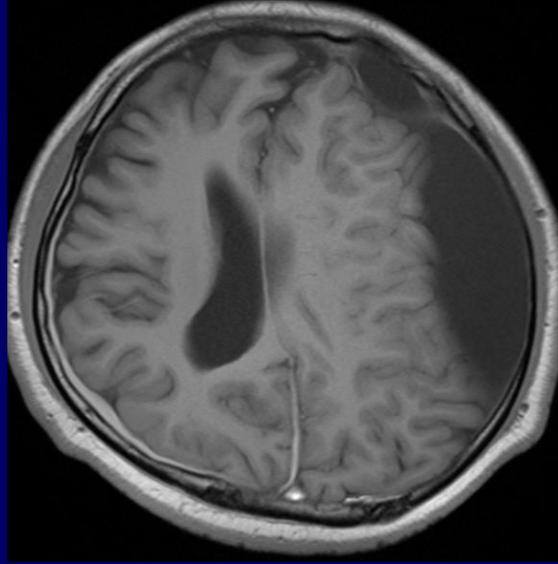
# 水母头征 Medusa head

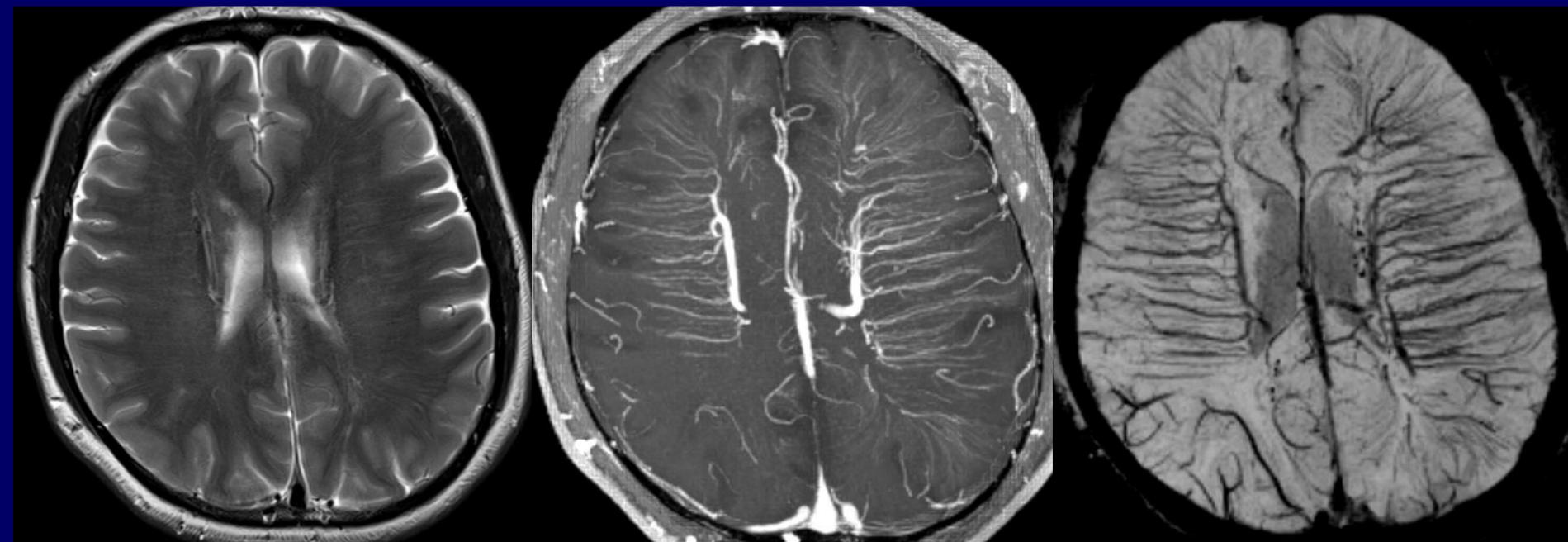


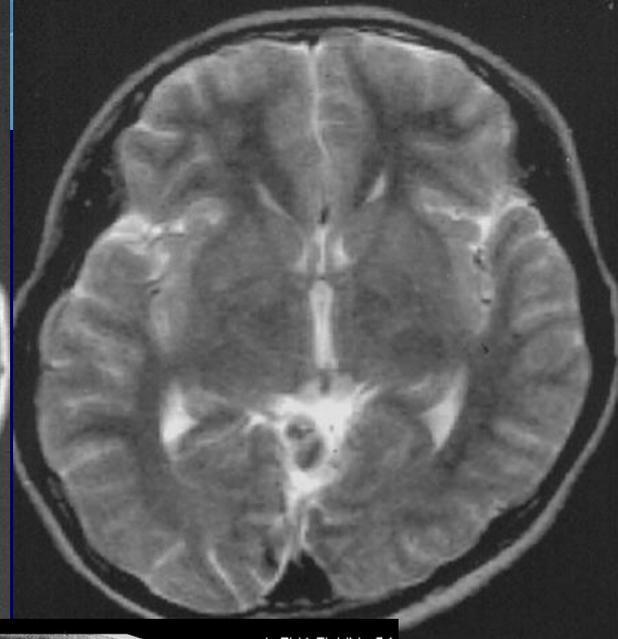
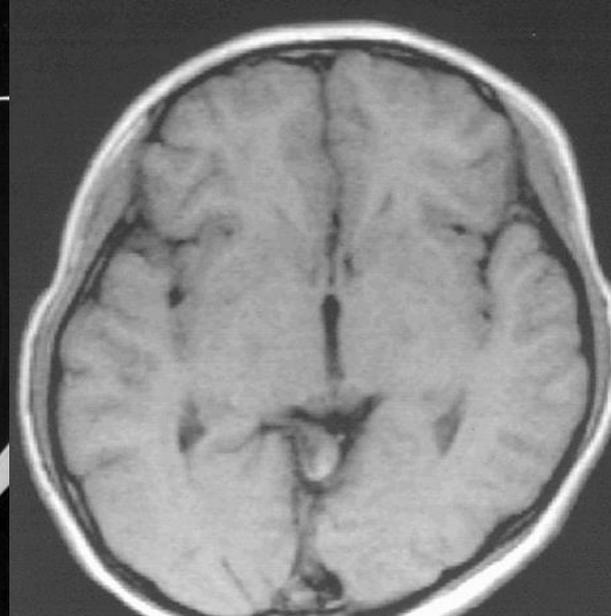




男，17岁，头晕、发热







**Galen 静脉畸形**



# 脑静脉窦血栓形成诱因

- **炎症性静脉窦血栓形成：**

  - 颅面部软组织和骨感染如中耳炎

  - 颅内感染如脑炎、脑脓肿

  - 全身性感染

- **非炎症性静脉窦血栓形成：妊娠与分娩、手术、口服避孕药、心衰、高热脱水、消耗性疾病（如结核、恶性肿瘤）、脑外伤、某些血液病（如镰刀状细胞贫血、白血病、红细胞增多症等）**

- **36%病因不明确**



# 临床表现

- 颅内压增高表现
- 感染中毒表现
- 不同静脉窦闭塞临床表现有别
  - 海绵窦：**Ⅲ、Ⅳ、Ⅴ对脑神经麻痹、视力下降、眼睑、结膜水肿、眼球突出，多为炎症性血栓
  - 上矢状窦：**多为非炎症性血栓。额顶部头皮静脉怒张
  - 乙状窦横窦：**单侧者可无症状  
腰穿压迫病侧颈静脉时，颅内压无变化
  - 直窦：**病情严重  
严重颅内压增高、惊厥、昏迷、去大脑强直



# CT诊断

增强CT+CTV » 平扫CT

**直接征象：**

**CT平扫：**

静脉窦高密度征（dense vein sign）

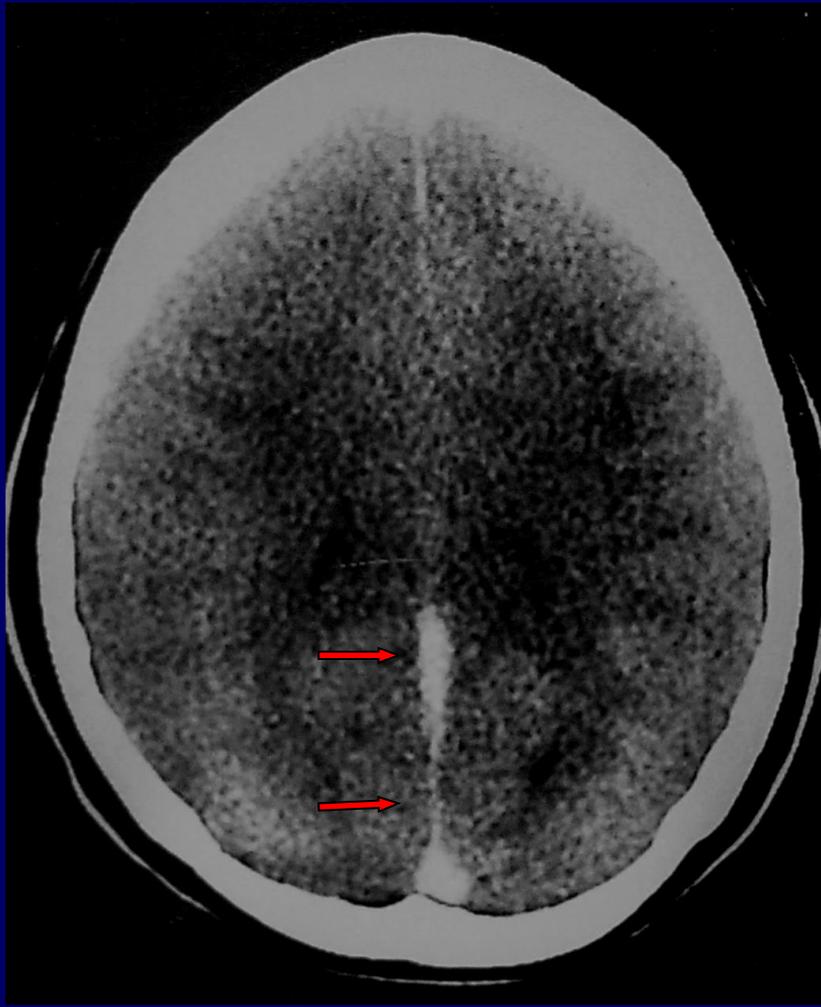
皮层静脉高密度带征（cord sign）

**CT增强：**

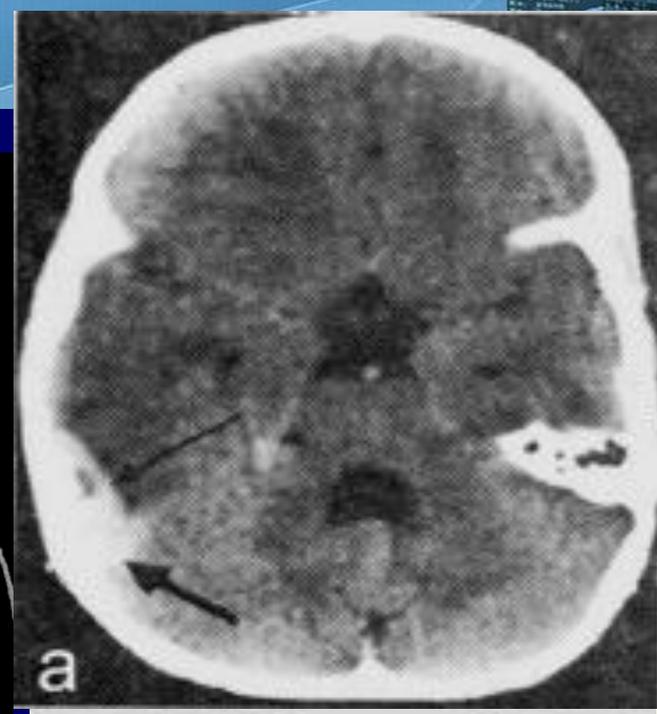
静脉窦“ $\delta$ ”征和空三角征

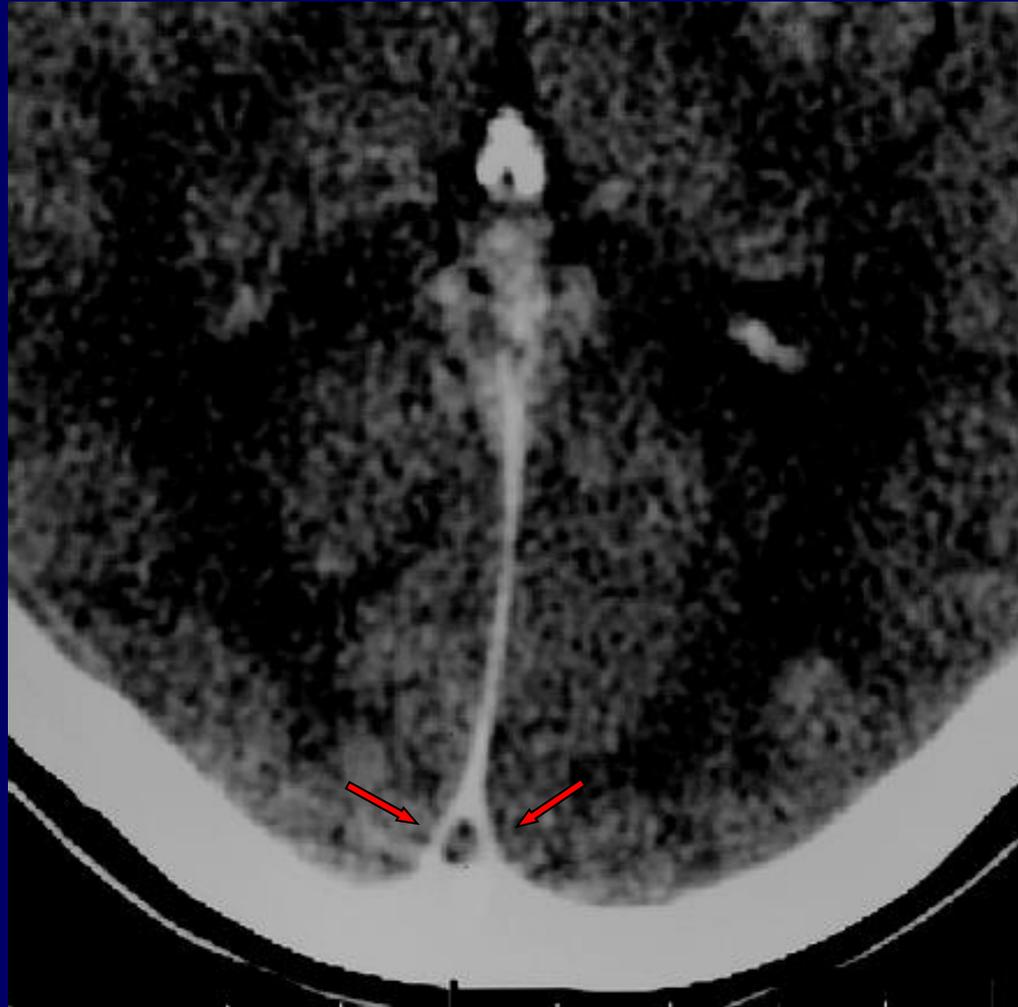
充盈缺损

**CTV：** 病变静脉窦不显示或充盈缺损

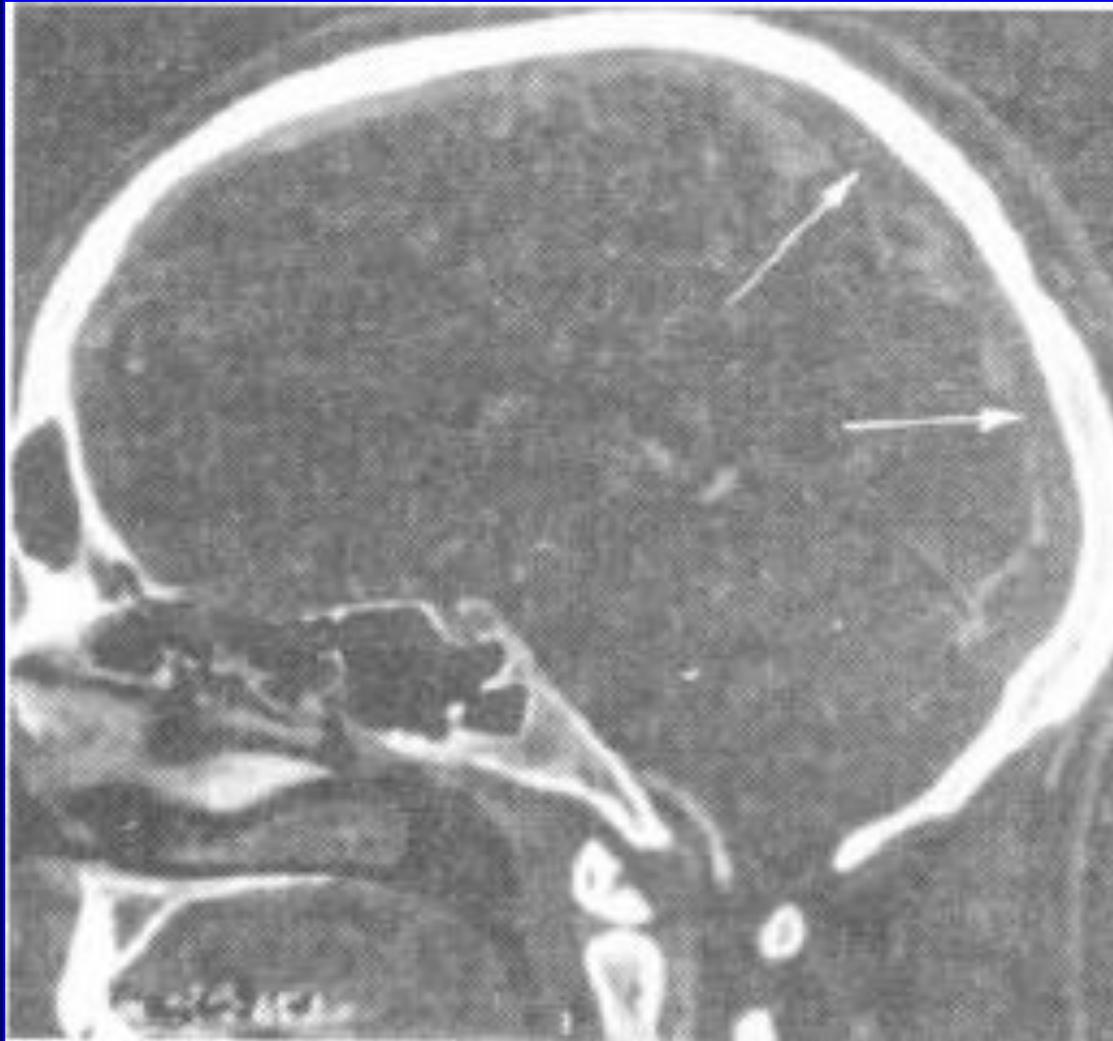


**dense vein sign**





$\delta$  sign



- CTV显示上矢状窦不规则充盈缺损



# CT诊断

增强CT+CTV » 平扫CT

## 间接征象：

弥漫性或局限性脑肿胀

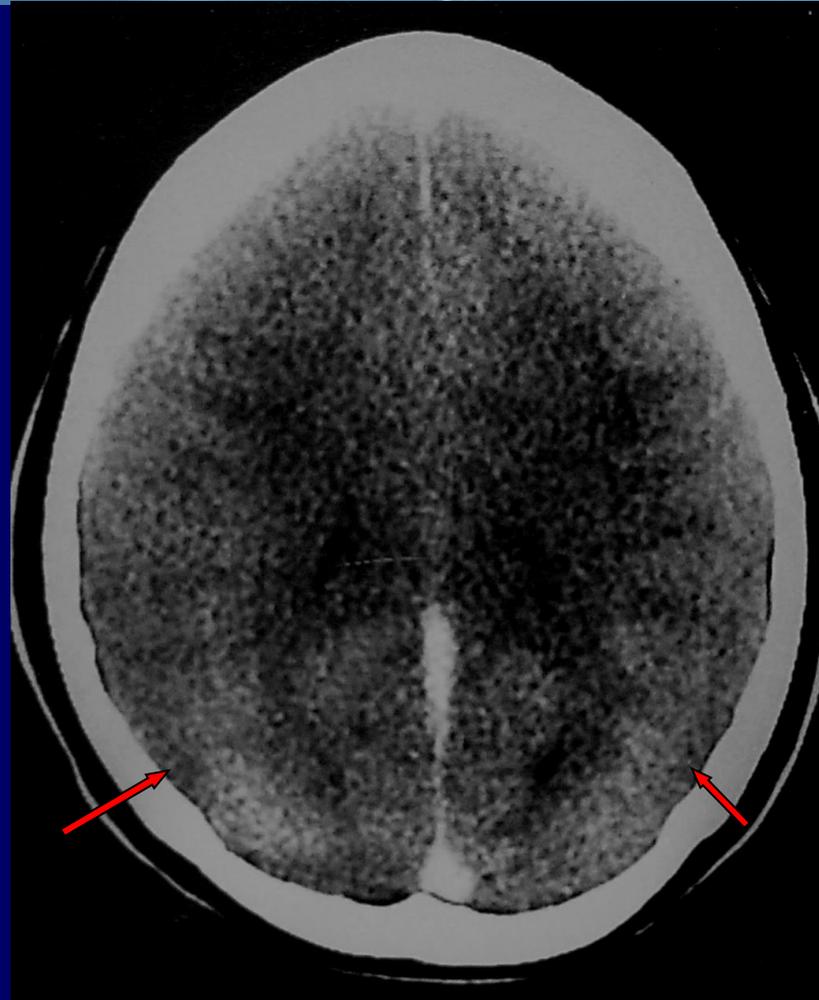
静脉性脑梗死、出血

静脉扩张

灰质强化增加

天幕强化明显

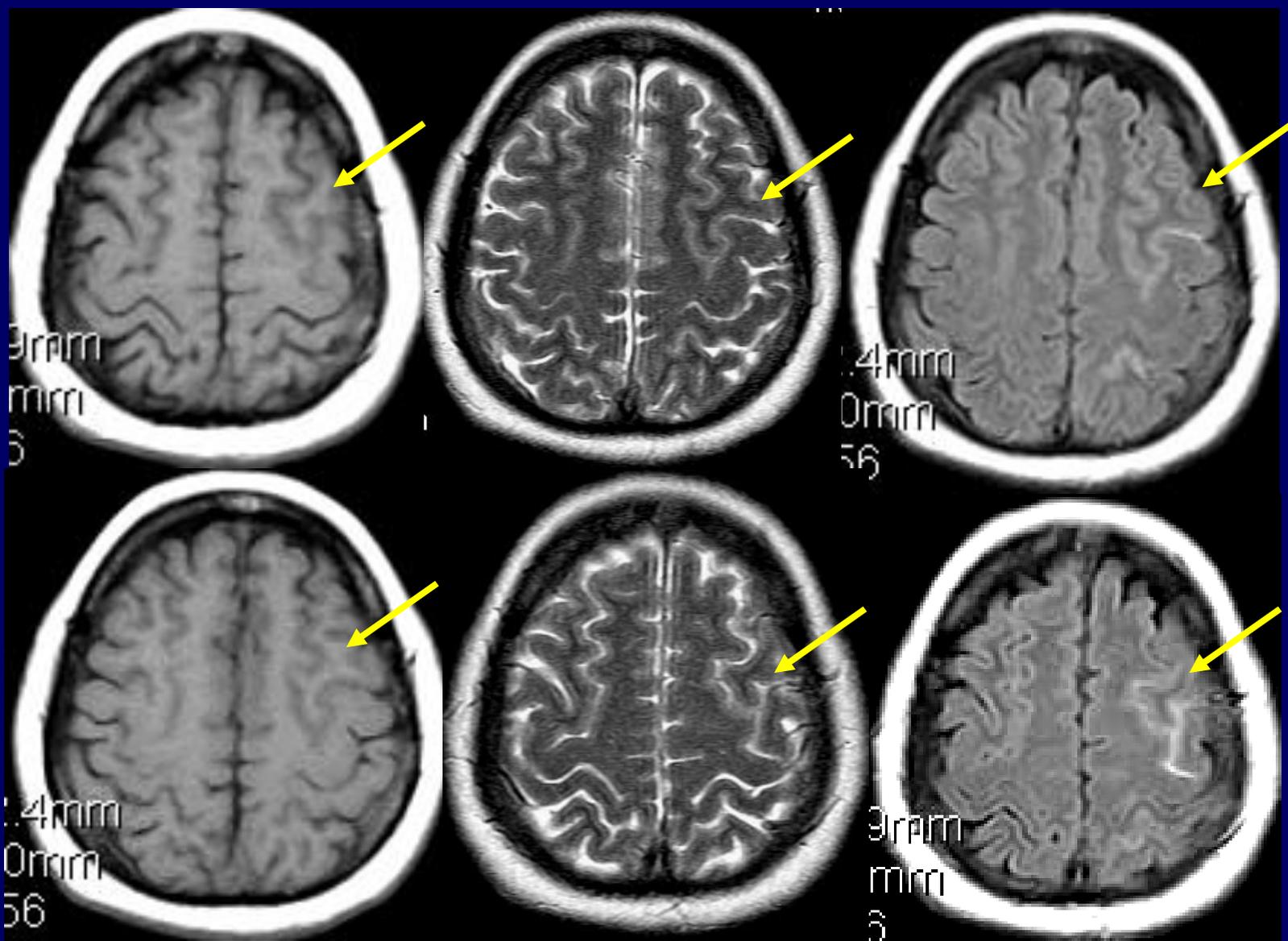
蛛网膜下腔出血



脑回肿胀

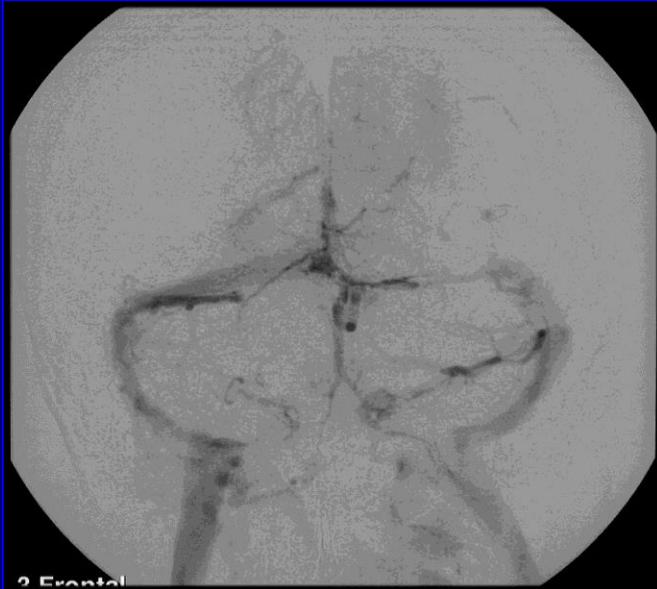


## 脑回肿胀：MRI更具优势





# 上矢状窦栓塞 (superior sagittal sinus thrombosis, SSST)





# MR表现:

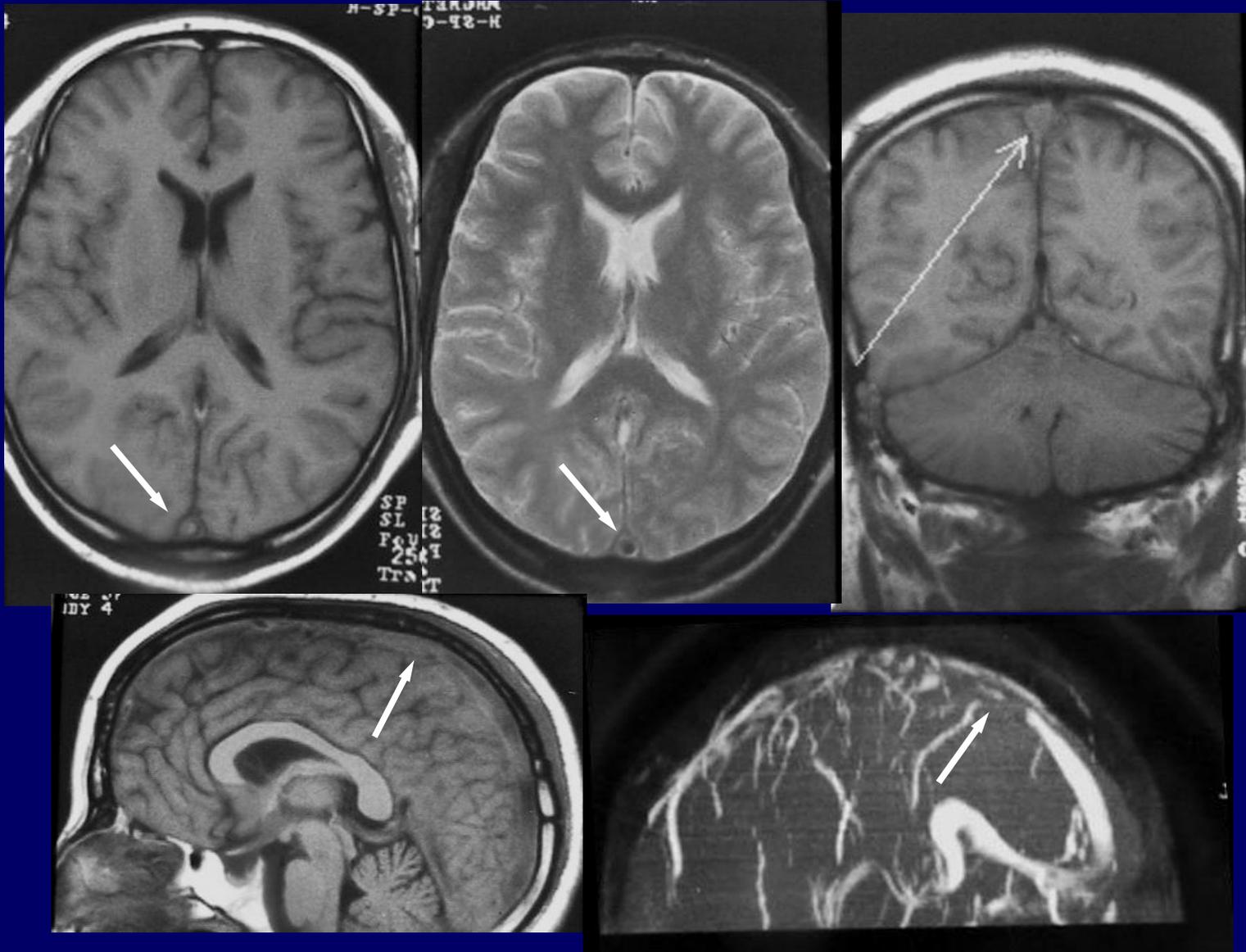
## 急性期 (<1周)

- 静脉窦流空信号消失
- $T_1WI$ : 中等信号  $\longrightarrow$  高信号
- $T_2WI$ : 中等信号或略低信号、极低信号

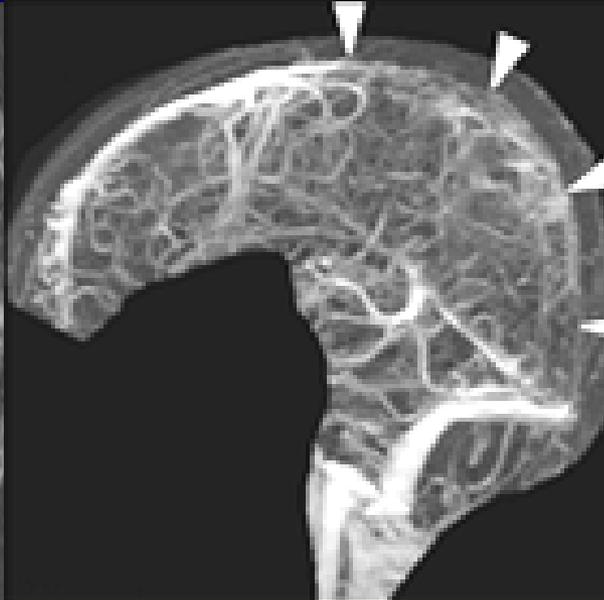
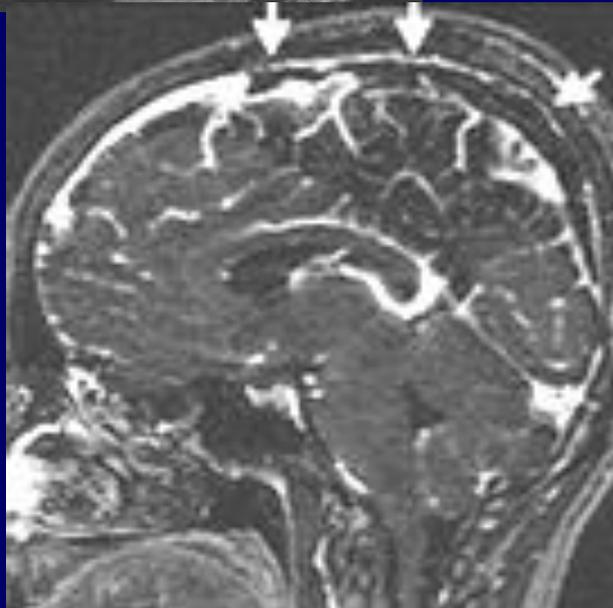
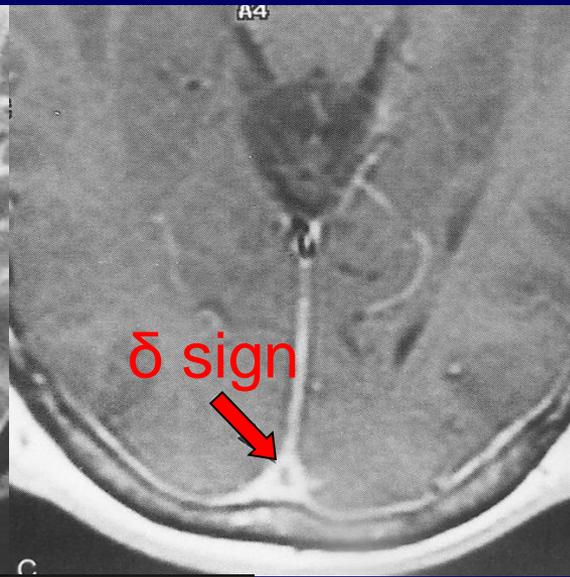
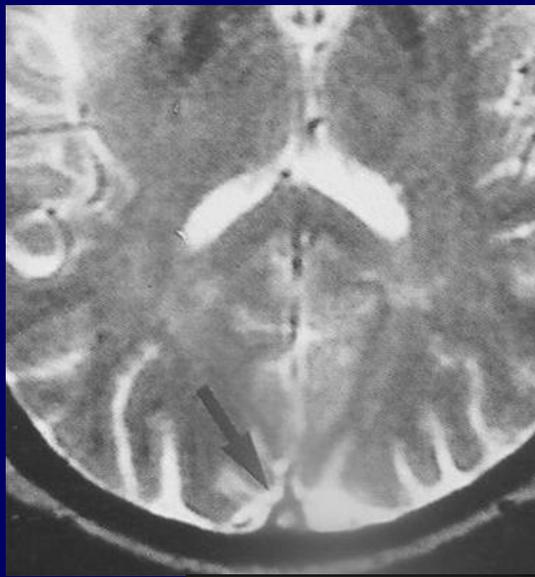
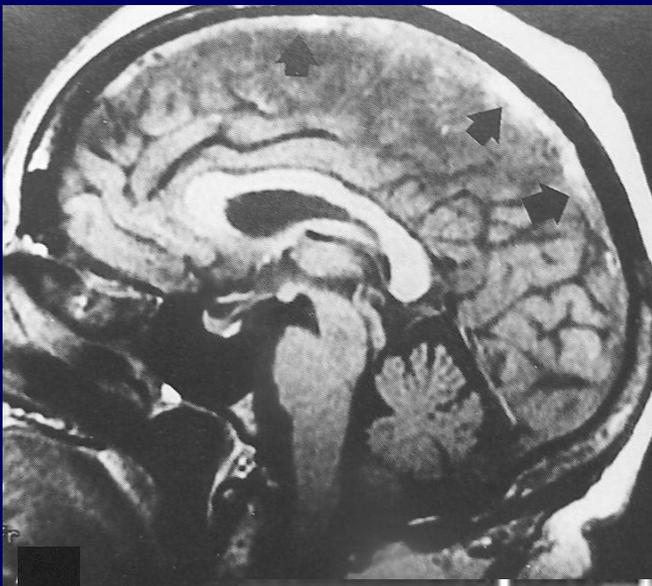
静脉窦壁呈高信号

(间接征象: 脑组织水肿、梗死等等)

- 增强MRI: “ $\delta$ ”征或空三角征
- MRV: 静脉血流信号消失或充盈缺损



3 days



5 days



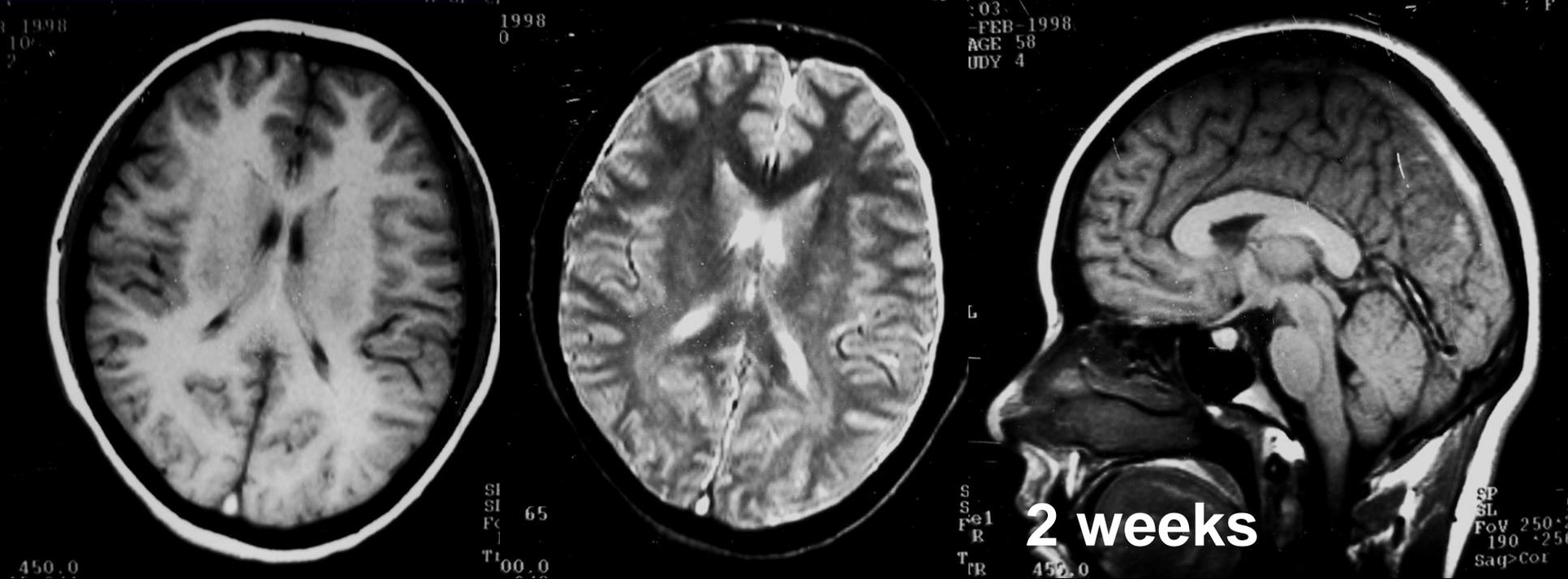
# MRI表现

## 亚急性期（1~2周）

- $T_1WI$ 、 $T_2WI$ 上均呈高信号

## 慢性期（>2周）

- 血栓软化吸收血流再通,呈流空信号
- 静脉窦壁常不规则
- 机化血栓 $T_1WI$ 、 $T_2WI$ 上呈低信号

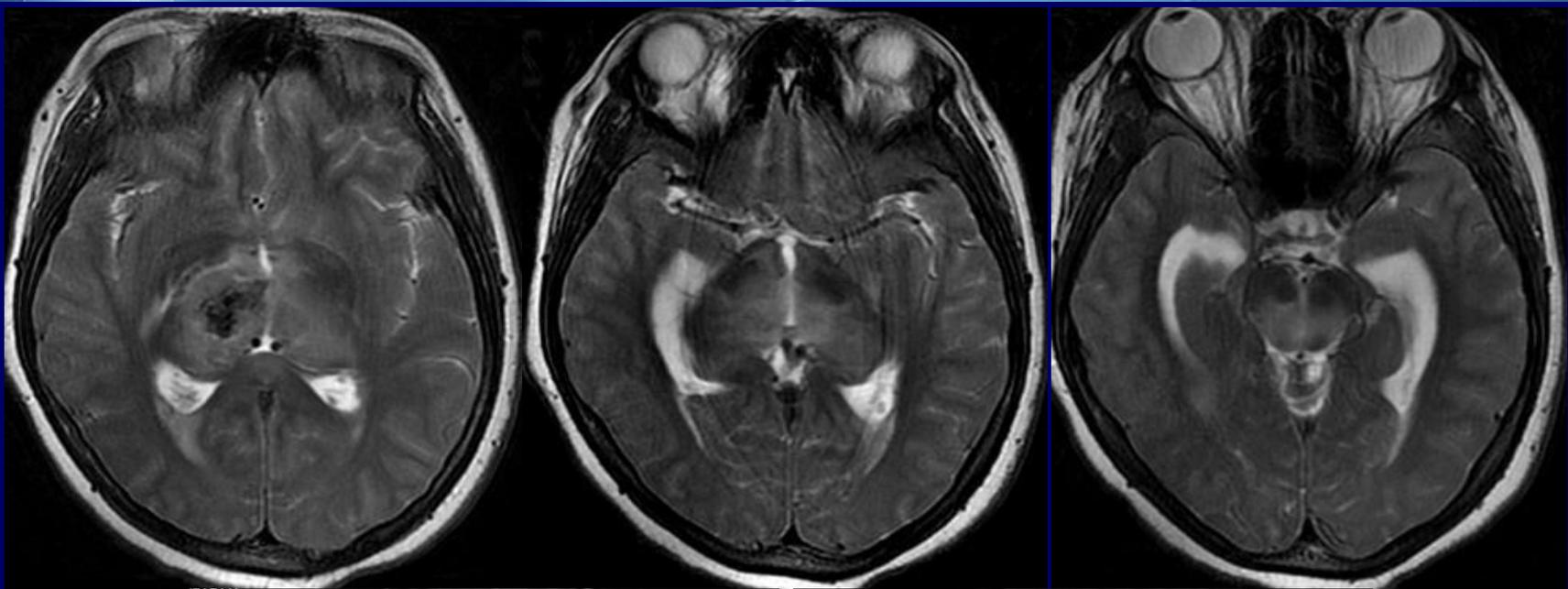




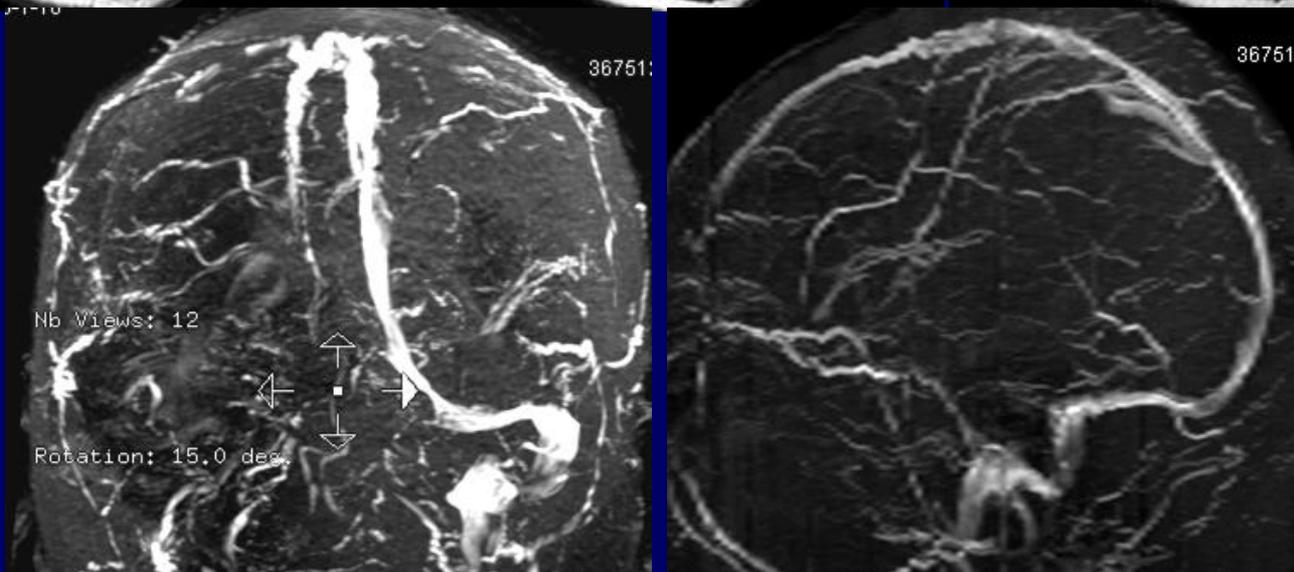
# 直窦栓塞

- 起始于大脑大静脉与下矢状窦汇合处，直行向后与上矢状窦相连
- 单纯直窦血栓少见，常合并其他部位血栓
- 如累及到大脑大静脉时，导致急骤颅压增高，昏迷





大脑大静脉、直窦栓塞

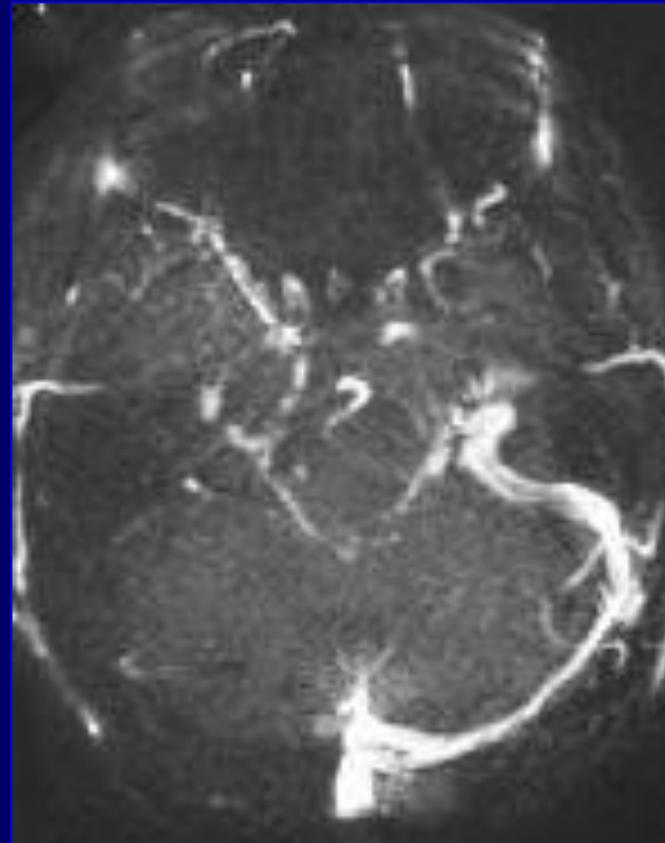
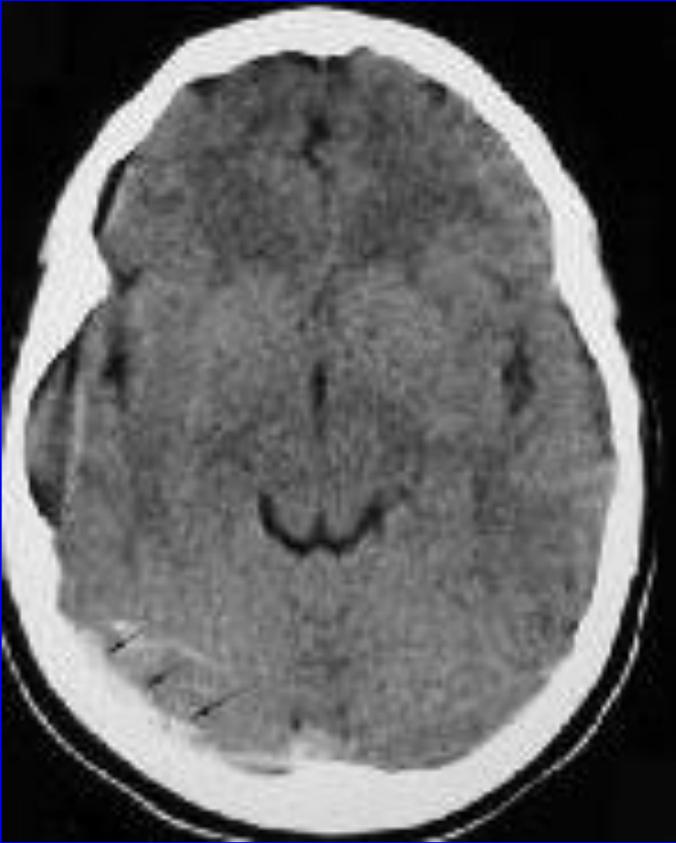


女，20岁，产后，头痛呕吐，嗜睡伴言语不清，按脑炎治疗效果不佳



## 横窦和乙状窦栓塞

(注意引流区域脑组织、表面血管的变化, 鉴别优势引流)

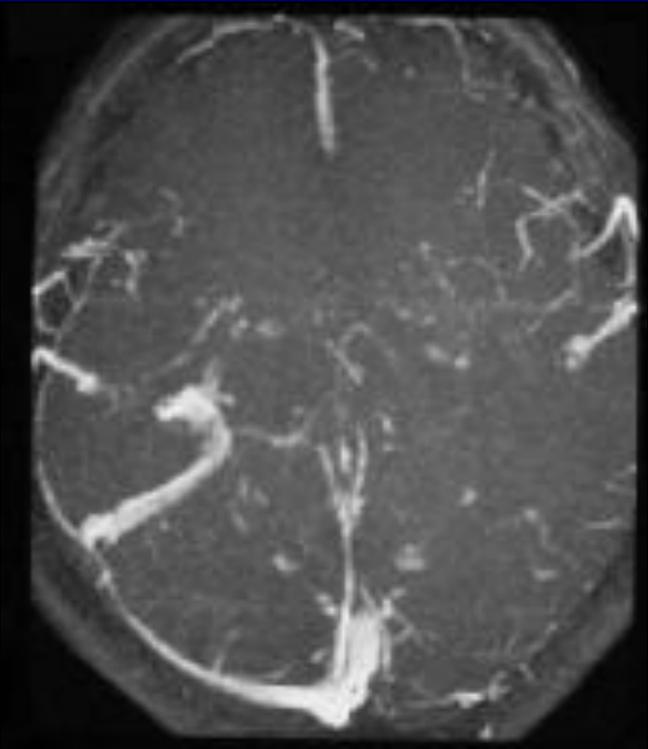
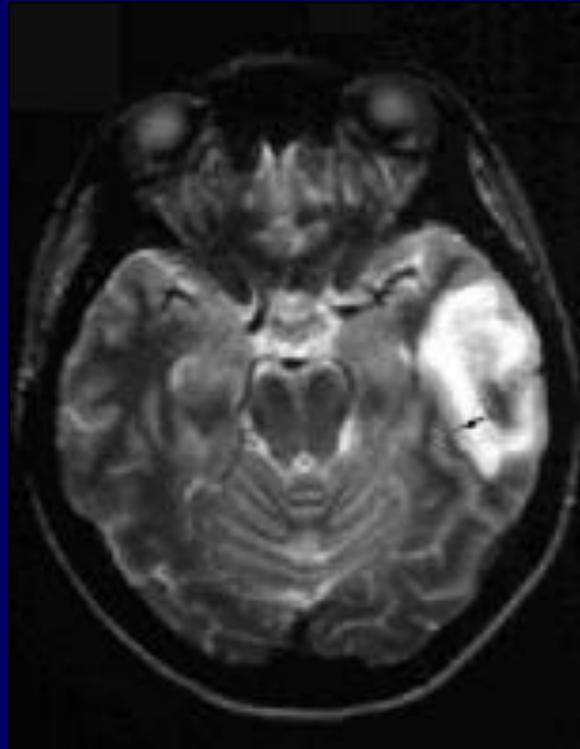
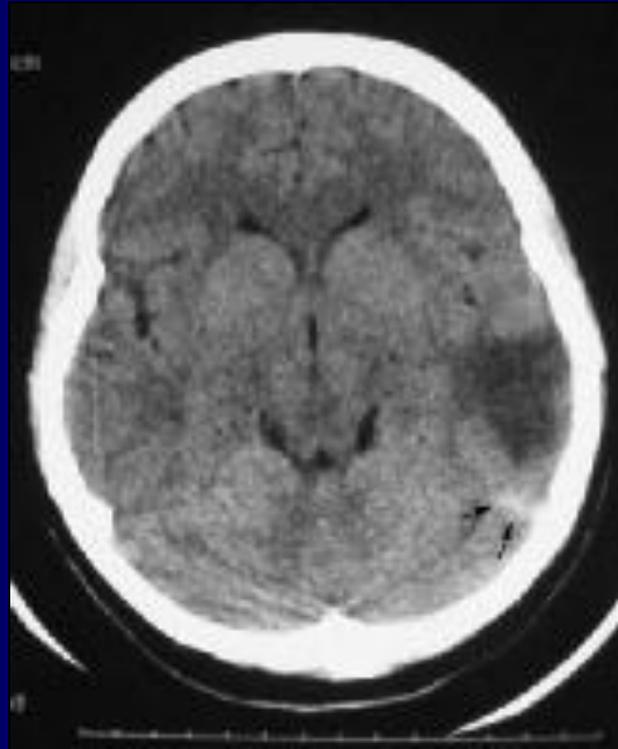


**Caption:** A 23-year-old female with headache. CT scan demonstrates a subtle right transverse sinus thrombosis with high attenuation (arrows). MR venography demonstrates absent flow in the right transverse sinus, sigmoid sinus, and internal jugular vein.



# 横窦和乙状窦栓塞

(注意引流区域脑组织、表面血管的变化, 鉴别优势引流)

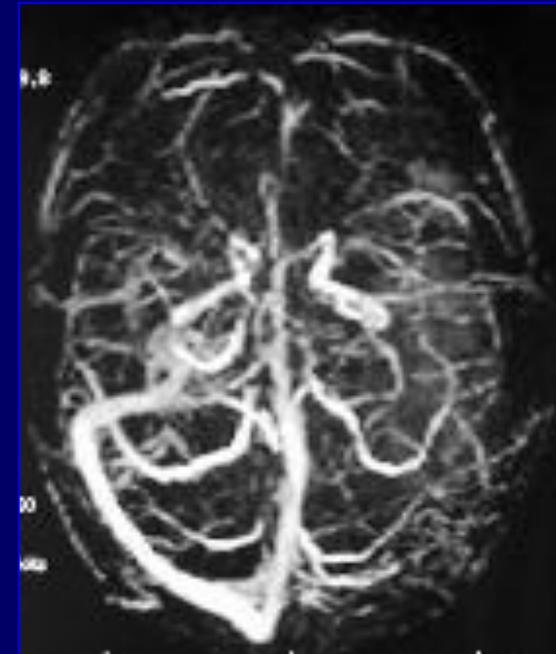
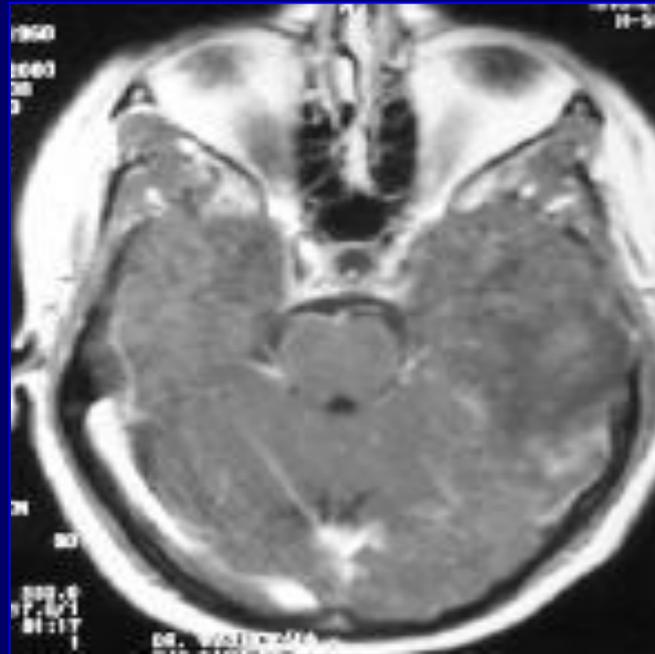


**32-year-old postpartum patient with headaches. Axial CT image shows a hypodense left temporal lobe venous infarct. A triangular high-attenuation focus (arrows) posterolateral to the area of infarction represents thrombus within the left transverse sinus. Axial MR venogram demonstrates occlusion of the left transverse sinus, sigmoid sinus, and internal jugular vein.**



# 横窦和乙状窦栓塞

(注意引流区域脑组织、表面血管的变化, 鉴别优势引流)



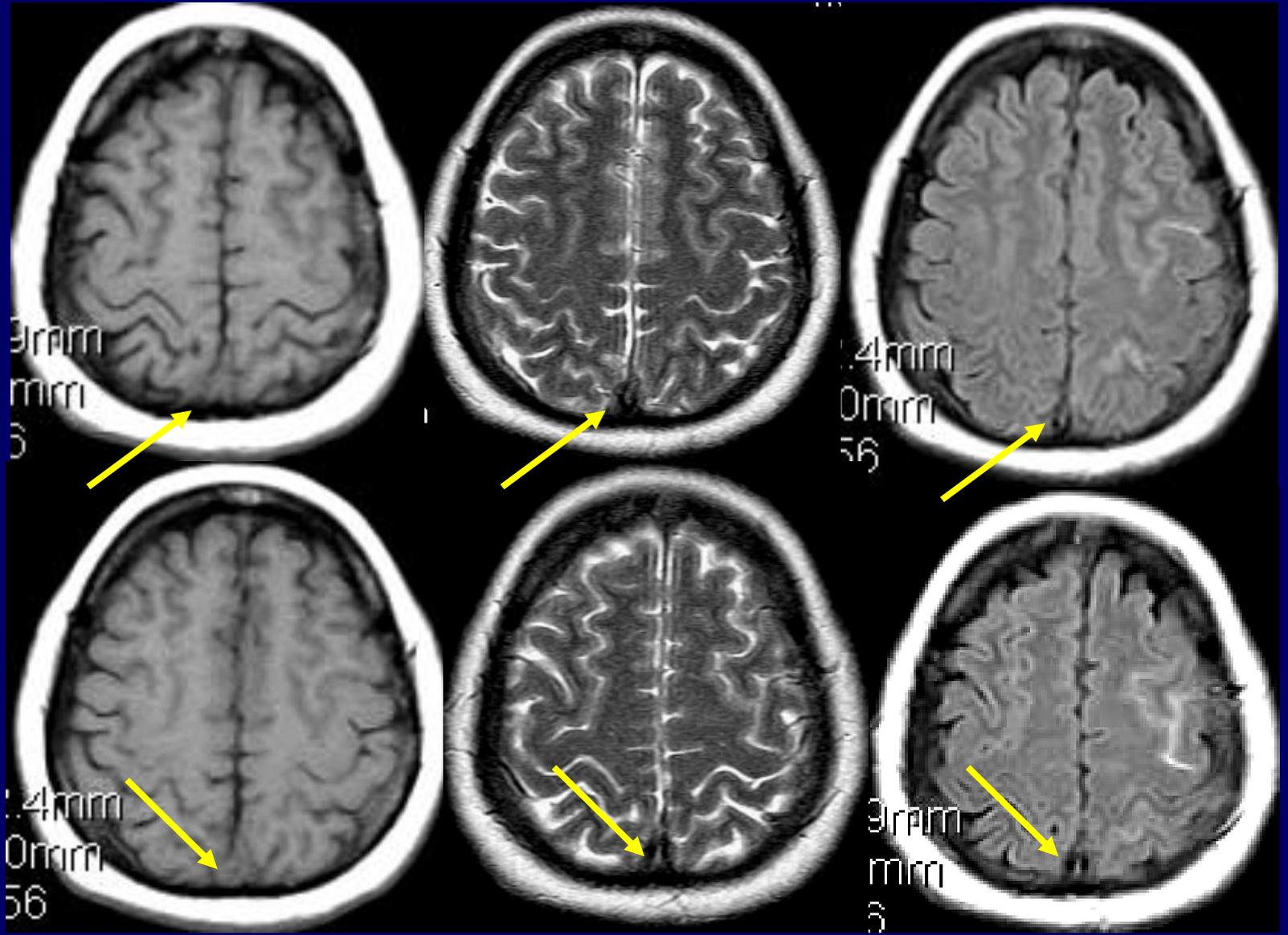
CT scan demonstrates: a left posterior temporal hematoma in a 38-year-old woman on oral contraceptives.

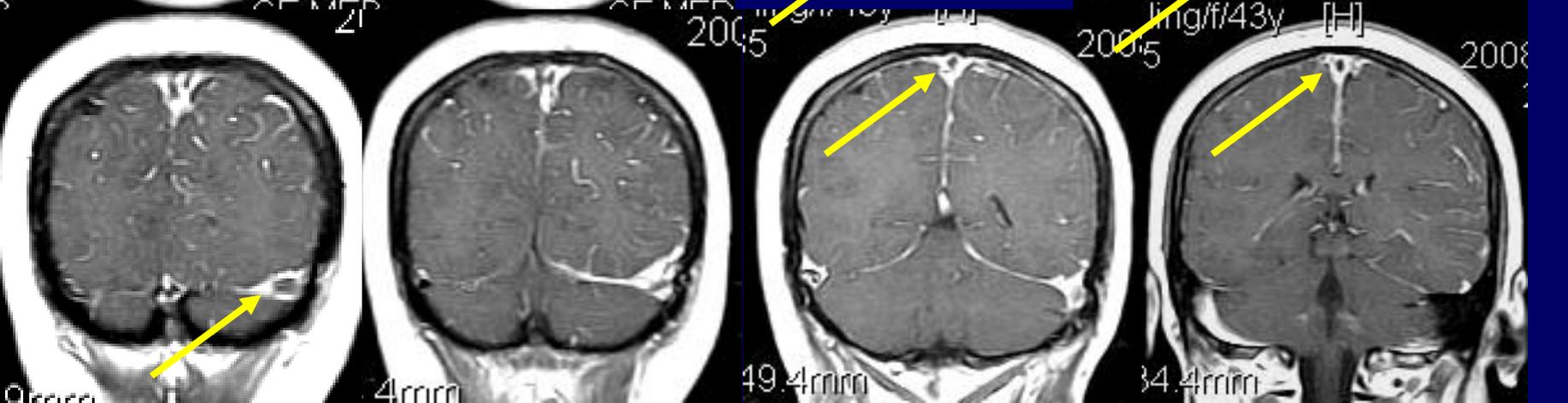
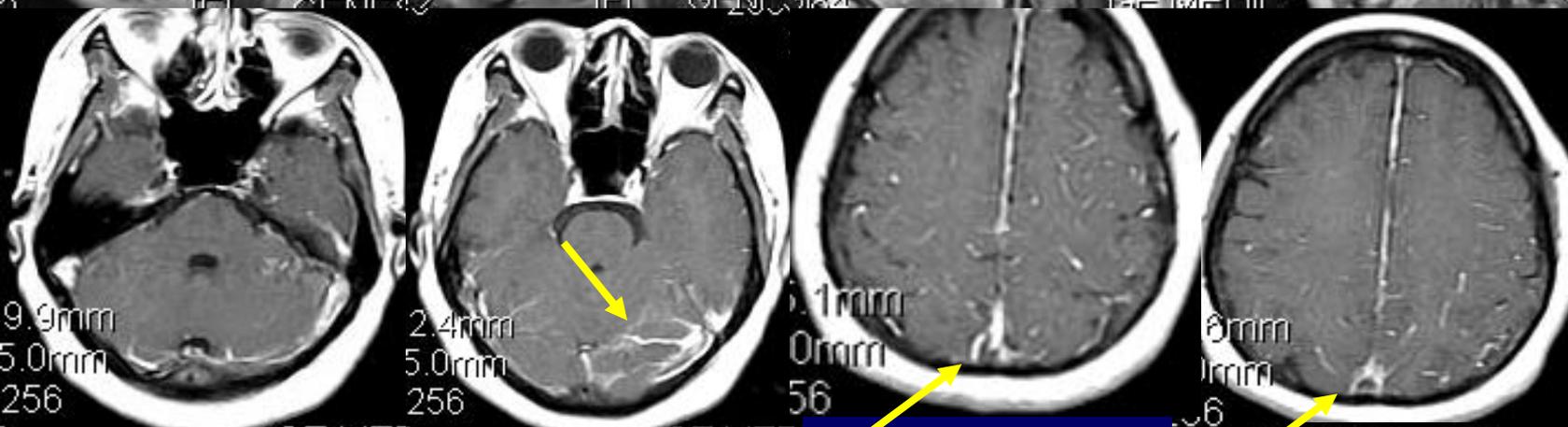
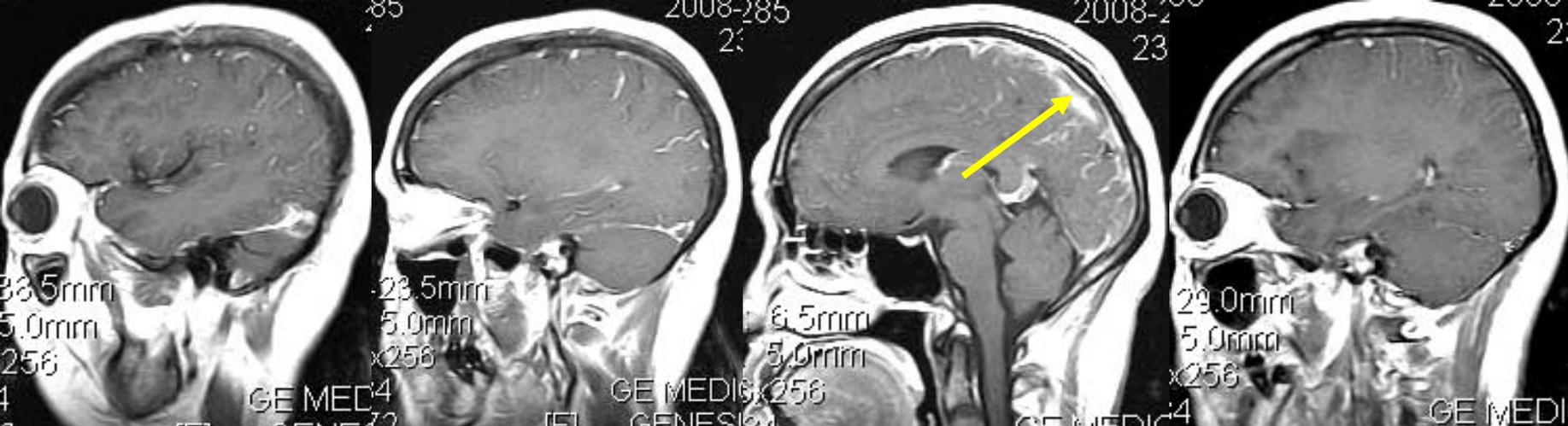
Contrast-enhanced MRI showing lack of filling of left transverse sinus

Axial view of MR venogram demonstrating lack of flow in transverse sinus

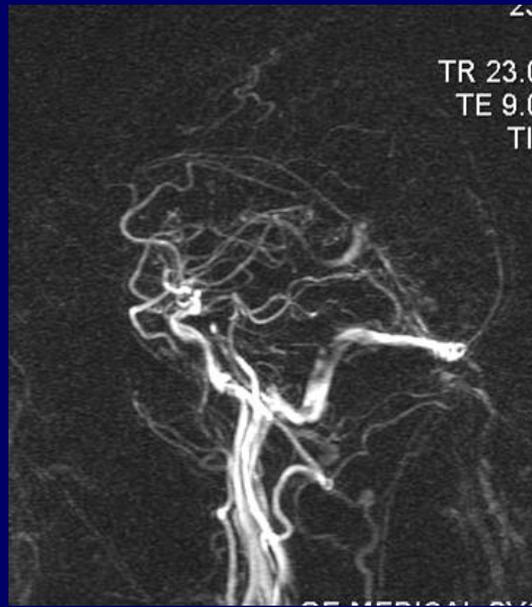


女,49岁,头晕13天加重伴视物旋转,恶心、呕吐2天,近日头痛加重

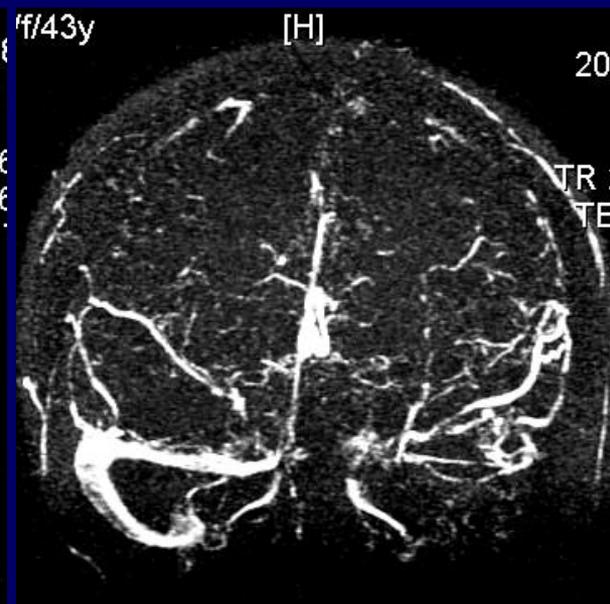
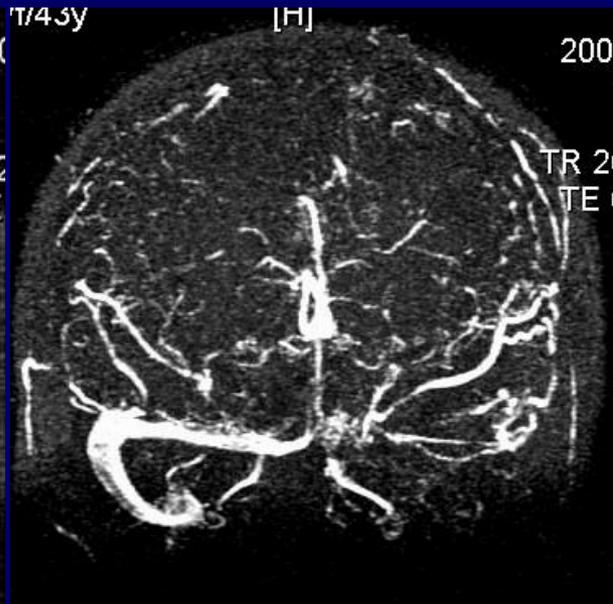
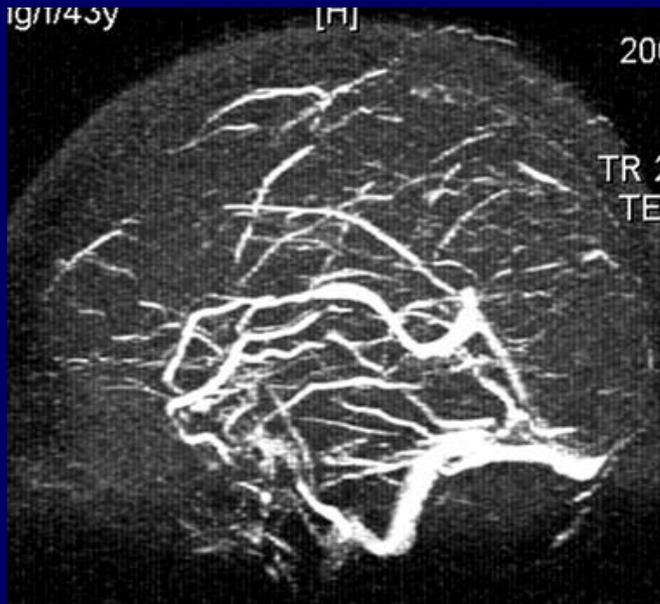




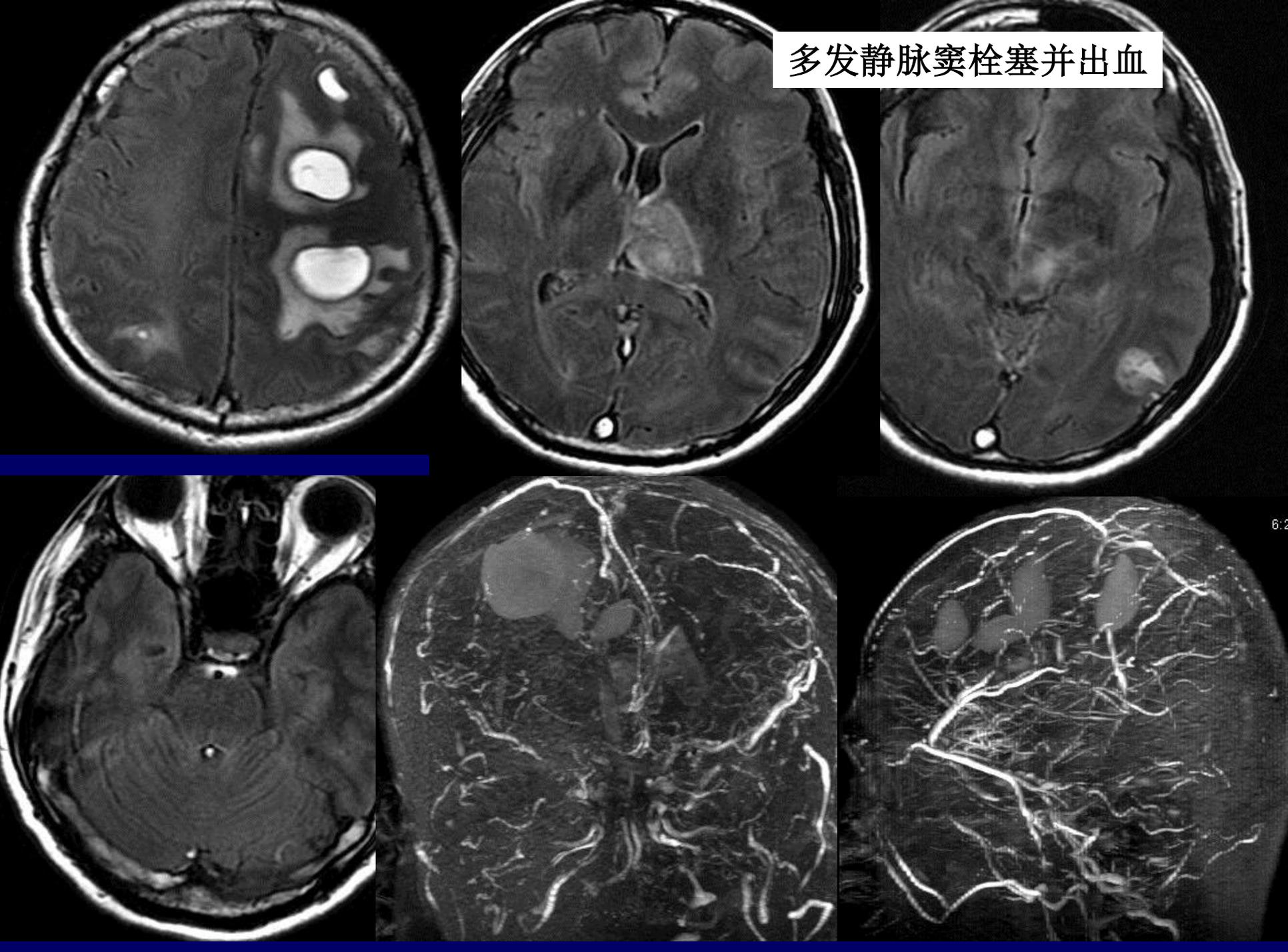
增强后



**MRV**



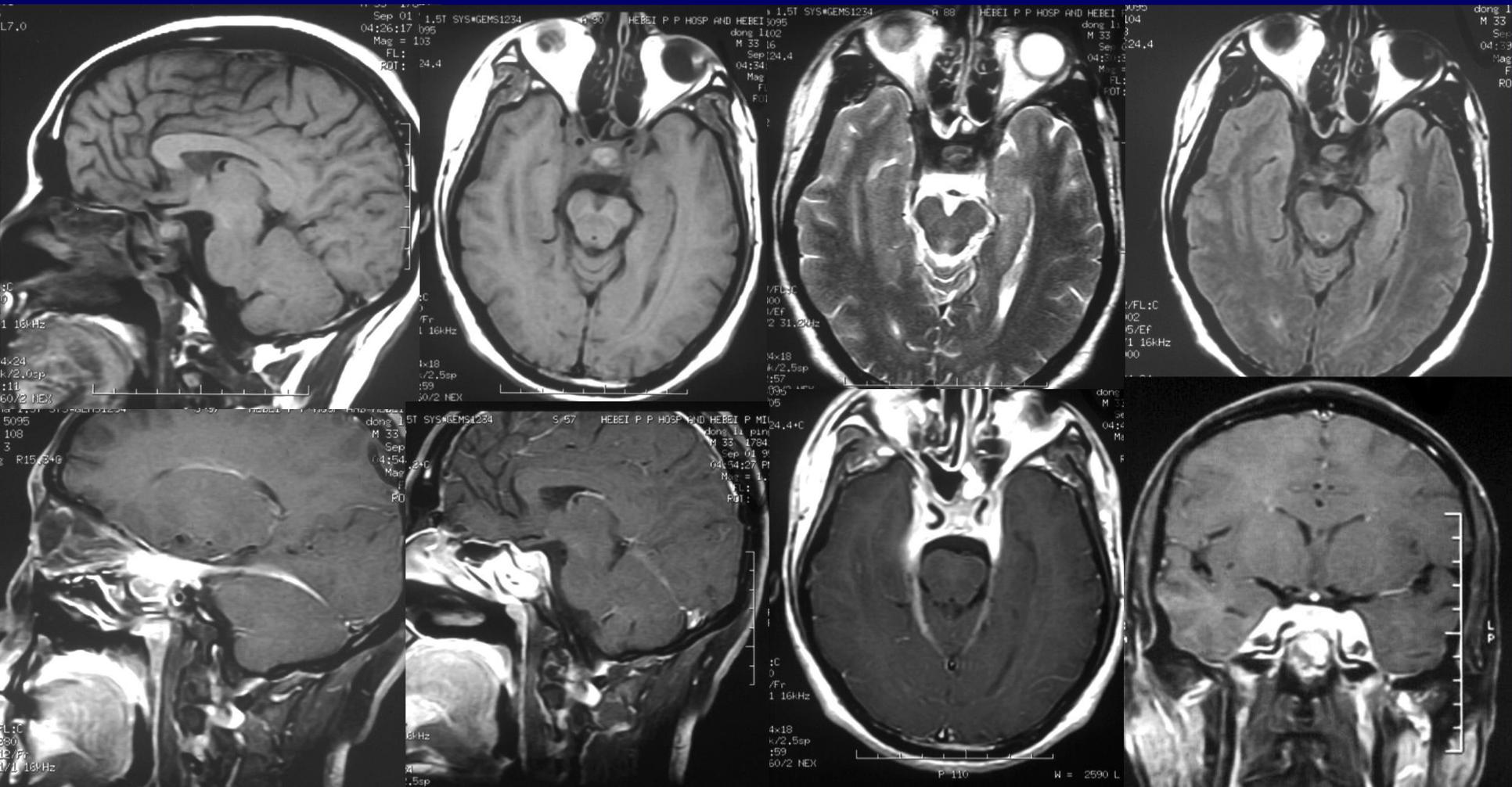
多发静脉窦栓塞并出血





# 海绵窦静脉栓塞

患者男，33岁，头晕呕吐半年余，近1个月加重伴复视及视物模糊，左眼较重。CSF正常，CT正常





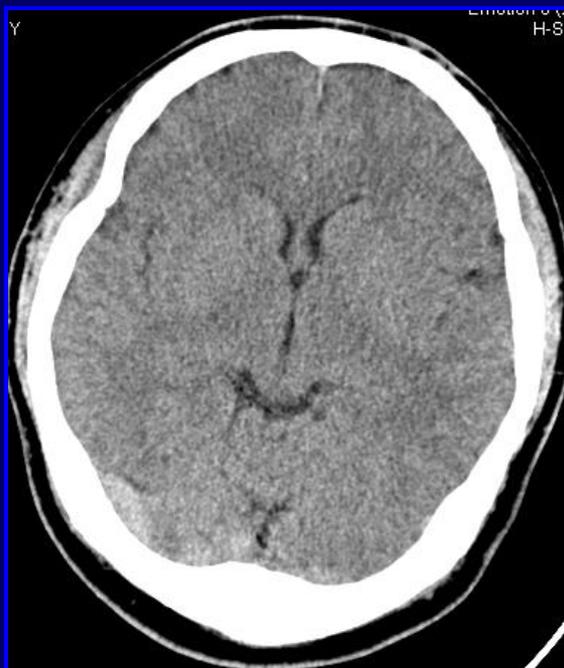
9-5. Coronal graphic shows the cavernous sinuses (CSs) and their contents. The CSs are fenestrated, septated, and multichanneled. The ICAs  $\Rightarrow$  and CN VI  $\Rightarrow$  are inside the CSs. CN III  $\Rightarrow$ , IV  $\Rightarrow$ , V<sub>1</sub>  $\Rightarrow$ , and V<sub>2</sub>  $\Rightarrow$  lie in the lateral dural wall.

表 1 脑静脉血栓形成的常规 MRI 表现

	正常静脉或静脉窦	急性血栓 (5 d内)	亚急性血栓 (5~15 d)	慢性血栓 (>15 d)
T <sub>1</sub> 加权像	流空、中等或高信号	中等信号	高信号	中等、高或不规则流空信号
T <sub>2</sub> 加权像	流空信号	低信号	高信号	中等、高或不规则流空信号
常规增强扫描后	造影剂均匀填充	无强化	无强化	明显或中度强化, 或见不规则再通管腔
信号表现原因	与血液流动相关伪影有关	红细胞未破裂, 内为脱氧血红蛋白	红细胞破裂, 高铁血红蛋白均匀分布	血栓机化或再通



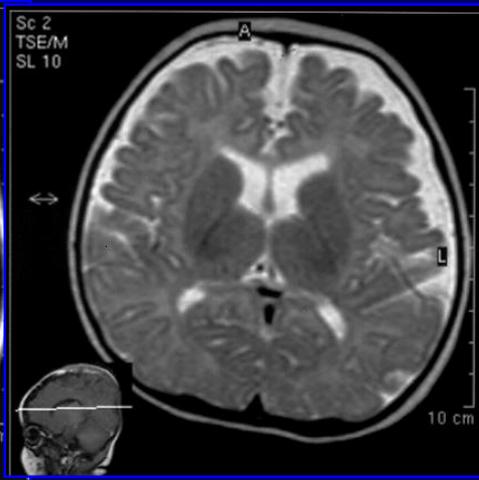
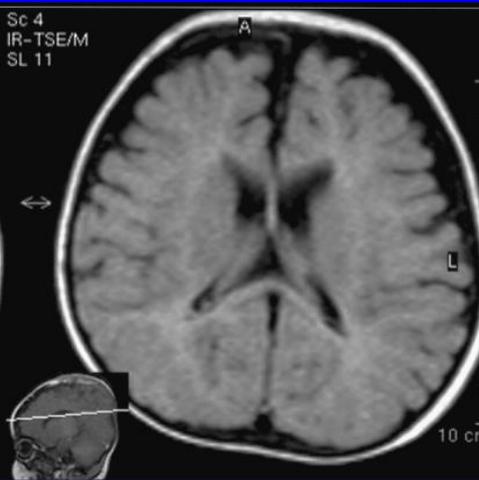
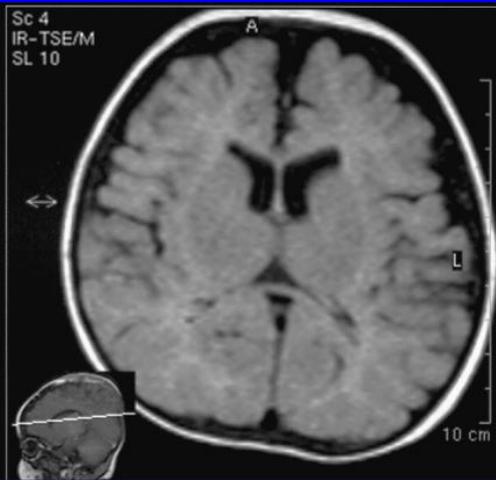
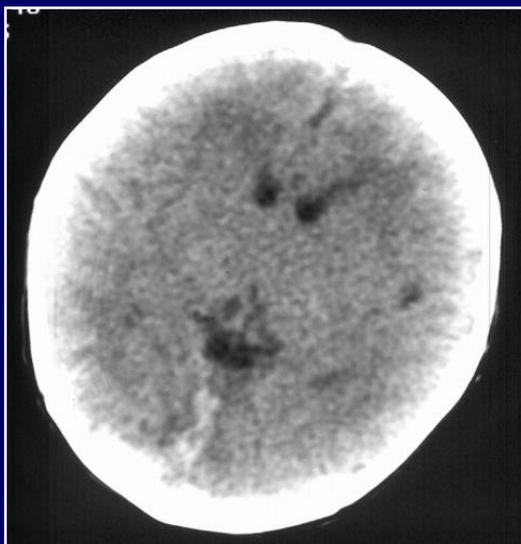
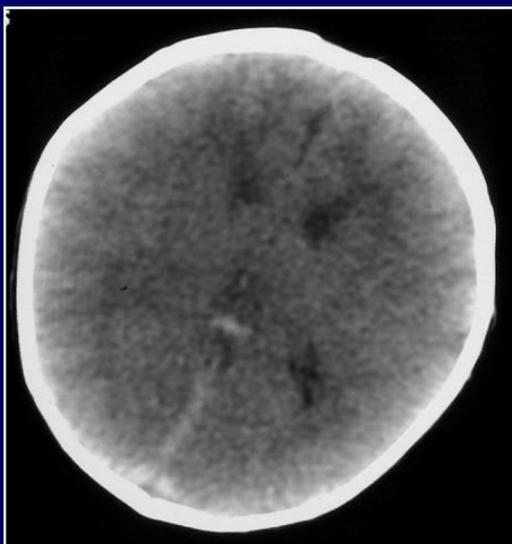
# 正常静脉窦高密度



注意：引流区域脑组织及表面血管无异常变化

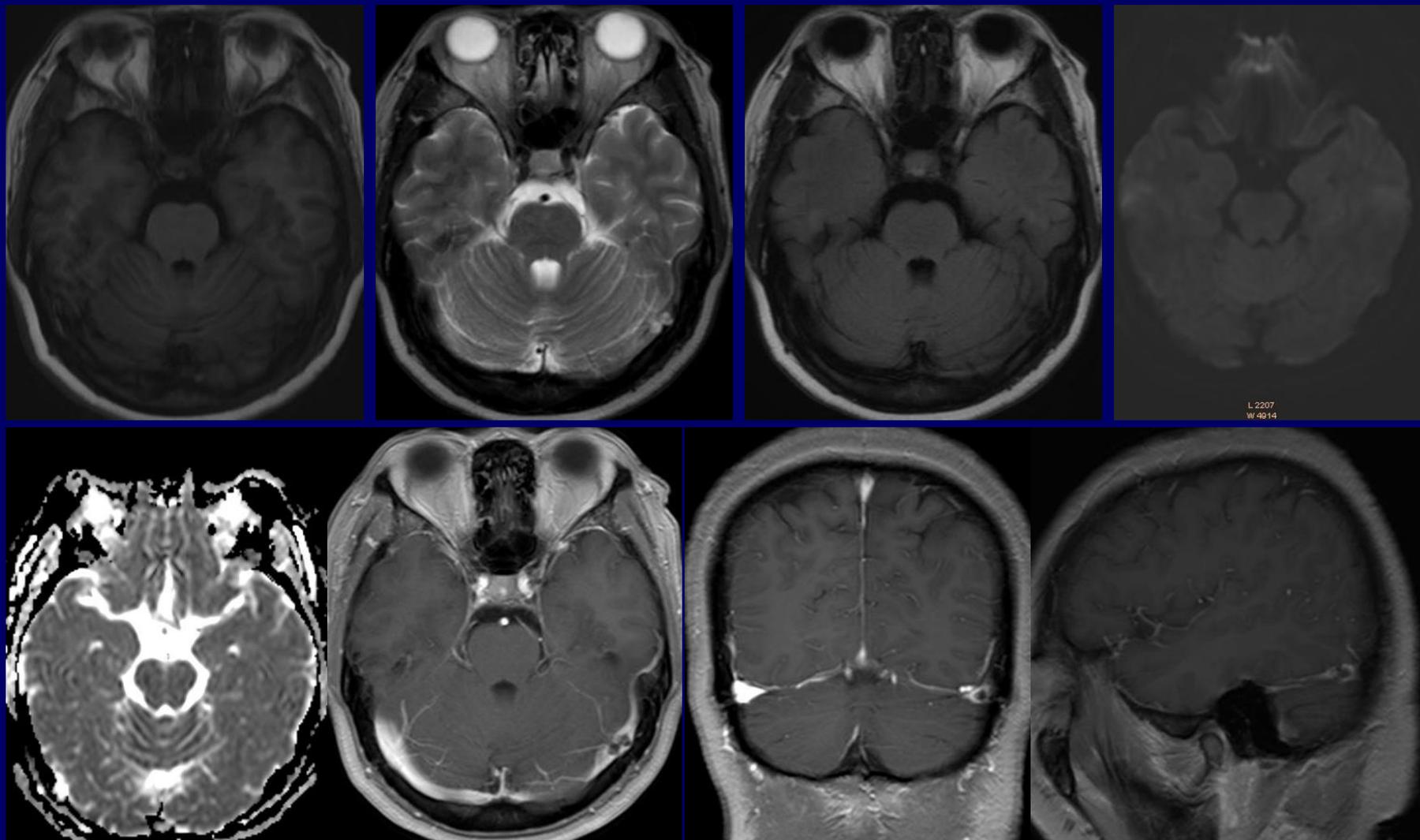


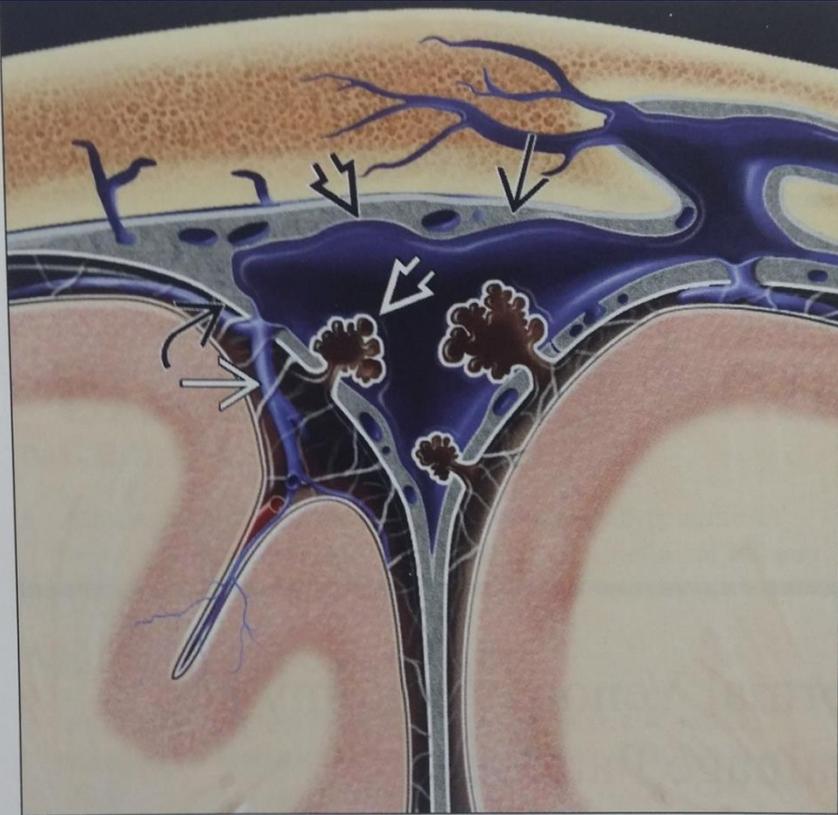
# 新生儿静脉窦密度相对较高，勿误诊为栓塞或出血





# 蛛网膜颗粒





9-1. Coronal graphic shows the SSS between the outer and inner dural layers. CSF-containing projections (arachnoid granulations) extend from the subarachnoid space into the SSS. Cortical veins also enter the SSS.



9-2. Graphic depicts an arachnoid granulation (AG) projecting into a venous sinus. CSF extends from the SAS into the AG and is covered by a cap of arachnoid cells. Channels in the cap drain CSF into the sinus.



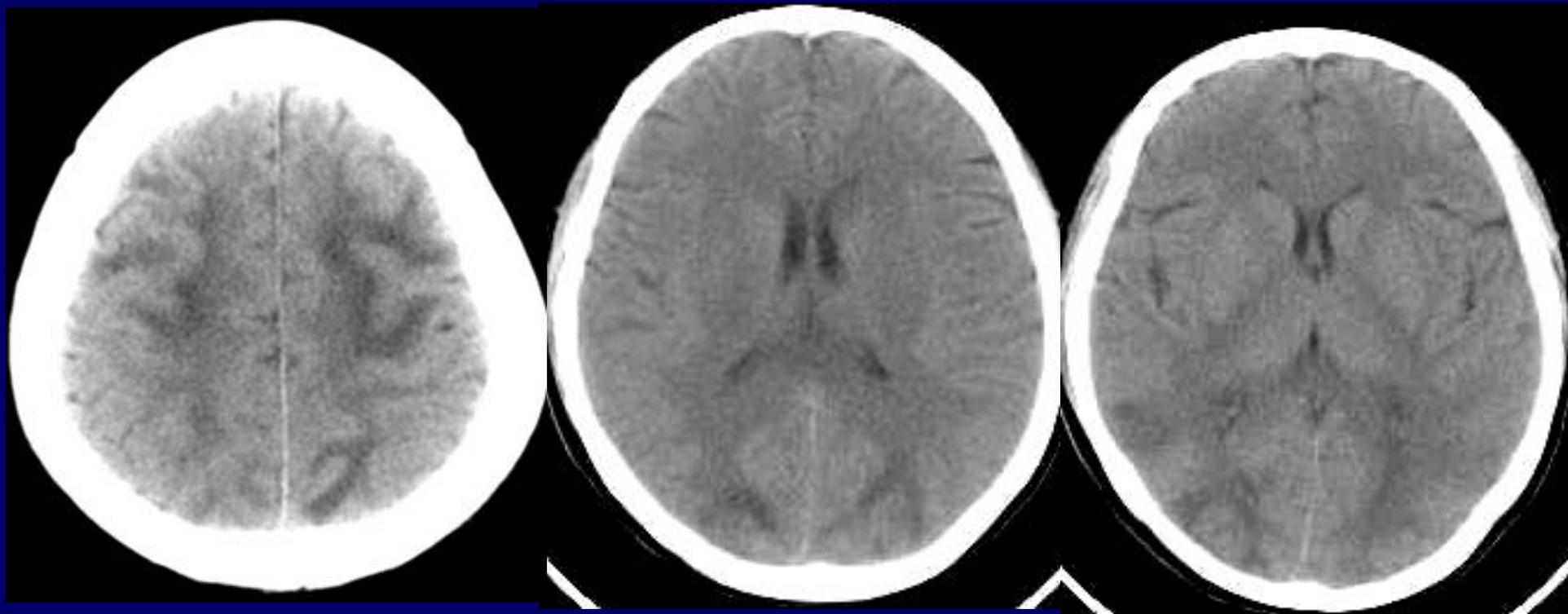
# 脑静脉小结

- 大脑静脉解剖特点及组成
- 静脉畸形
- 静脉窦血栓形成  
(注意与优势引流、蛛网膜颗粒等鉴别)
- 动、静脉梗死的鉴别点



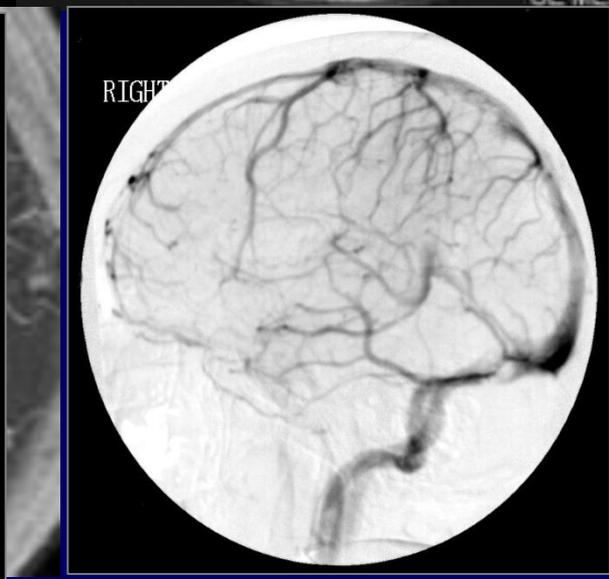
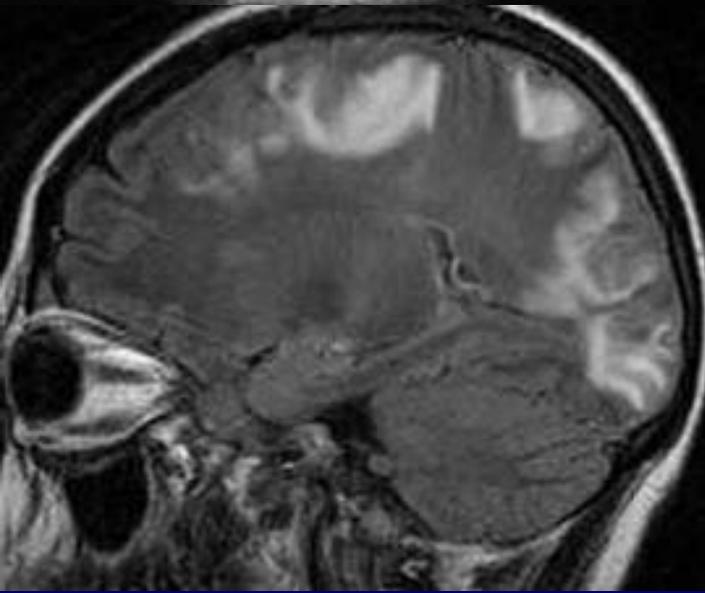
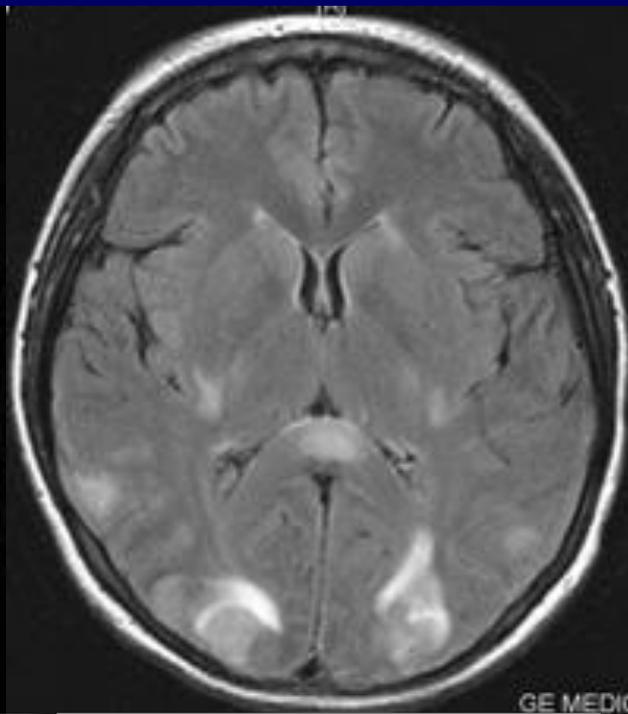
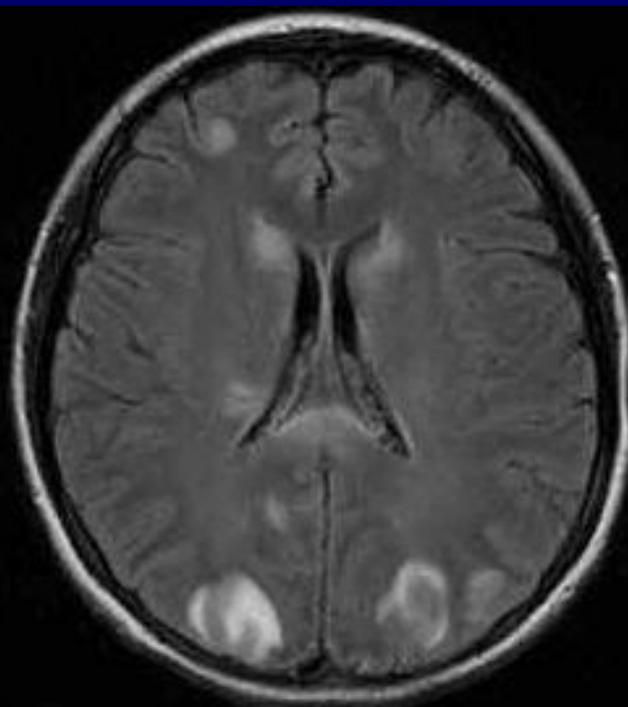
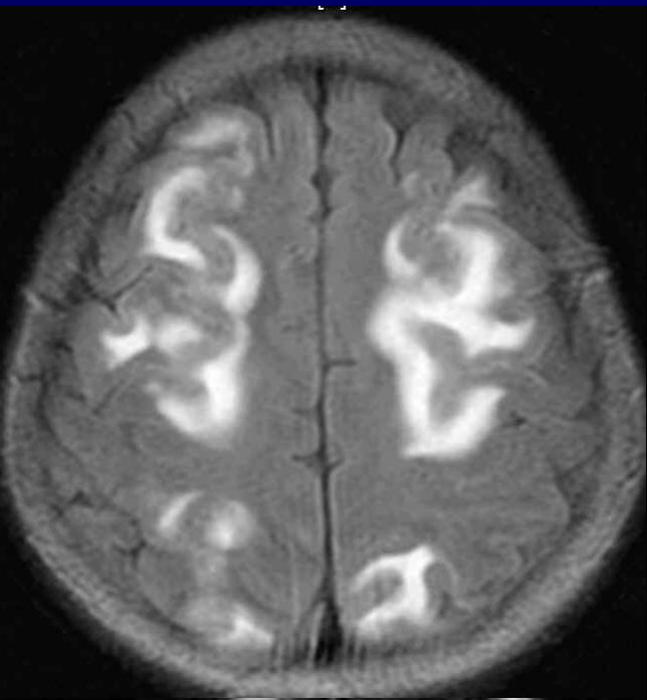
## 诊断??

停经7月，抽搐两次，Bp: 180/120mmHg  
头痛，一般情况差，烦躁，神志恍惚





# 后部可逆性脑病综合征





# 后部可逆性脑病综合征

- **Posterior reversible encephalopathy syndrome**
- **PRES**



# 临床特点

- 头痛、意识模糊、癫痫发作和视力下降  
无力和昏睡、头痛常为首发体征  
癫痫发作亦可为最初症状  
轻微昏睡到意识混乱，严重者可昏迷  
一般都有视力改变：视物模糊，偏盲、  
视野缺损、视幻觉及完全皮质盲



- 成人
- 儿童也有报道
- 女性发病率稍高



# 病因学

- 多继发于血压急剧升高，如高血压脑病患者及子痫前期或子痫发作的孕妇
- 抗排斥反应药物（如环孢霉素A）的并发症，如器官移植患者
- 继发于尿毒症、溶血性尿毒综合征、血栓性血小板减少性紫癜患者及某些化疗药物应用之后



# 机制（有2种推测）

- 血管痉挛导致的缺血：DSA、MRA出现过大大血管痉挛现象，但主要出现在子痫前期或子痫患者，大多数患者并不出现，故学者们普遍持否定态度
- 脑血管自我调节能力丧失致组织间液渗透到血管外引起：血压急剧升高超过调节限度时，自我调节能力丧失，血脑屏障亦出现功能受损，导致组织间液、大分子物质、甚至血细胞渗出到脑实质内。由于脑白质组织细胞排列较灰质疏松，因此病变主要出现在皮质下白质内

# 3D MRA





# 机制

- 严重高血压并不是PRES形成的必要条件
- 基础血压水平
- 快速发展的、波动性或间歇性高血压尤其具危险性
- 内皮细胞功能障碍



# 病理生理学

- 人体血压尽管有变化，但通过小动脉的收缩与舒张，自动调节保持了脑血流量的稳定
- 超出脑自动调节的上限后收缩的小动脉由于血压的持续升高被迫扩张，出现既有血管收缩又有血管舒张的区域，尤其是在动脉分水岭区，导致脑高灌注、血脑屏障破坏并液体渗出到间质内，即为血管源性水肿
- 有些严重的病人脑血流自动调节的紊乱会导致低灌注和梗死，尤其在后分水岭区
- 导致既有细胞毒水肿又有血管源性水肿



- 优先累及脑后部区域的原因未完全明了
- 解释一：交感神经分布支配的部位不均一

软脑膜血管受来自于颈上神经节的交感神经支配，颅内小动脉的交感神经支配可以保护大脑不受血压明显升高的影响。超微结构研究表明前循环区域交感神经密度最大，向后下降，基底动脉及其分支最少。由于这一从前向后的交感神经分布梯度，就可观察到PRES中从前向后水肿梯度的高灌注状态



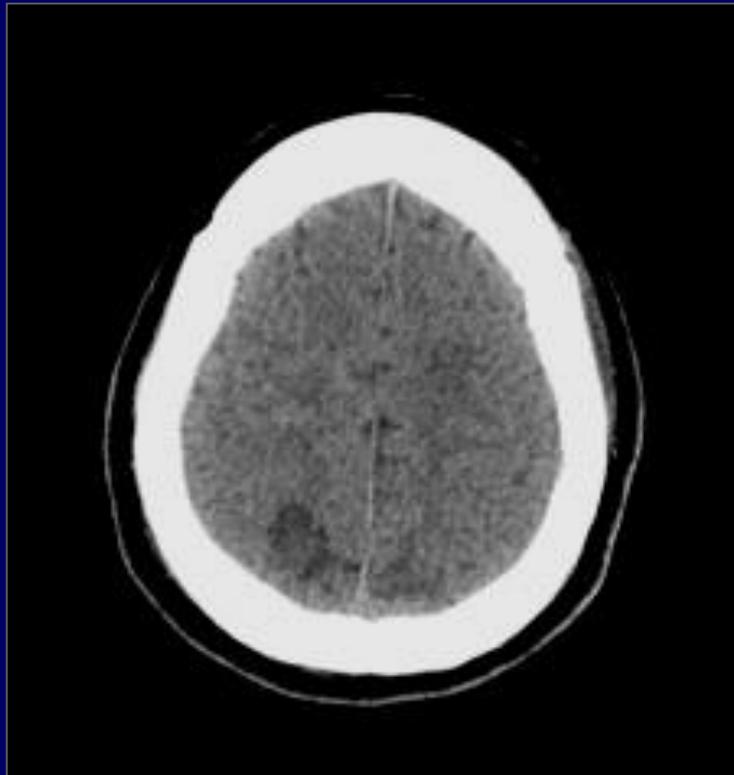
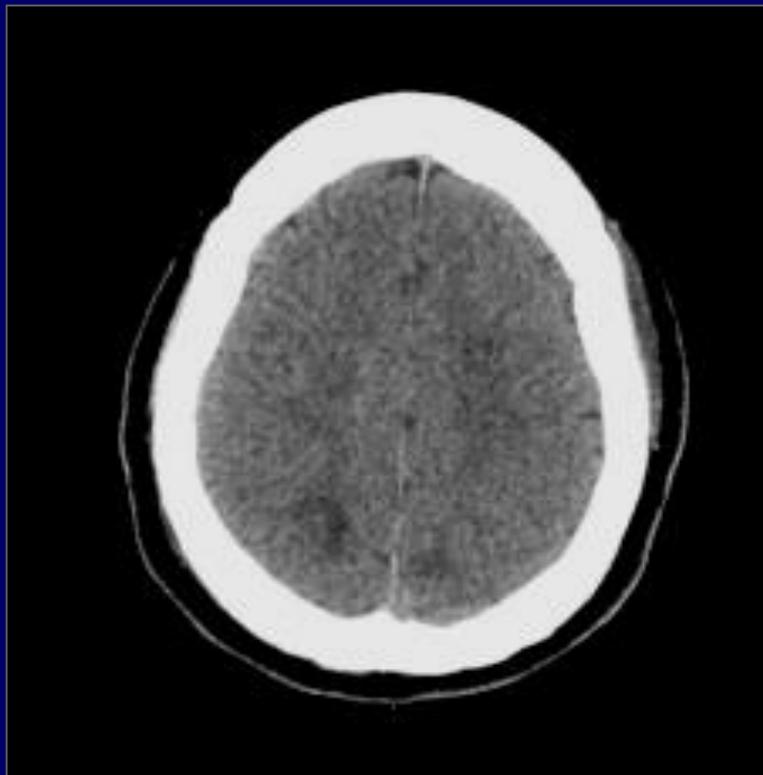
# 影像学表现

- 大脑后部（后循环区域）尤其是顶枕区白质内出现脑水肿
- 小脑、脑干可累及
- 额叶和颞叶也可受累
- 主要位于皮层下白质，但皮层、基底节也可受累
- 常对称性分布

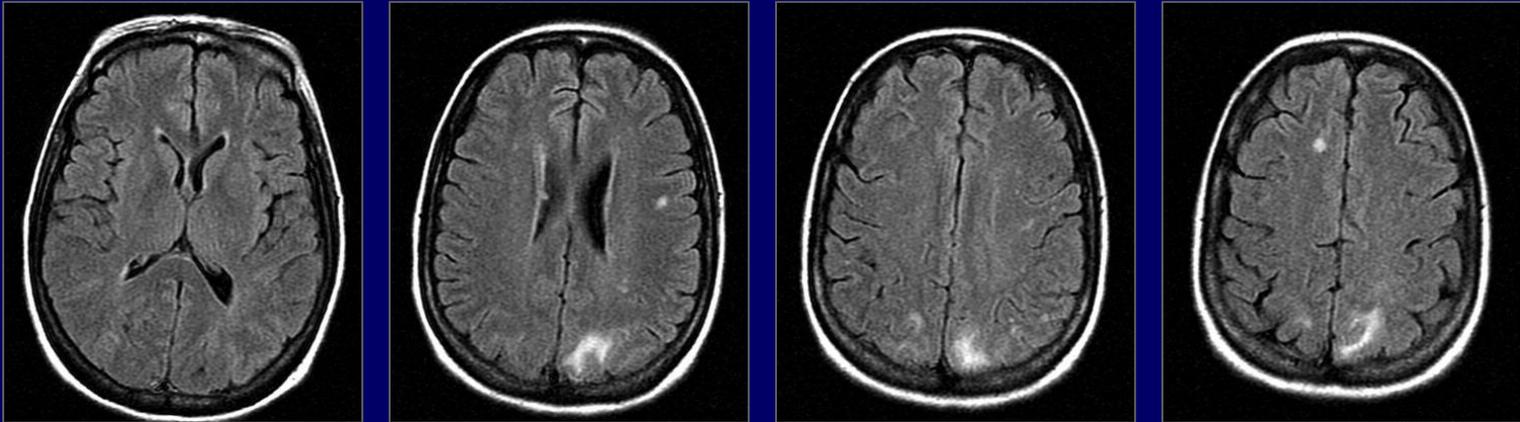
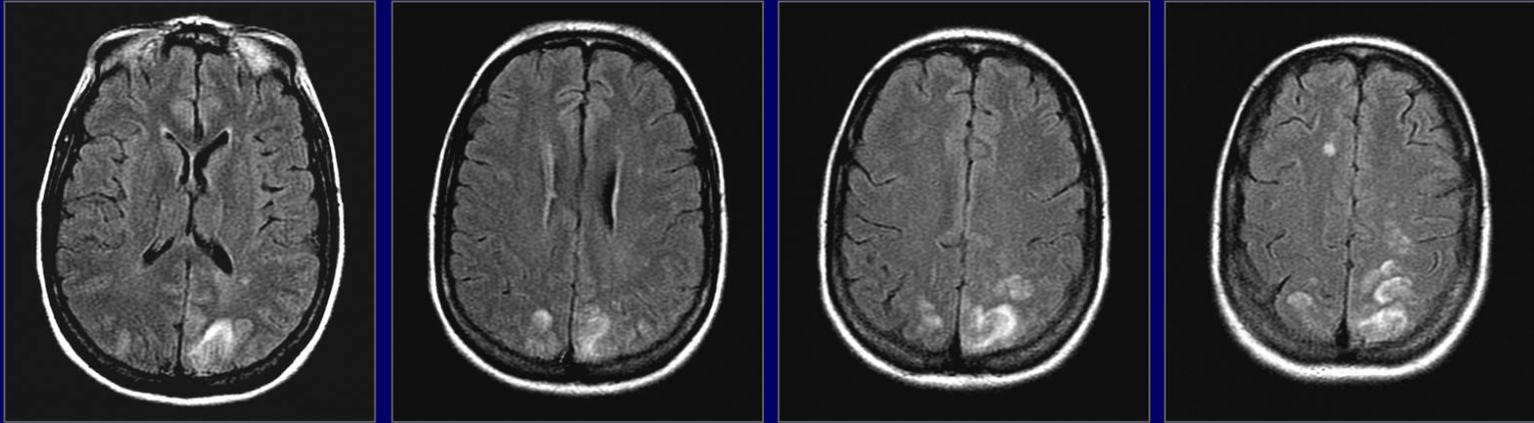


# 影像学表现

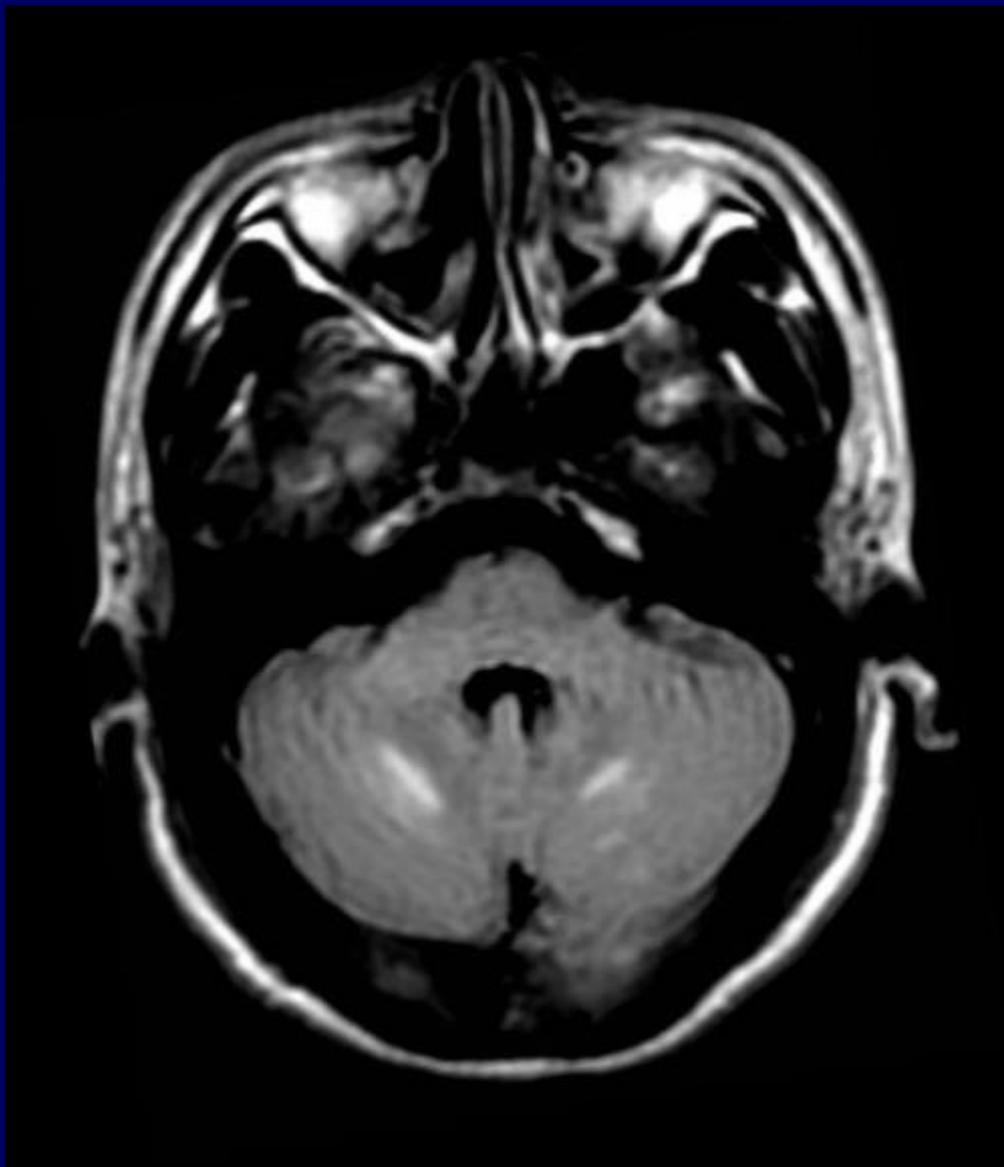
- CT呈低密度，MRI优于CT，FLAIR显示皮层病灶更佳
- 长T1长T2信号，FALIR高信号
- 注射Gd-DTPA后可呈脑回样强化（通透性增加）
- 梯度回波序列可发现小出血，重者可有大片出血
- 大多数治疗后复查病灶消退，提示其为一过性脑水肿而不是真正的脑梗死

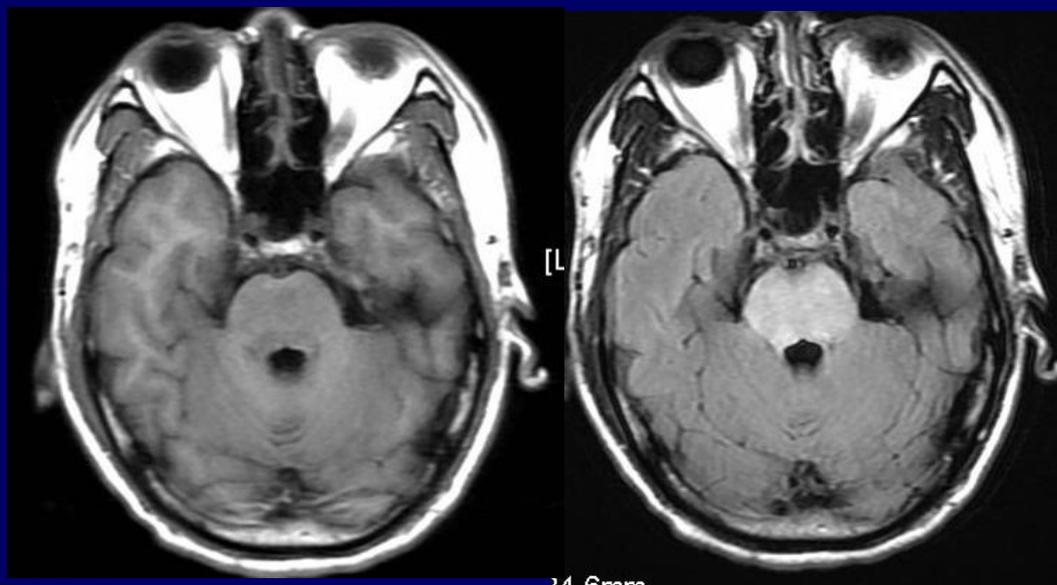


# PRES: Reversible

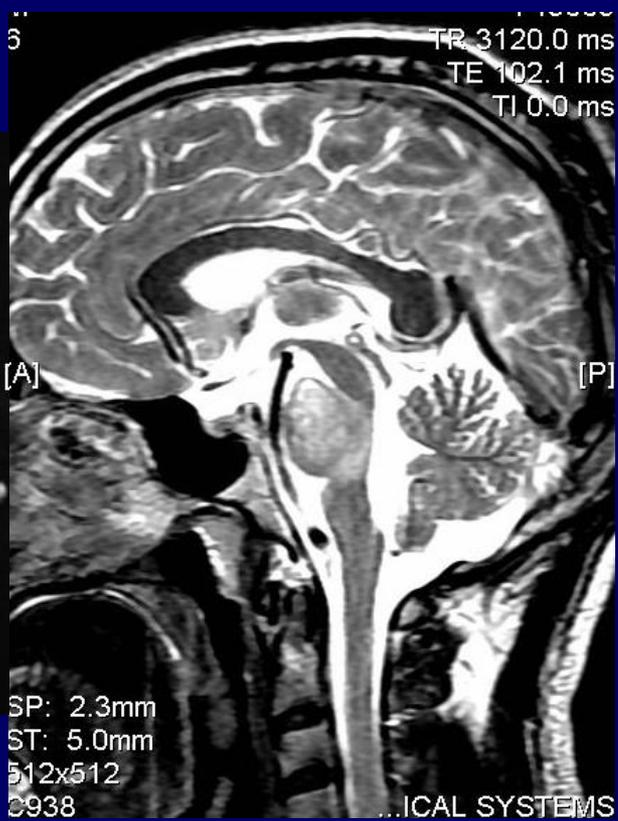


3 Days Later





24.6mm



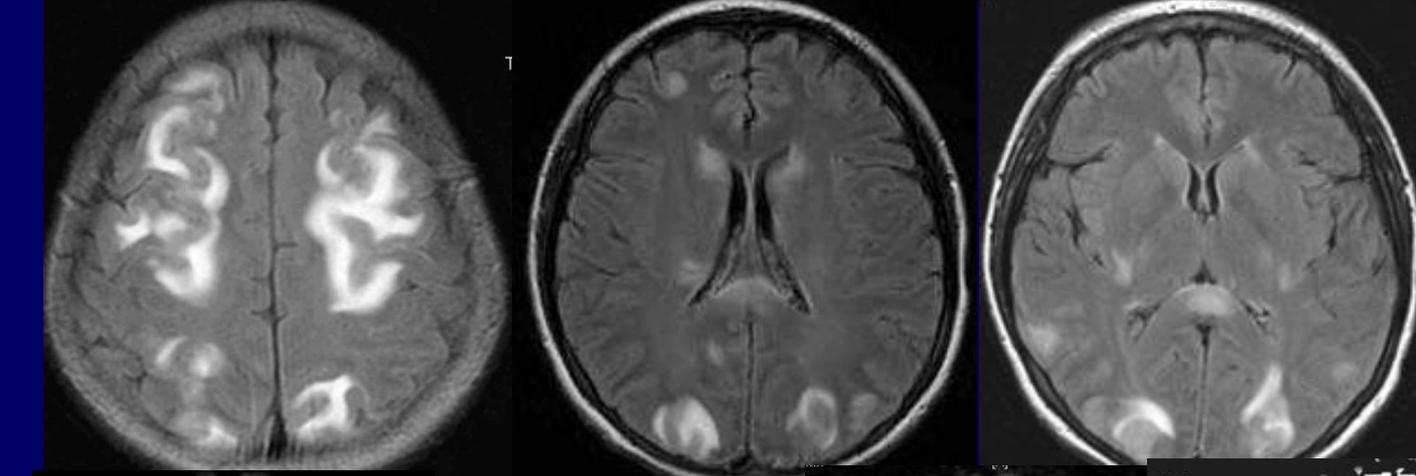
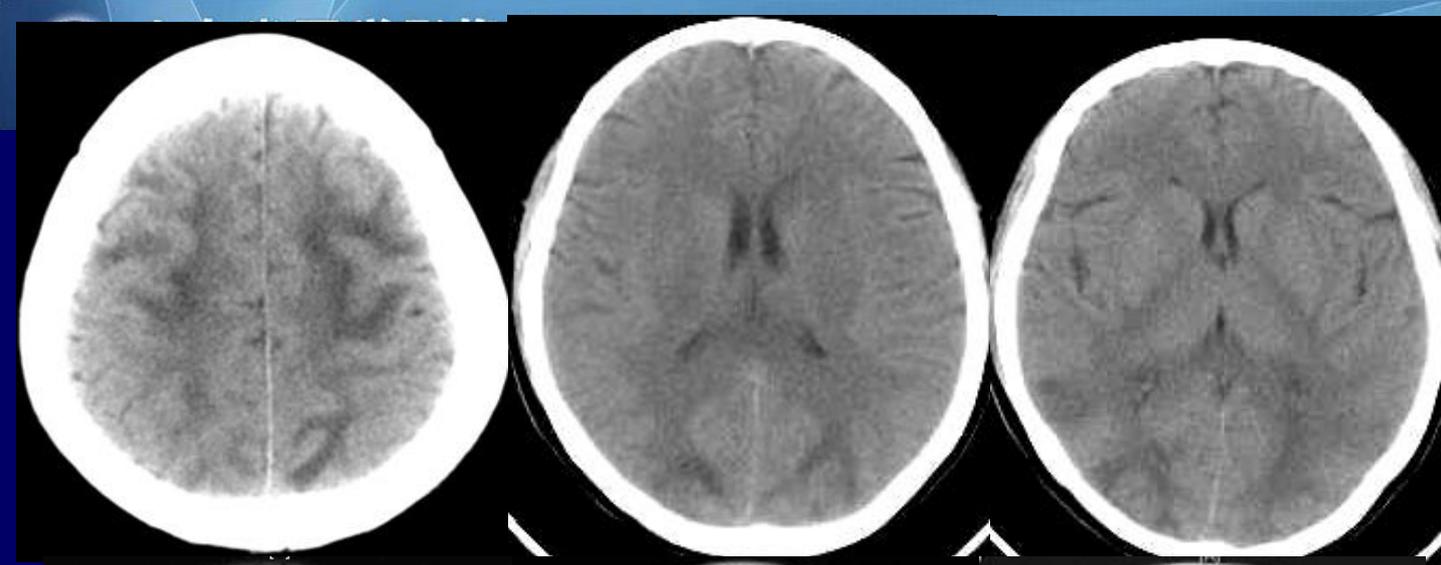


# DWI

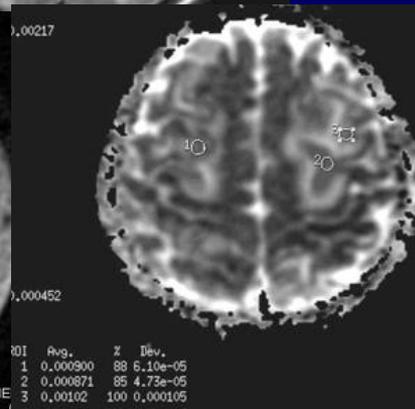
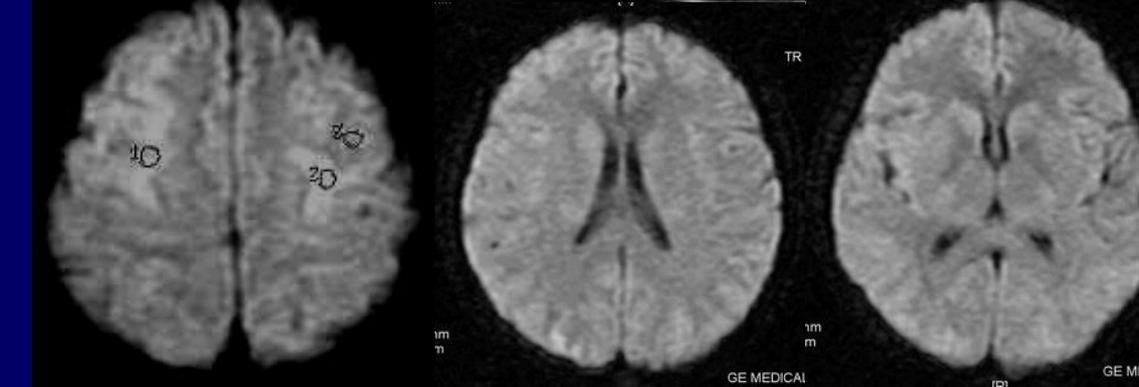
- ADC值增加，符合血管源性水肿
- DWI可为高、低或等信号

ADC图为等、高信号

$T_2$ 滤过效应



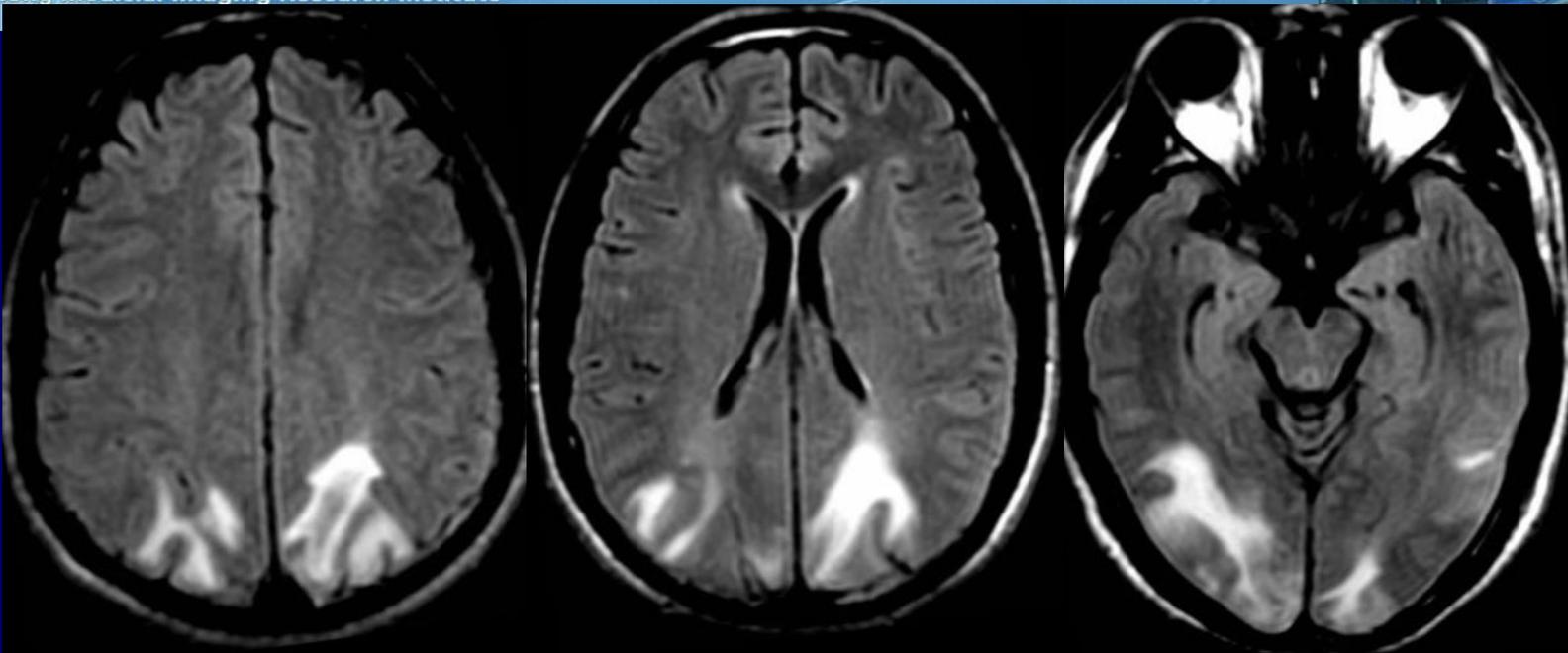
停经7月，抽搐两次，  
Bp: 180/120mmHg  
头痛，一般情况差，  
烦躁，神志恍惚



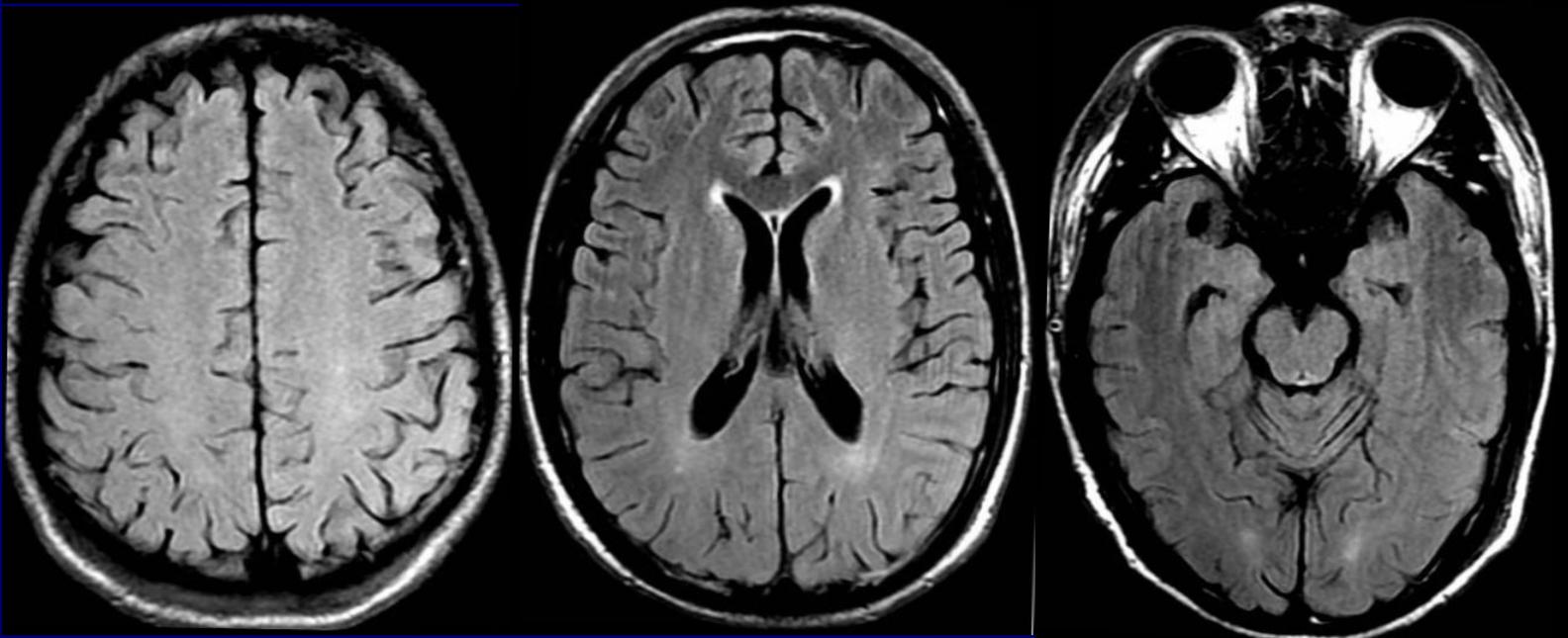
DWI、ADC图  
均高信号  
血管源性水肿

肾炎，肾衰竭尿毒症期.头痛呕吐3天， Bp 250/130mmHg意识模糊，嗜睡，呼之能应，对答欠切题

Shandong Medical Imaging Research Institute

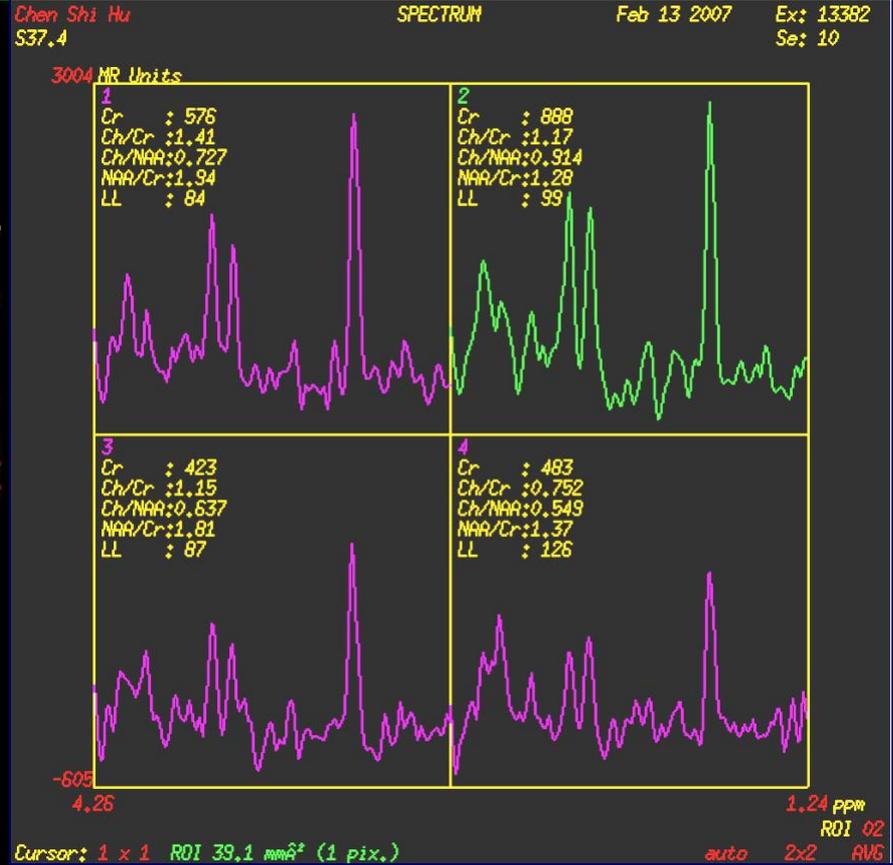
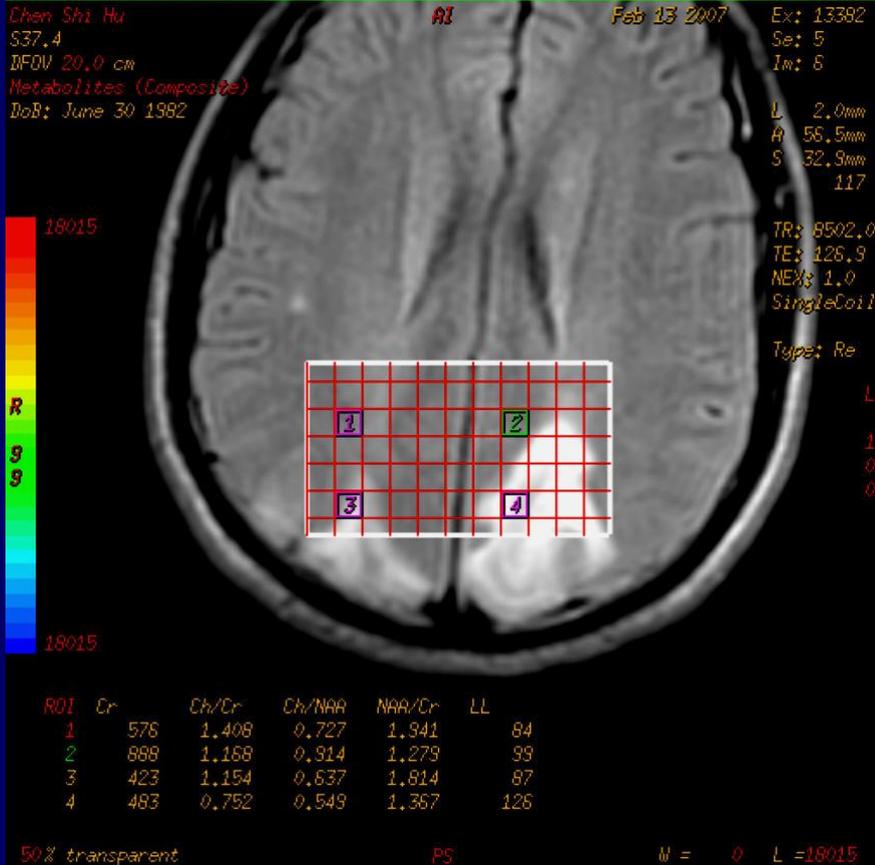


治疗前



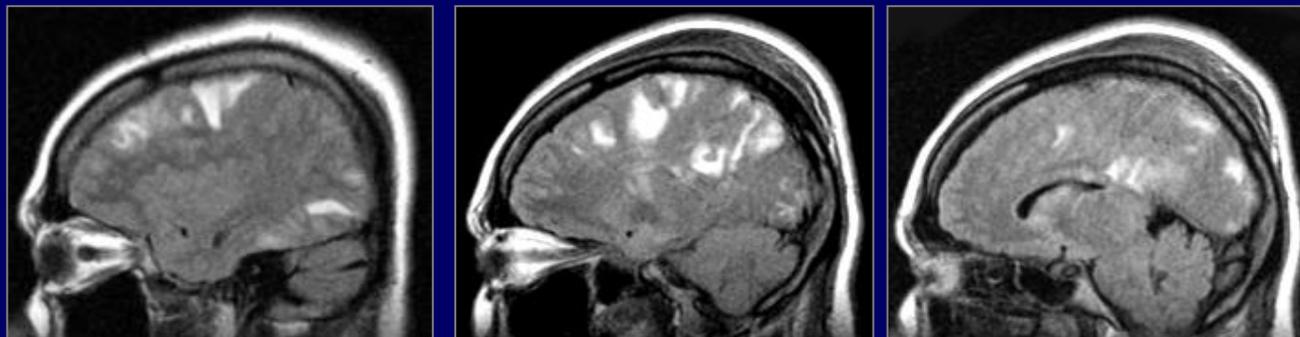
治疗后



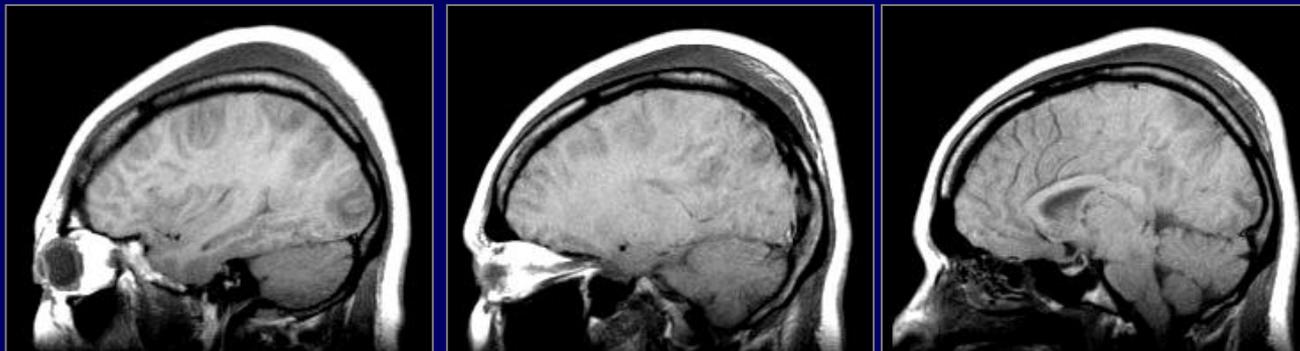




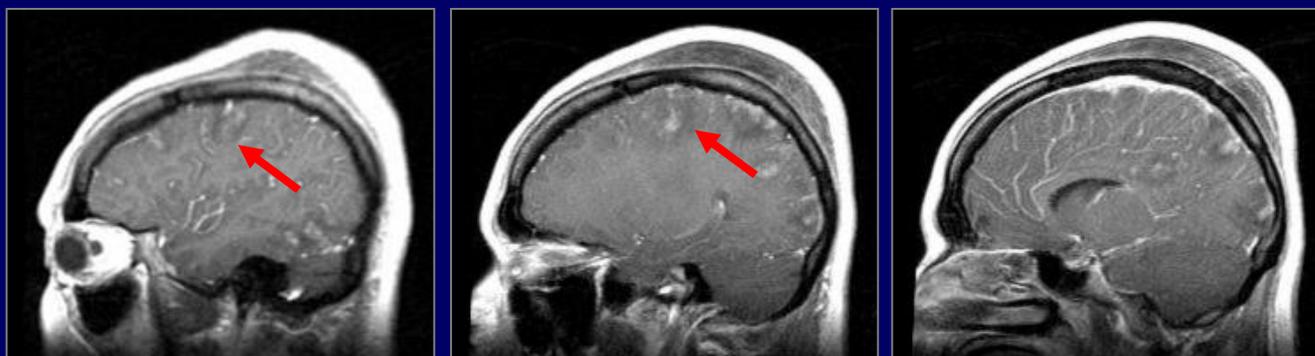
T2 FLAIR



T1 SE



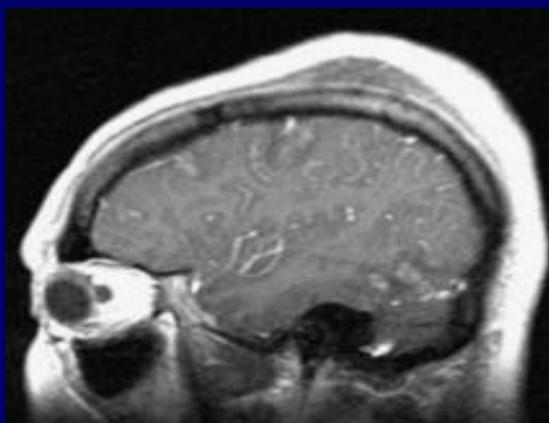
T1 + C



注射Gd-DTPA后可呈脑回样强化（通透性增加）



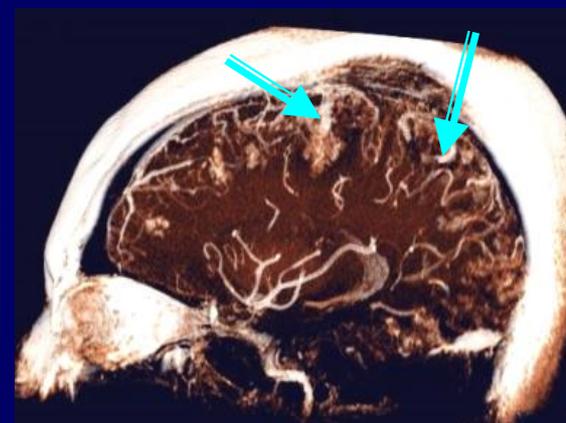
T1+C



3D MRA+C



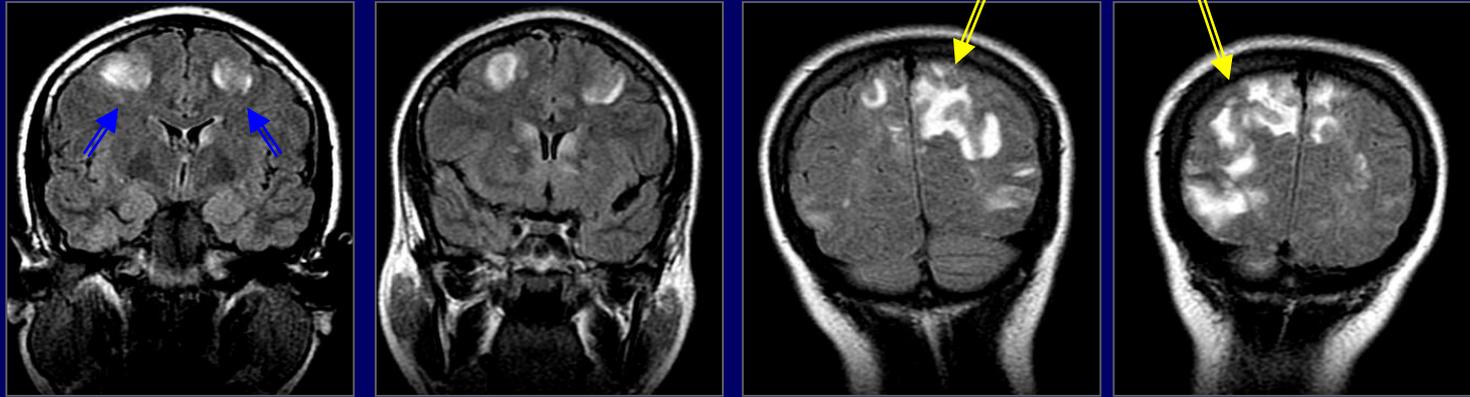
Color illustration



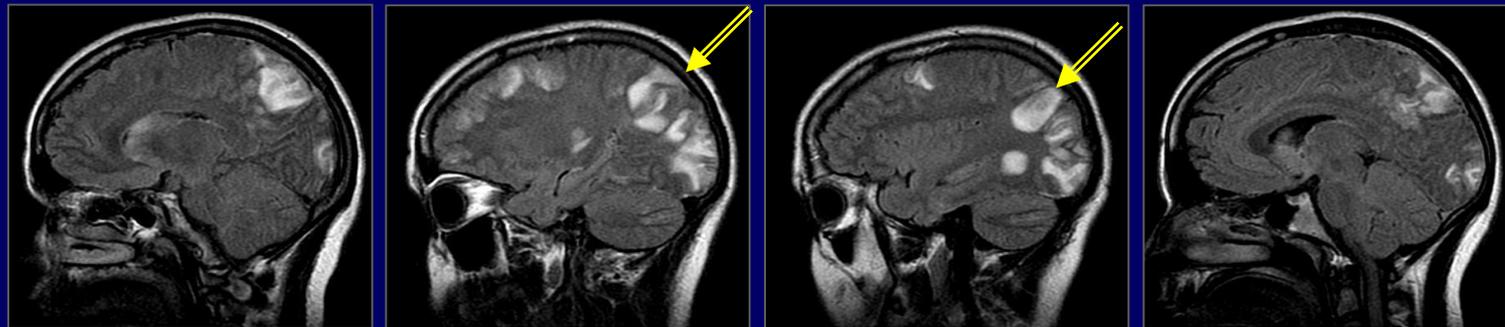
注射Gd-DTPA后可呈脑回样强化（通透性增加）

# 头痛、癫痫、视物模糊

Coronal MRI T2 Flair

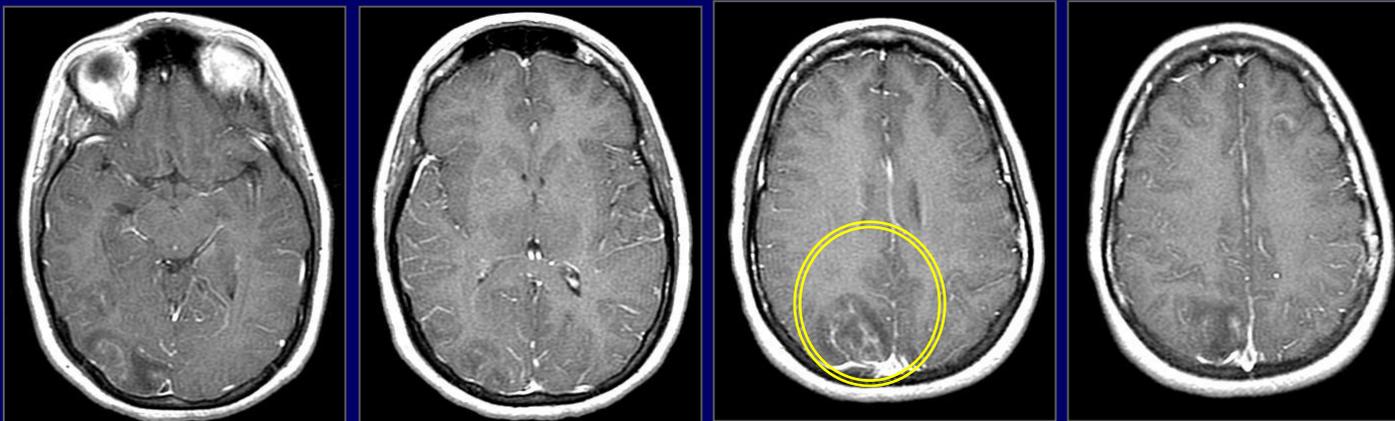


Sagittal MRI T2 Flair

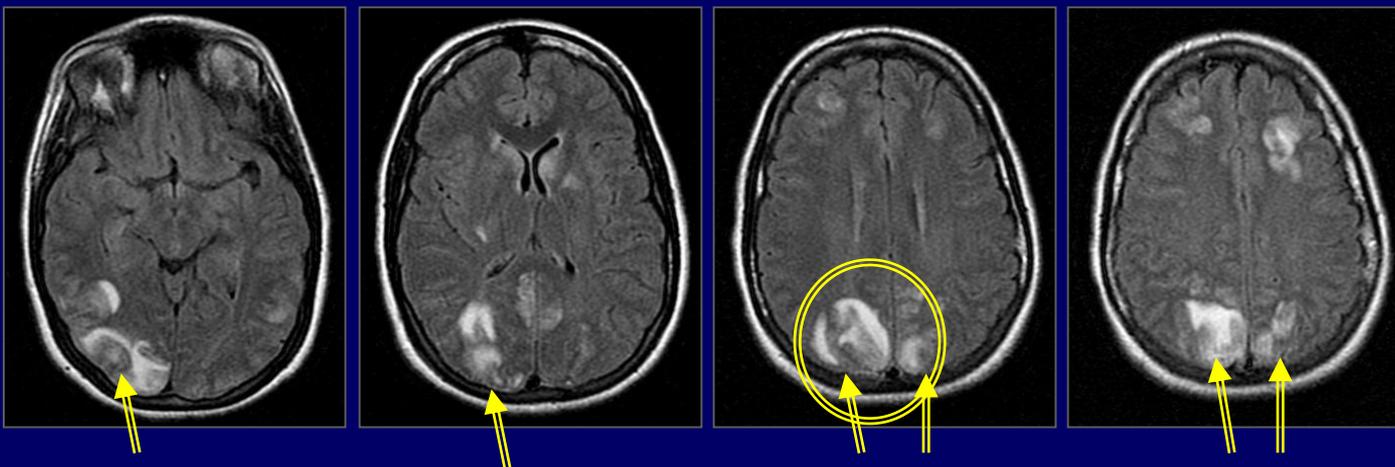




T1+C



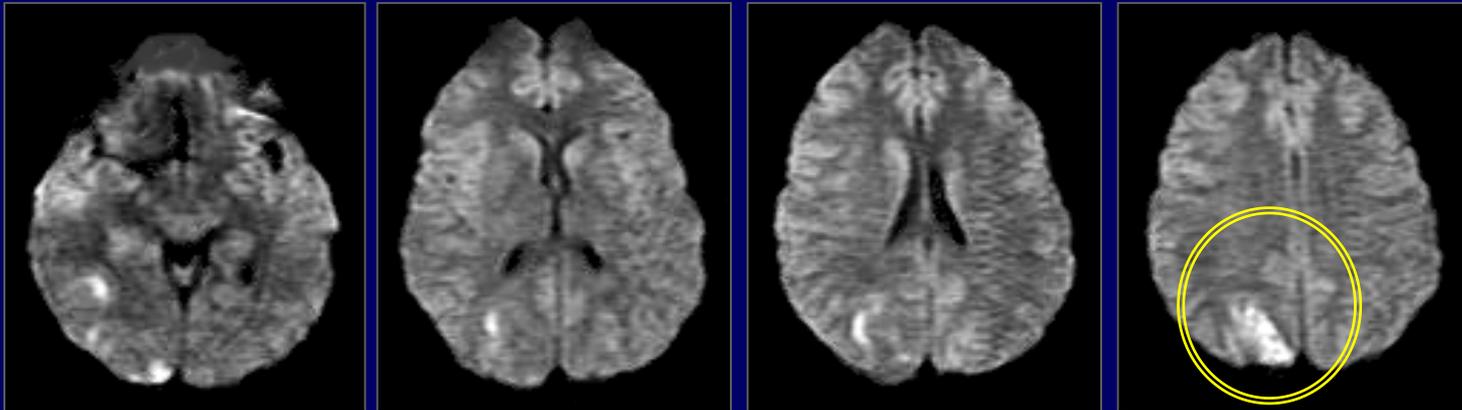
T2 Flair





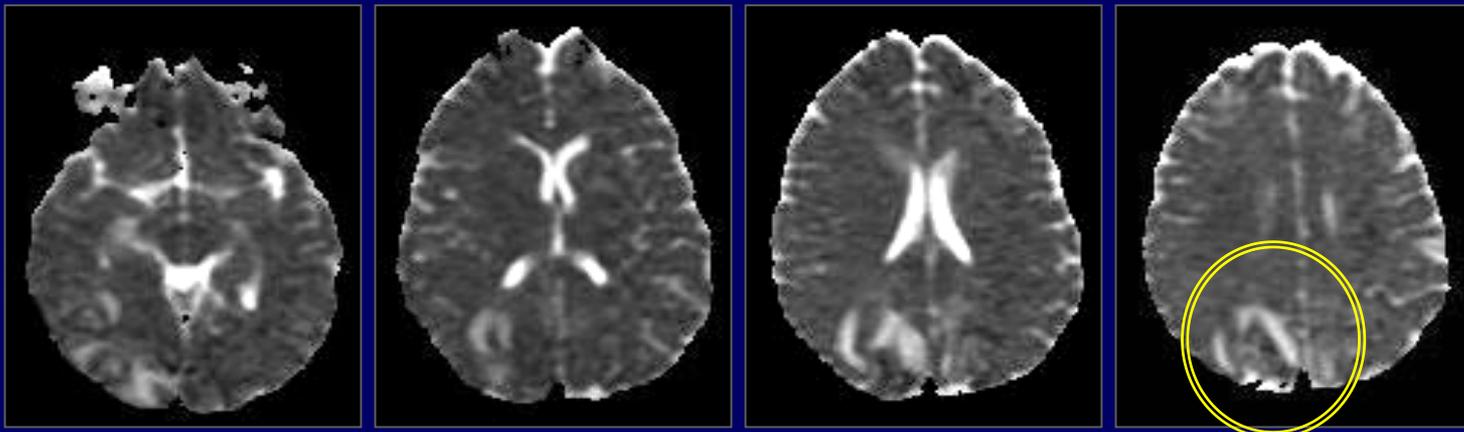
# T2 DW & ADC show Cytotoxic Edema

T2 DW



Bright signal

ADC



Low signal

Infarct in right occipital lobe





# 鉴别诊断

- 上矢状窦栓塞、静脉性脑梗死

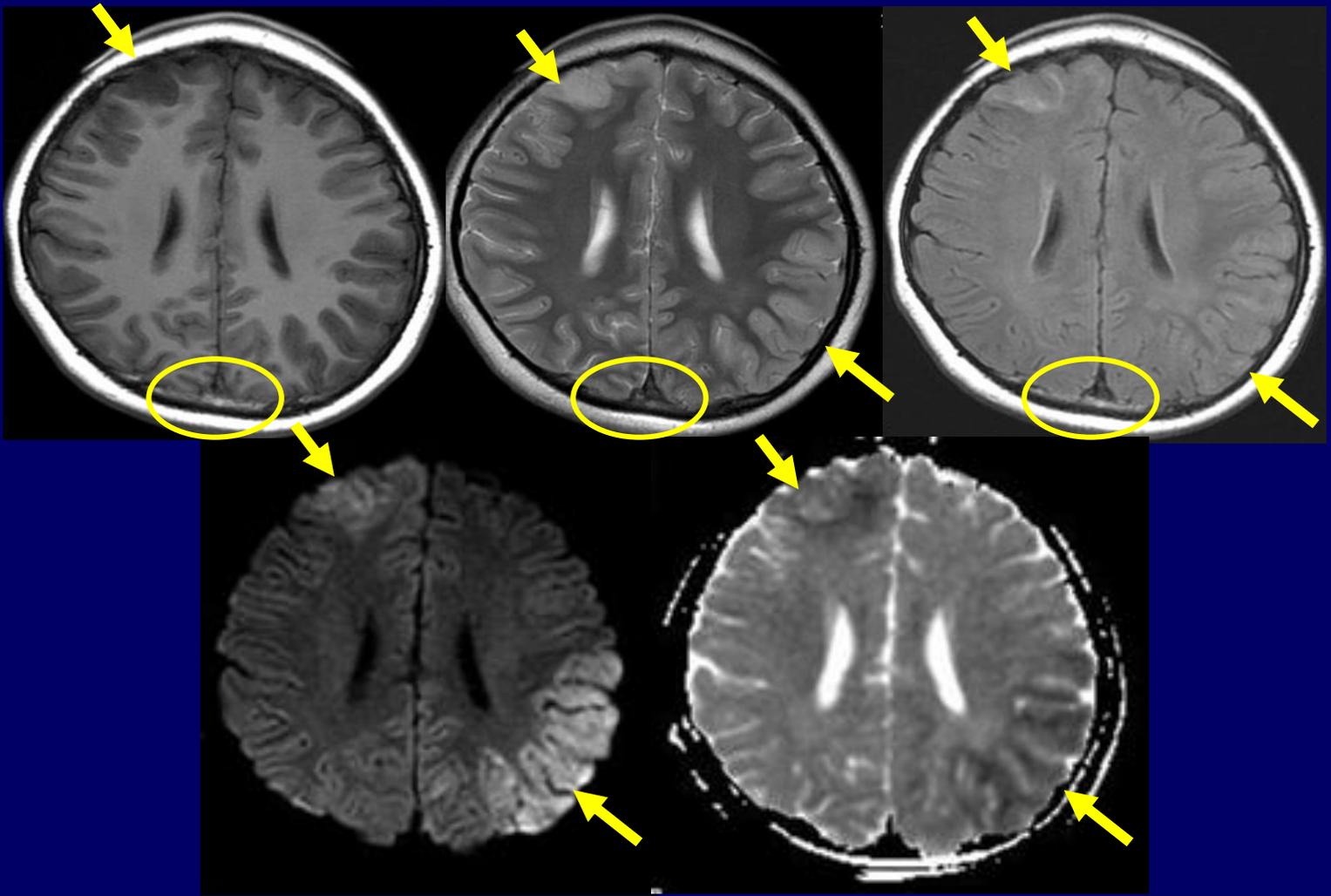
MRV对于鉴别上矢状窦栓塞、静脉性脑梗死有重要价值。PRES患者脑内静脉窦及脑静脉不出现狭窄、闭塞、血栓形成等征象，而上矢状窦栓塞发生时MRV可直接显示栓塞部位及范围

- 脑炎

好发部位、强化方式、临床症状及实验室检查

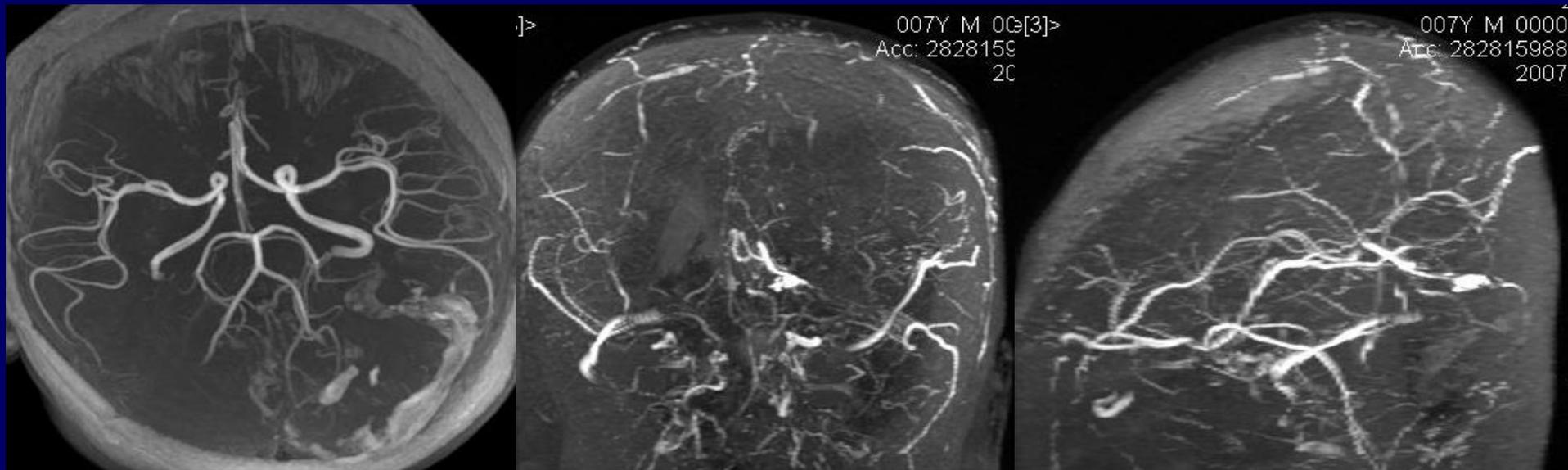


男，7岁，肾炎、尿毒症，头痛、意识模糊  
皮质受累为主！与静脉窦引流范围一致！



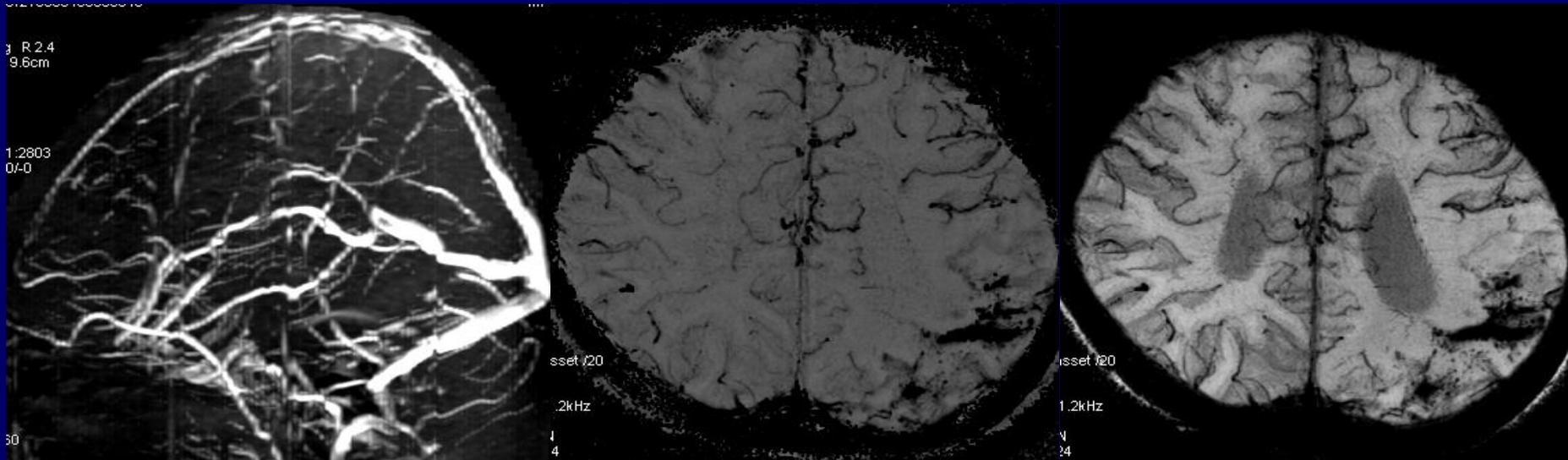


男，7岁，肾炎、尿毒症，头痛、意识模糊  
皮质受累为主！与静脉窦引流范围一致！





## 治疗1周后复查



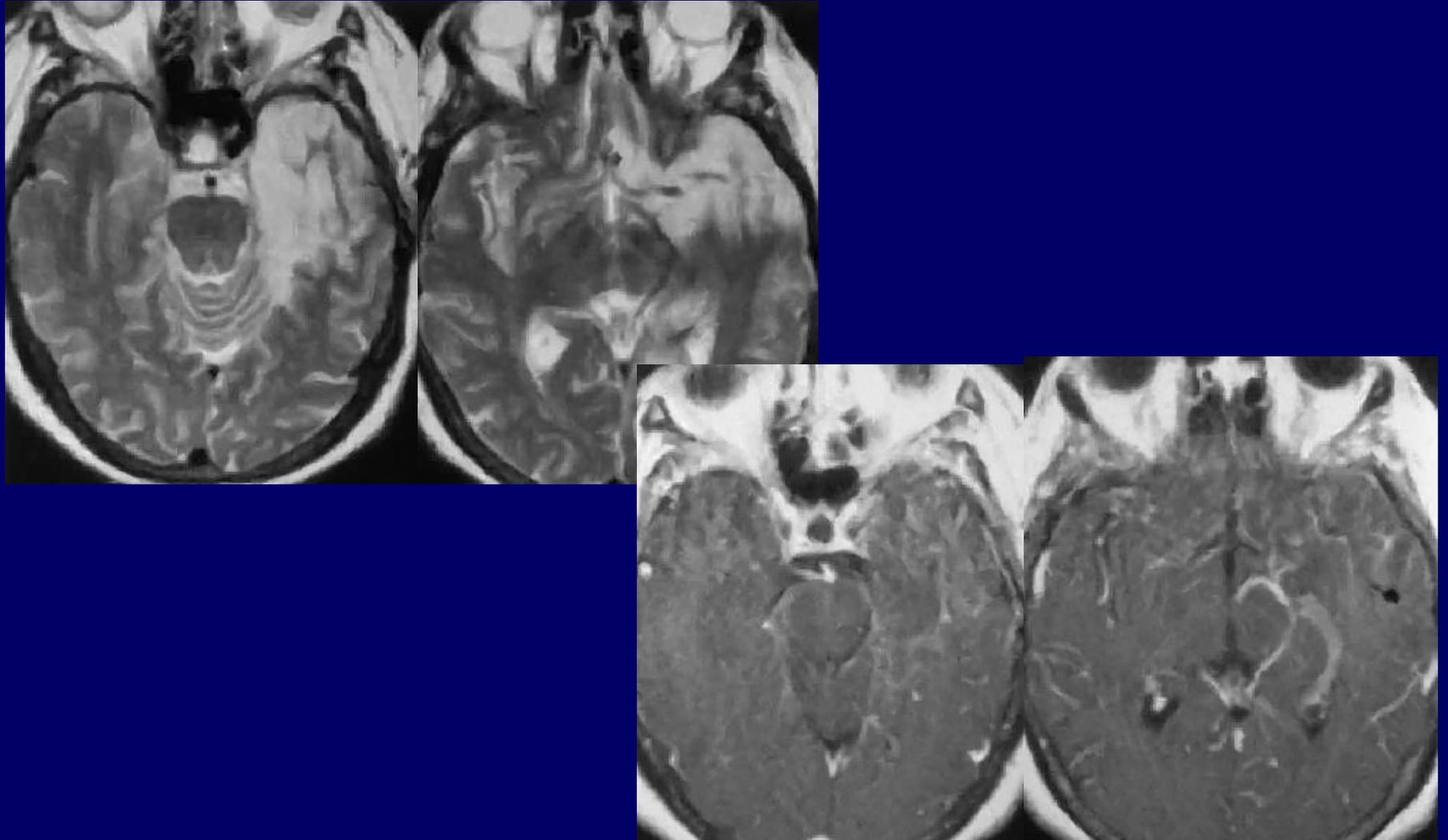


# 病毒性脑炎

临床症状：发热等，无恶性高血压史等  
见于颞叶、岛叶和额叶，皮质及皮质下  
片状，可有出血、占位效应明显  
增强扫描可见局灶性、线样或脑回状强化  
晚期可见脑萎缩、软化、钙化



# 病毒性脑炎 (herpes simplex encephalitis)





# PRES 小结

- 头痛、意识模糊、癫痫发作和视力下降
- 孕产妇、血压急剧升高者、尿毒症、化疗药物应用
- 顶枕区皮层下白质内多见，但皮层、小脑、脑干、基底节也可受累
- 常对称性分布
- 可逆性
- DWI示无弥散受限（受限，则转变为梗死）
- 鉴别诊断

# 静脉性脑梗死、动脉性脑梗死、PRES鉴别

- 1、**静脉性脑梗死区域与引流静脉相一致**，称“**静脉引流区域综合征**”：
  - 上矢状窦栓塞：多见额、顶、枕叶
  - 乙状窦、横窦栓塞：多见颞叶和小脑
  - 直窦栓塞：多见双侧基底节、丘脑、脑干
  - 常对称、皮层、皮层下
  - 动脉性脑梗死区域与供血动脉分布区域相一致**，多发生在白质或灰白质均受累
- 2、静脉性脑梗死可单发或多发，范围大小不一，形态不规则，呈**片状或脑回状**  
动脉性脑梗死常呈**扇形、三角形、楔形**
- 3、MRI平扫可显示**静脉(窦)流空信号消失**，MRV不显影
- 4、PRES:大脑后部皮质下白质、无弥散受限、可逆、静脉(窦)无栓塞、好发人群



# 病例

患者男性，40岁

主诉：头痛、左下肢沉重感、走路不稳伴发作性左侧肢体抽搐7天

患者主要表现为无诱因突发双侧颞部持续性胀痛，阵发性加重，伴全身大汗、恶心，但无呕吐，用止痛药后头痛稍缓解，抽搐发作时左侧肢体阵挛，双眼向左凝视，口吐白沫，意识丧失

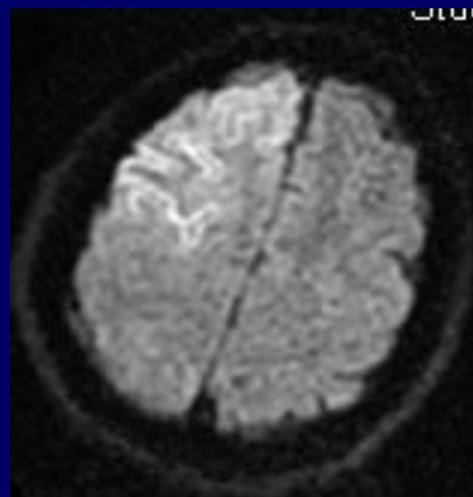
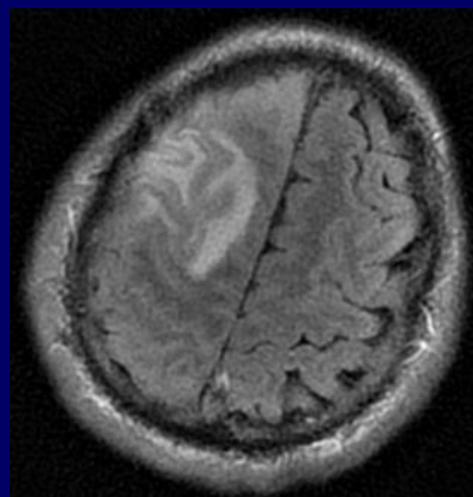
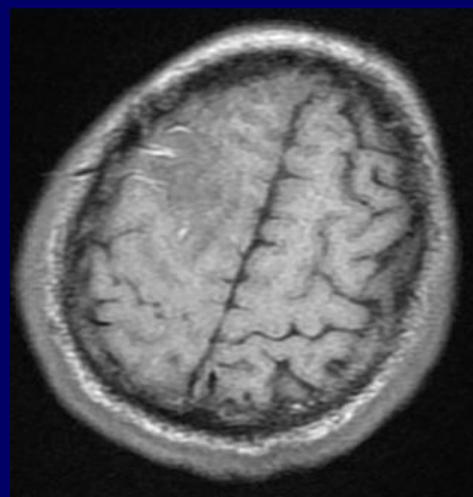
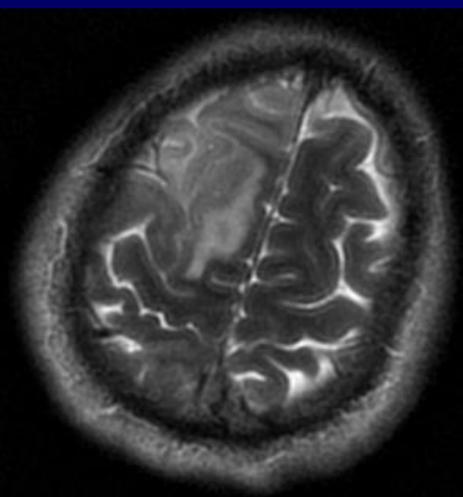
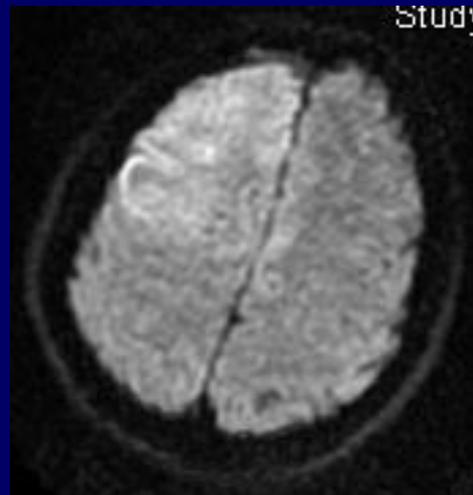
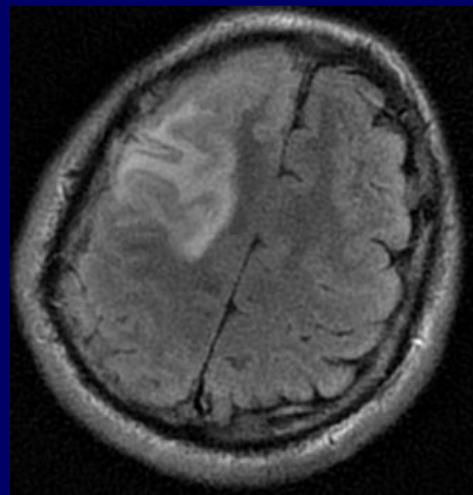
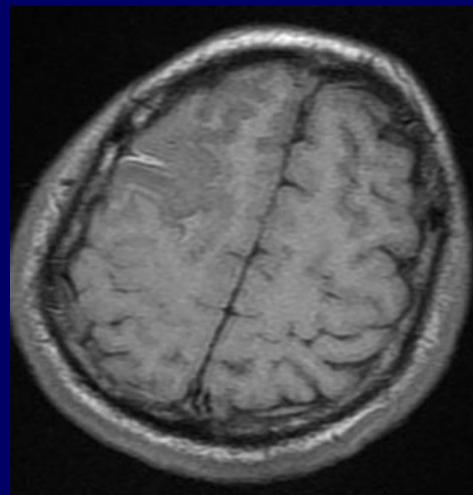
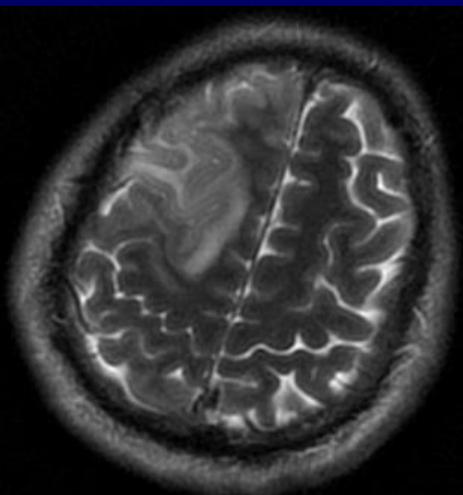
既往史：无高血压、糖尿病、乙肝、结核等病史

脑电图：异常脑电图

CSF：压力为215mmH<sub>2</sub>O，各种成分实验室检查正常



# 诊断?



T2WI

T1WI

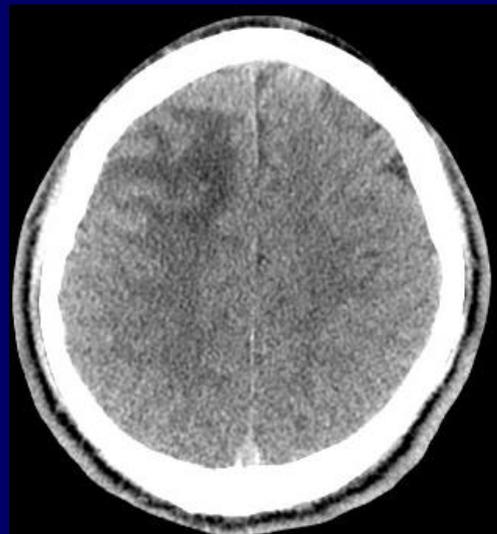
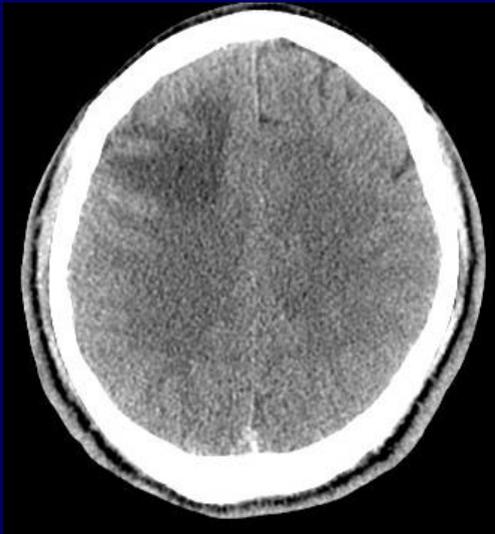
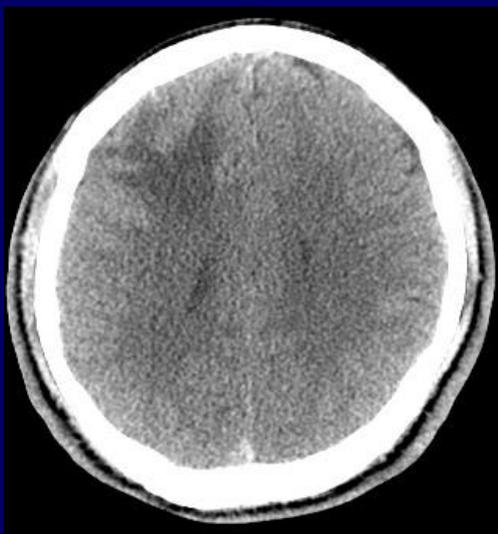
T2FLAIR

DWI

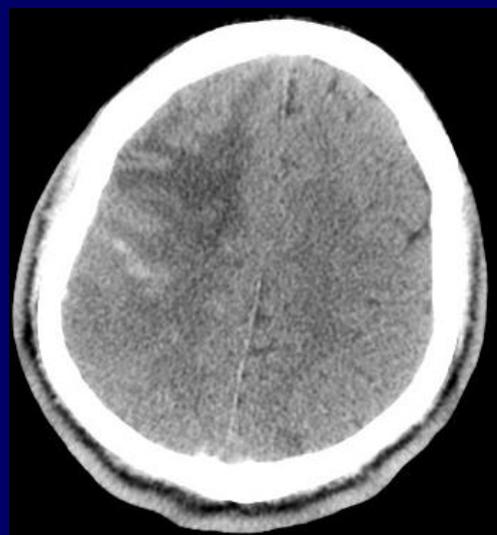
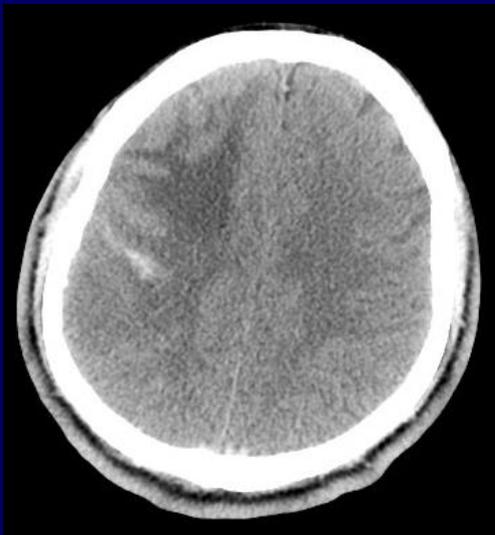
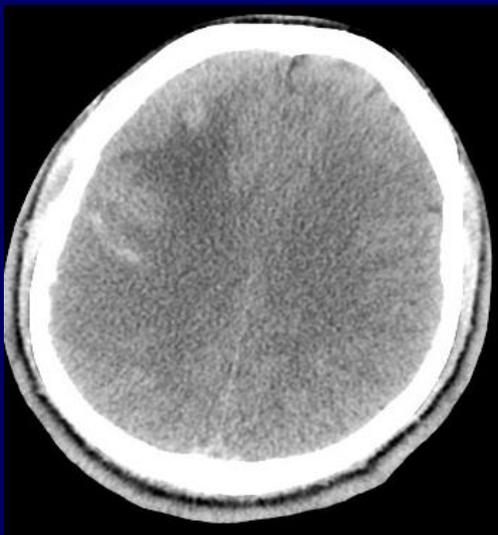


# CT复查（发病后第18、19天）

第十八天



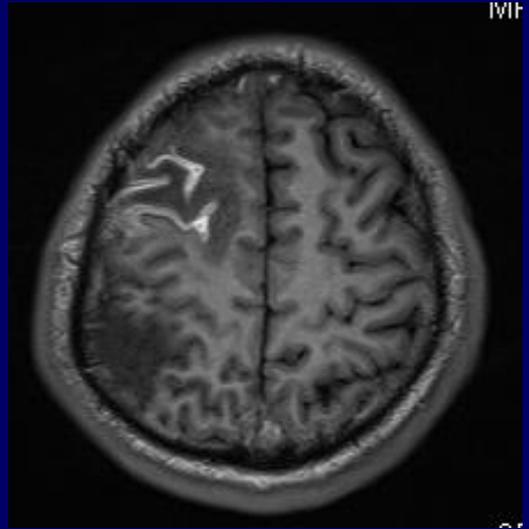
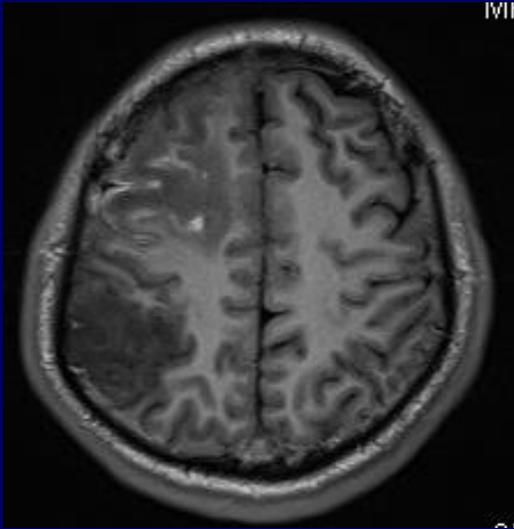
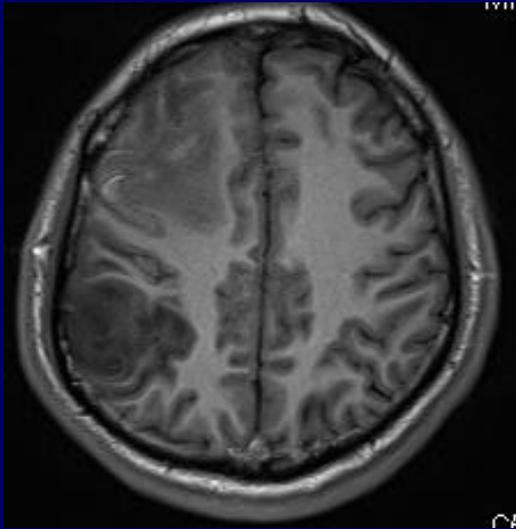
第十九天



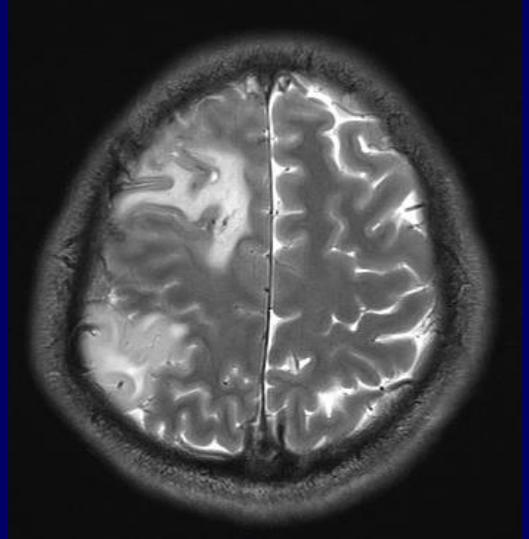
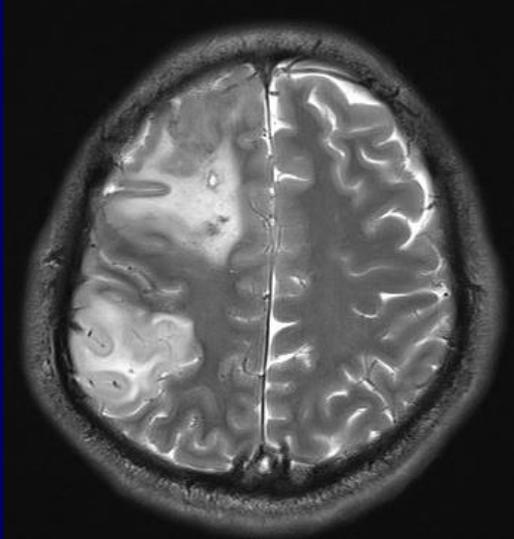
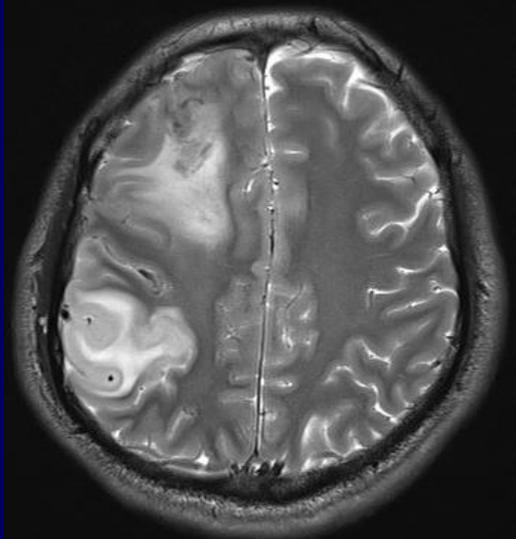


# MR复查（发病后第20天）

T1WI



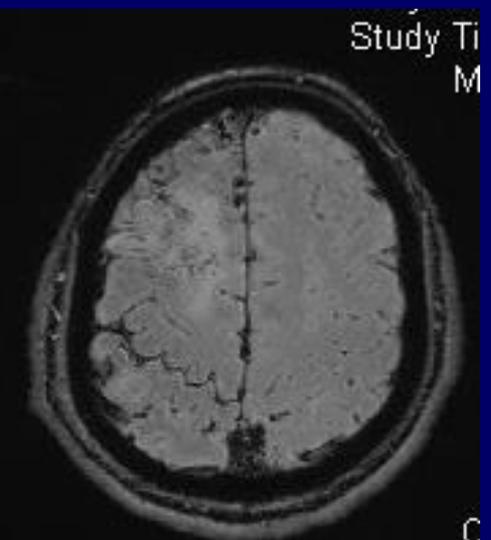
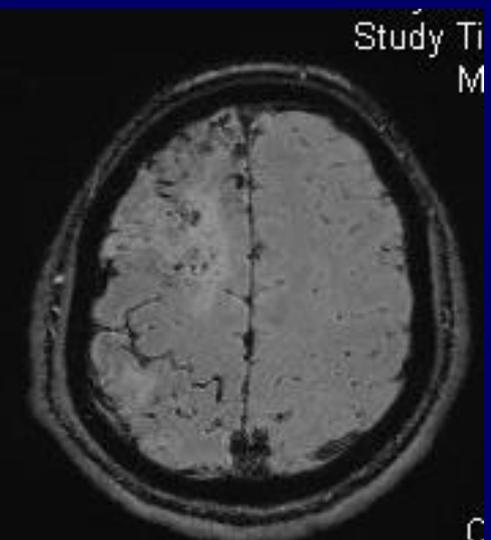
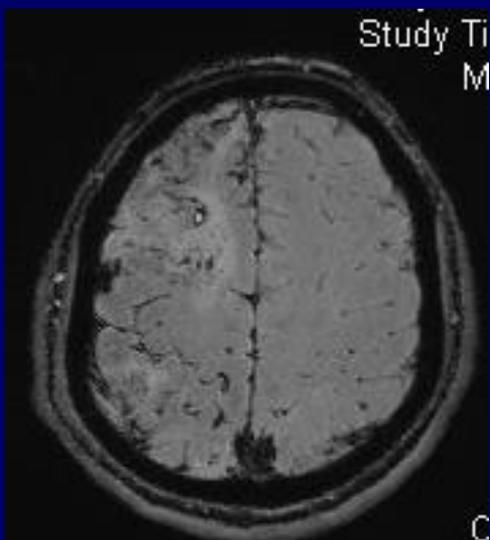
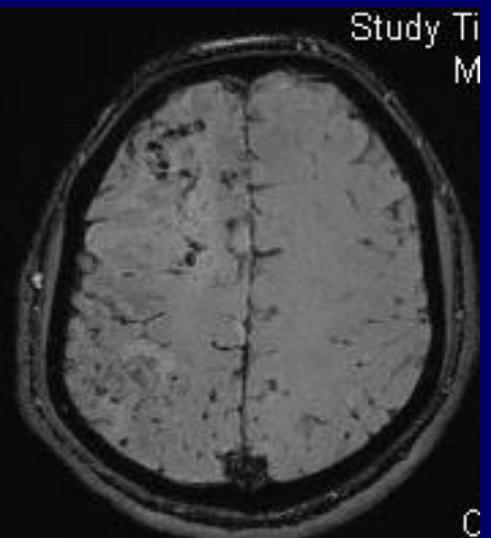
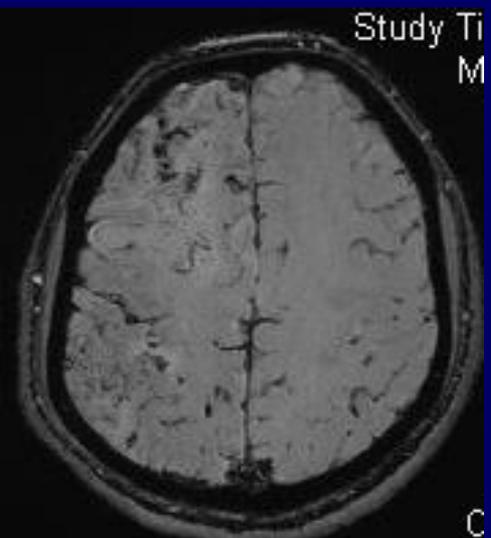
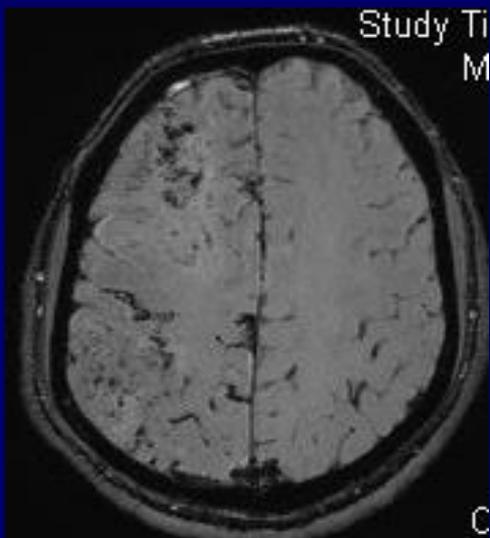
T2WI





# MR复查（发病后第21天）

SWI

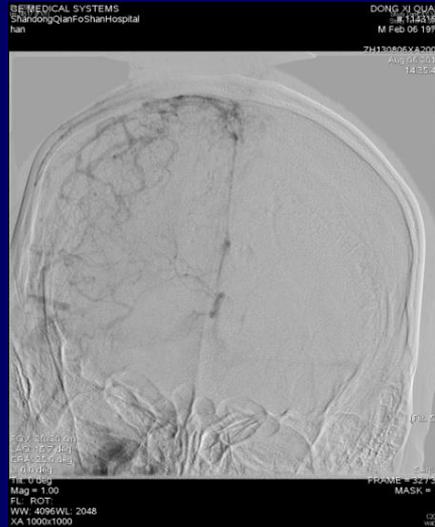




# DSA (发病后第22天)

静脉窦血栓形成并静脉性脑梗死！！

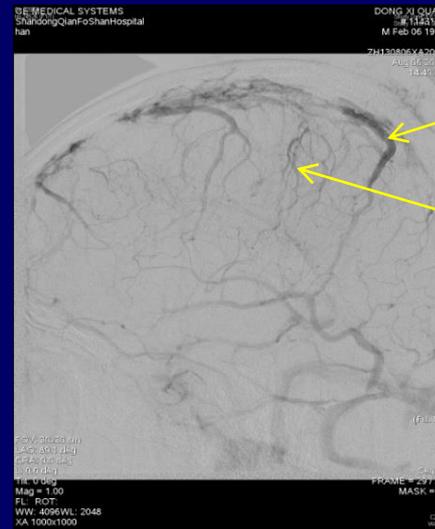
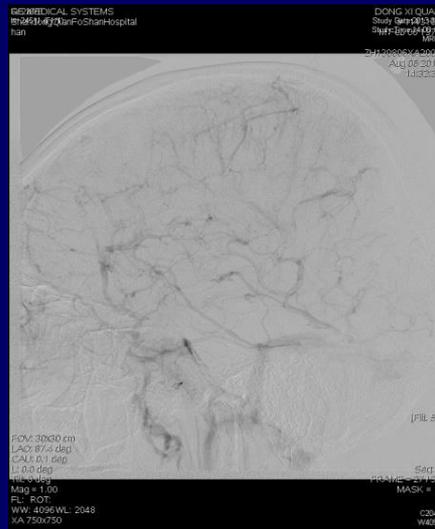
正位



中央沟静脉

上吻合静脉

侧位



中央沟静脉

上吻合静脉



- 单纯皮层静脉血栓形成

(Isolated cortical vein thrombosis, ICoVT)

- 患者经抗凝（肝素、尿激酶，华法林）

治疗后，患者病情迅速好转，于治疗六天后出院



# 临床特点

- 此病较为少见，占脑静脉血栓形成的6-7%
- 多见于中青年，18-45岁占70.6%
- 女性多于男性
- 急性或亚急性起病
- 临床症状轻
- 死亡率达48%



# 病因

- 口服避孕药
- 低颅压
- 围产期
- 炎性肠道疾病
- 血栓性疾病



# 临床表现

- 癫痫发作 (67.3%)
- 头痛 (34.7%)
- 局灶性神经功能缺损
- 意识障碍
- 认知功能减退
- 精神异常
- 少数患者可出现严重意识障碍和颅内压增高
- 神经科检查没有明显阳性体征或仅有轻微局部神经损害体征



# 病灶表现特点

- 累及大脑浅层静脉
- 相应脑实质病变多位置表浅，仅累及局部皮质和邻近白质
- 表现为出血或非出血性静脉梗死
- 不按动脉性脑梗死分布，脑组织坏死程度较轻
- 病灶可单发或多发
- 单侧或双侧
- 常伴有局部脑水肿和占位效应
- 常伴有局部蛛网膜下腔出血
- 增强扫描成脑回状或皮质下强化，或小灶状或类圆形强化



# CT表现

- 可无异常表现
- 出血性脑梗死（间接征象）
  - 皮层及皮层下大小不一的低密度灶，在病灶区可见散在高密度灶
  - 局限性脑沟内高密度灶，即蛛网膜下腔出血
- 含血栓的皮层静脉（直接征象）
  - 部分患者可见病灶区高密度束带征、绳索征



# MR表现

- 静脉性出血性脑梗死（间接征象）
  - 病灶区均呈的长短混杂T1、T2异常信号改变
  - 少量出血可出现于局部脑实质内或蛛网膜下腔
- 含有血栓的静脉影（充盈缺损！直接征象）
  - 病灶区皮层局部可见管状异常信号灶
    - 急性期：T1WI等信号，T2WI低信号
    - 亚急性期：T1WI高信号，T2WI高信号
    - 慢性期：T1WI等信号，T2WI等或略高信号



# MR表现

- T2\*WI (GRE)
  - 对皮层静脉血栓较为敏感
  - 含有血栓的皮层静脉呈低信号 (具有较强的特征性)
- SWI
  - 出血性脑梗死的出血区呈低信号
  - 含血栓的皮层静脉呈低信号
- MRA
  - 多无异常发现
- MRV
  - 无阳性发现
  - 或呈局部皮层静脉稀少、不规则充盈、截断、缺如、或周围静脉扩张等



## 总 结

- 颅脑病变的定位：中央沟的确认

- DWI的原理及临床应用：

  - ADC图的重要性

  - 生理性弥散受限

- 缺血性脑血管病的影像诊断及鉴别诊断

  - ACA、MCA、PCA供血范围脑梗死（腔梗）

  - 脑干半切征

  - 血管周围间隙

  - 静脉引流区域的识别及病变（静脉性梗死）

  - 可逆性后部脑病



安康鱼

干部鱼



谢谢大家！

