# MR图像后处理技术在显示颅神经及其与血管关系中的应用

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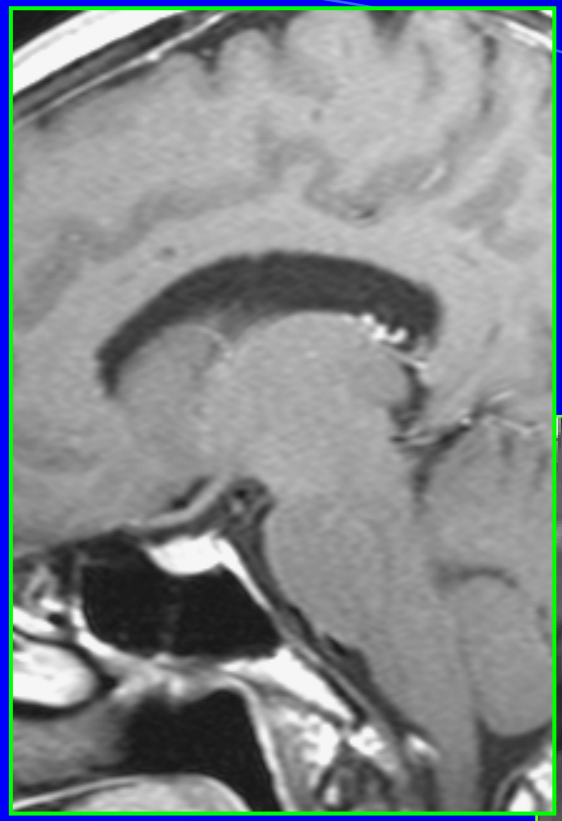
# 一、常规MR扫描的局限性

1、颅神经纤细，难以利用扫描角度的调整来全程显示颅神经在脑池段的走行。

2、颅神经与邻近血管的交叉角度多变，常规三个切面难以确切显示两者的解剖关系。

3、脑脊液搏动伪影影响纤细神经的显示。

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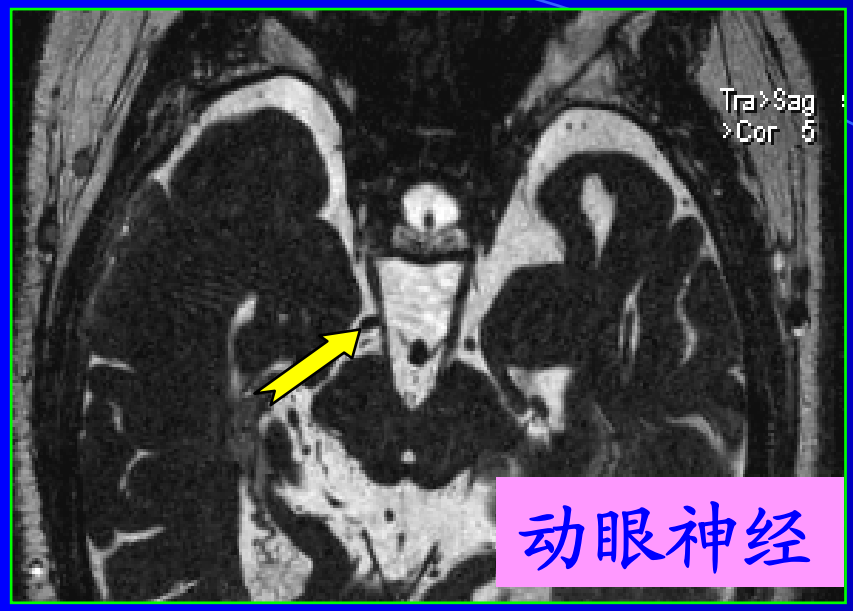
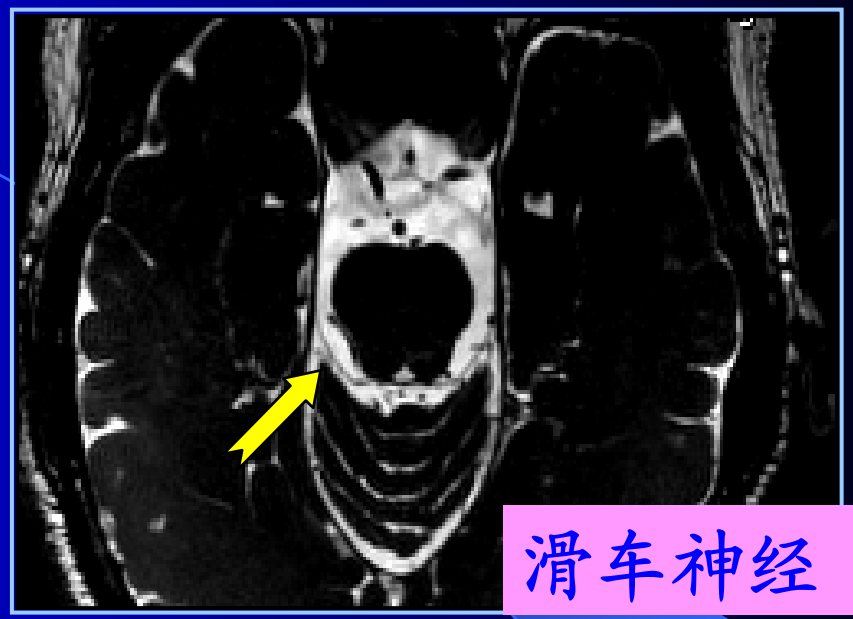
# 二、3D-CISS序列的优势

1、很好的抑制了脑脊液搏动伪影，有利于走行在脑池的颅神经的显示。

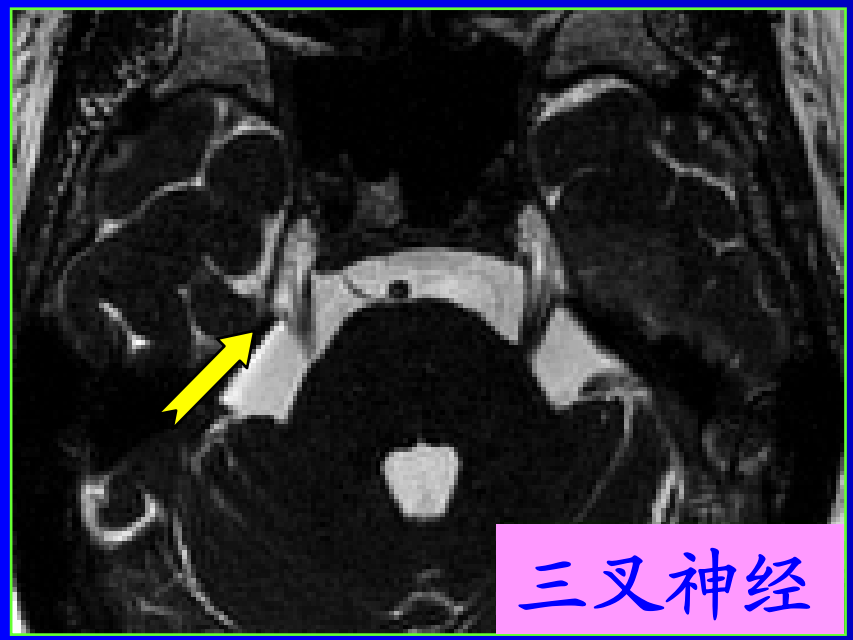
2、亚毫米层厚，采集容积数据，不仅提高了空间分辨力，而且实现了各向同性扫描，为图像后处理打下基础。



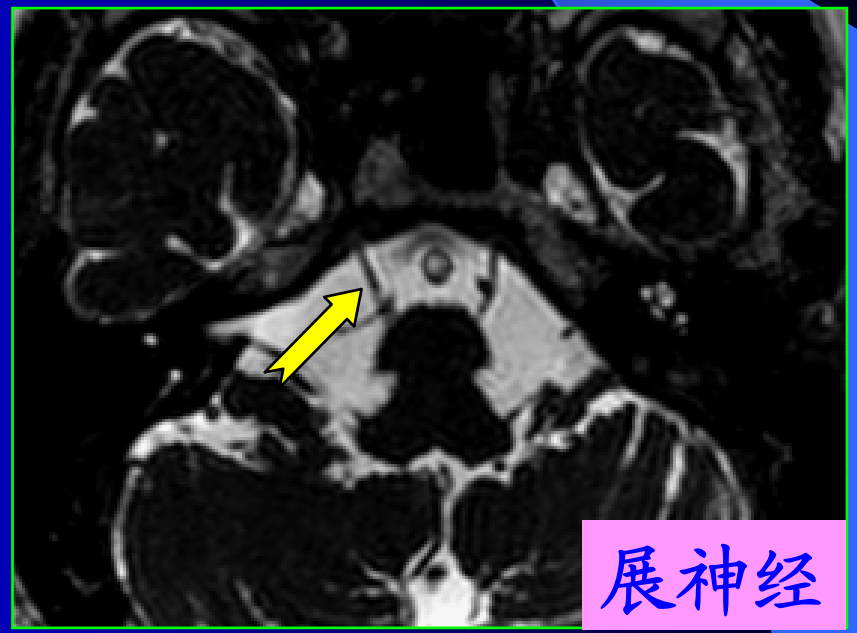

动眼神经



滑车神经



三叉神经



展神经

# 用3-DTOF来帮助确定是否血管

# 三、MPR技术的应用

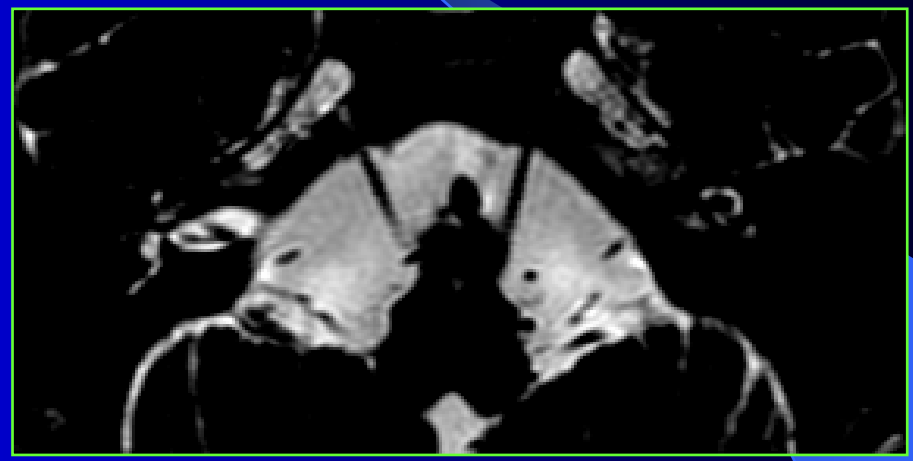
1、各向同性扫描为MPR技术的应用打下了基础。

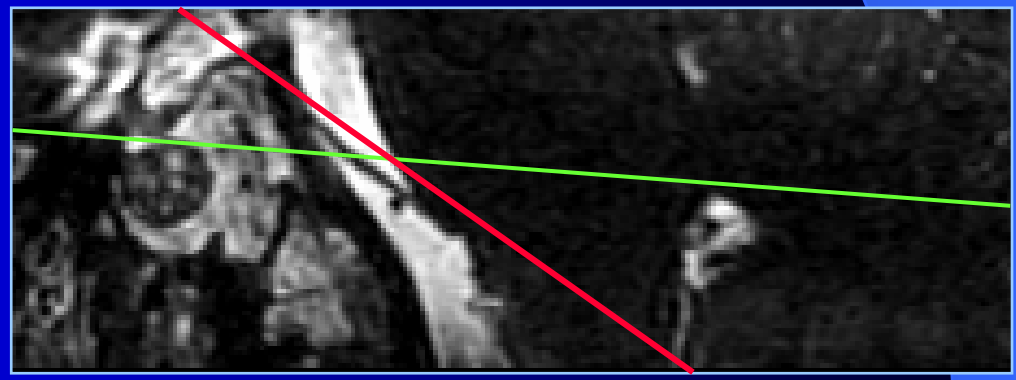
2、MPR技术弥补了扫描角度难以事先准确划定的不足。

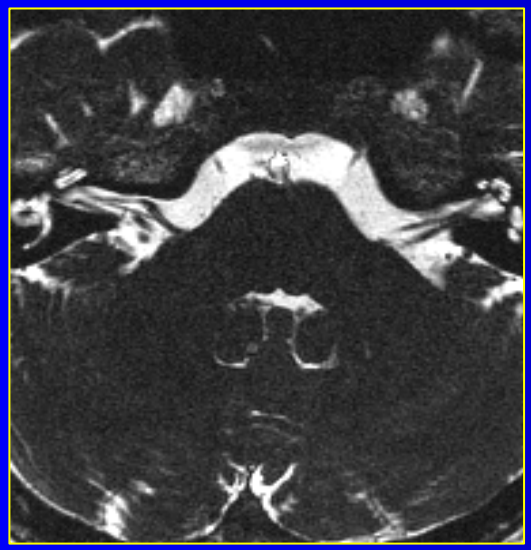
3、 MPR技术的应用可以显示那些特定角度的切面。

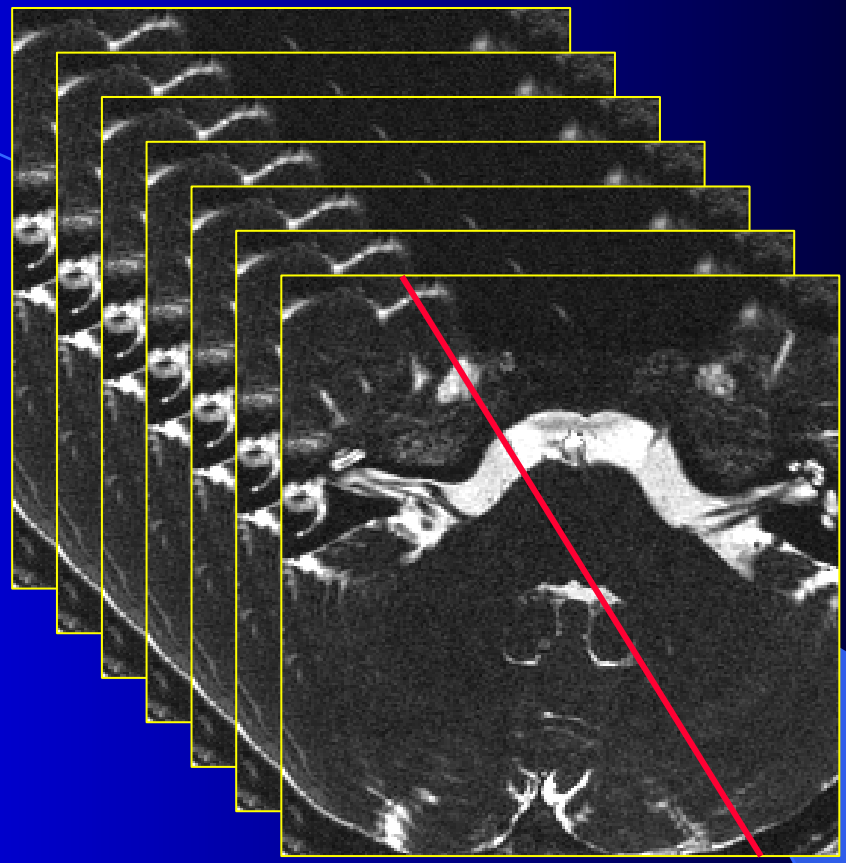
4、 MPR技术可以大大节约扫描时间。

# MPR技术弥补了扫描角度难以事先准确划定的不足







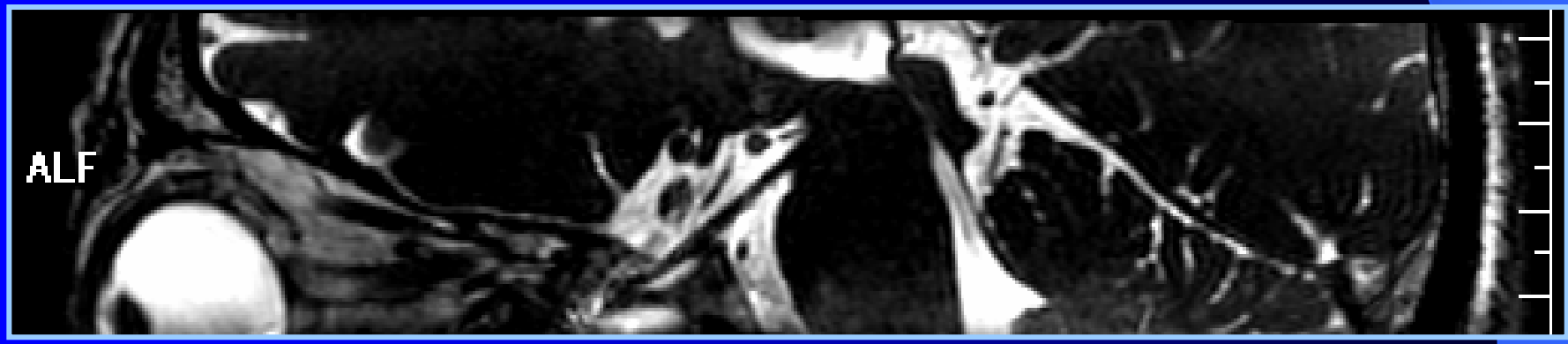


MPR 技术的应用可以显示那些特定角度的切面

# 四、研究目的和结果

- 本研究把**3D-CISS**序列扫描与多平面重组（**MPR**）结合起来，试图更好地显示脑池段颅神经的走行以及他们与邻近血管的解剖关系。
- 主要的研究对象：动眼神经、滑车神经和展神经。

# 1、动眼神经 oculomotor nerve



# 解剖 anatomy

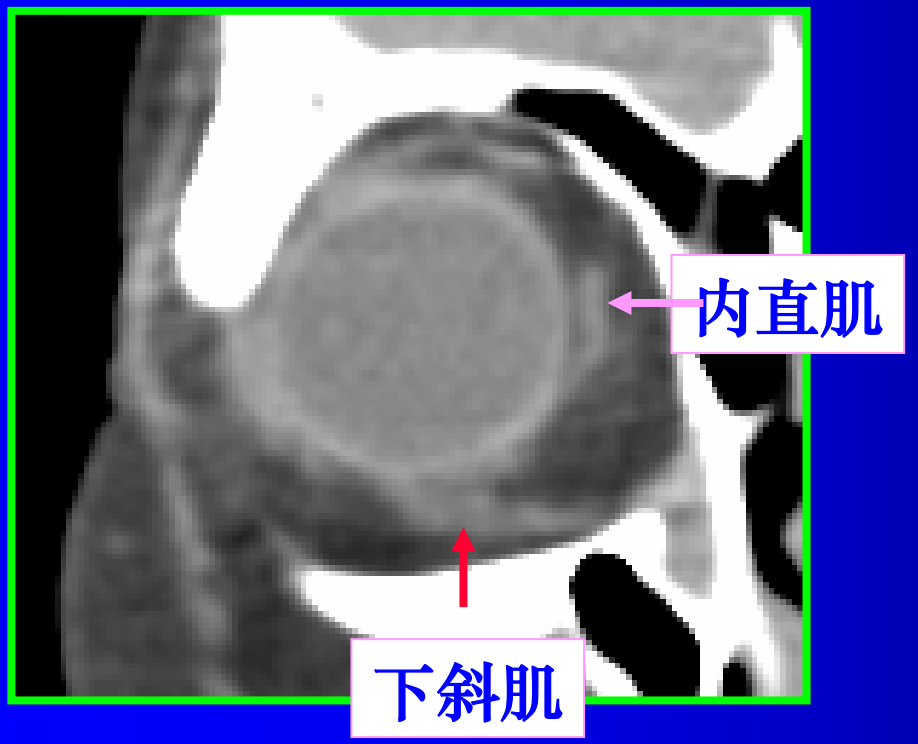
动眼神经核（大脑脚）

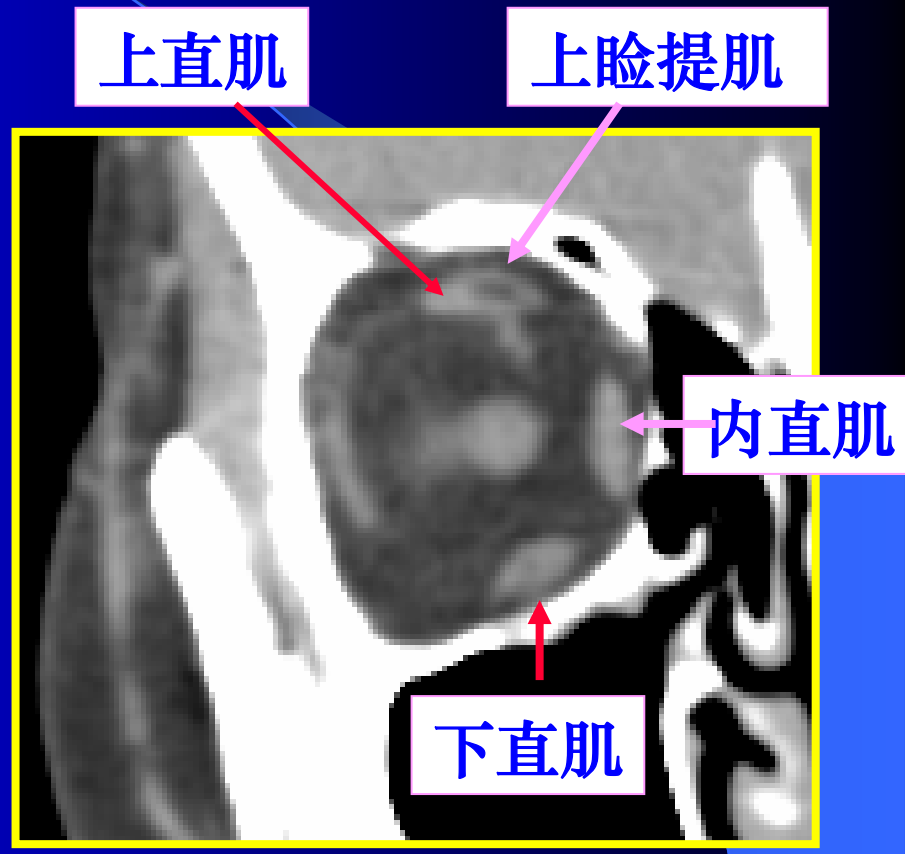
脑池段（脚间池）

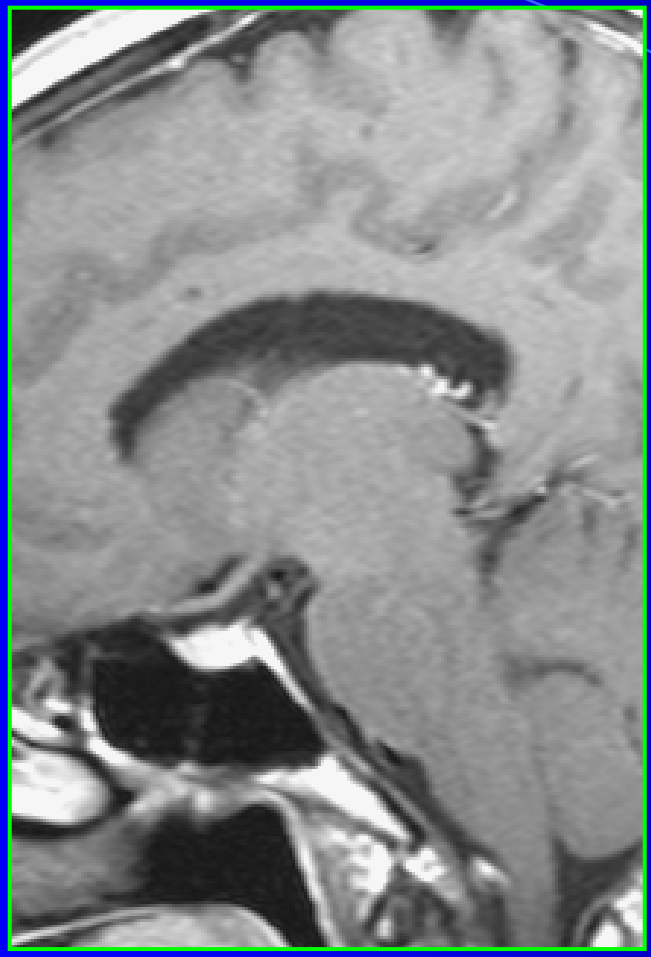
海绵窦段

眶内段

# 动眼神经的支配

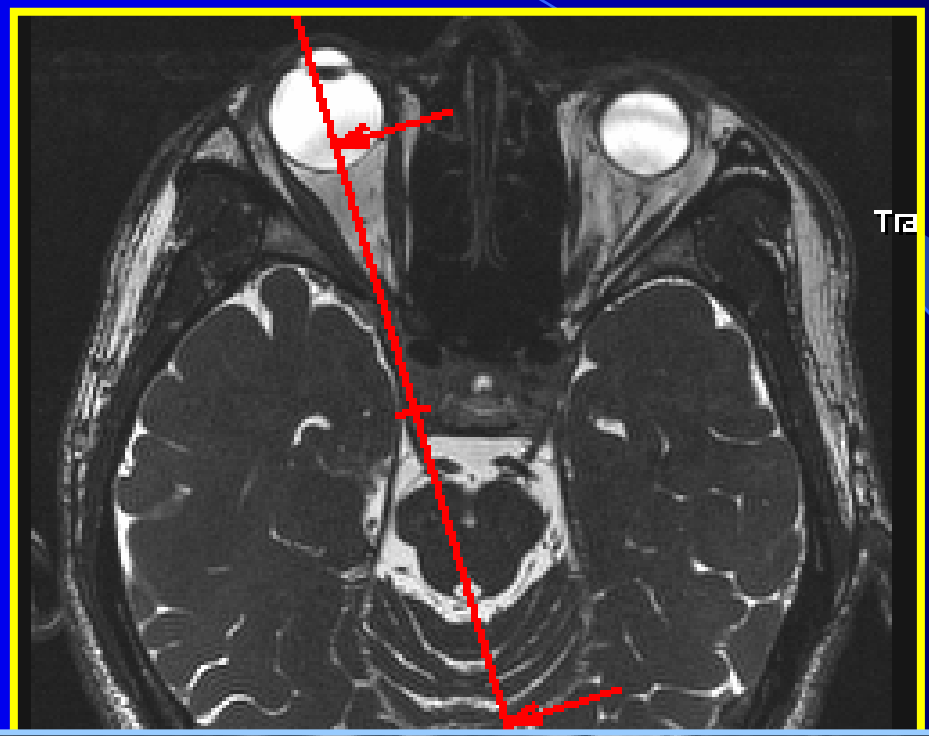


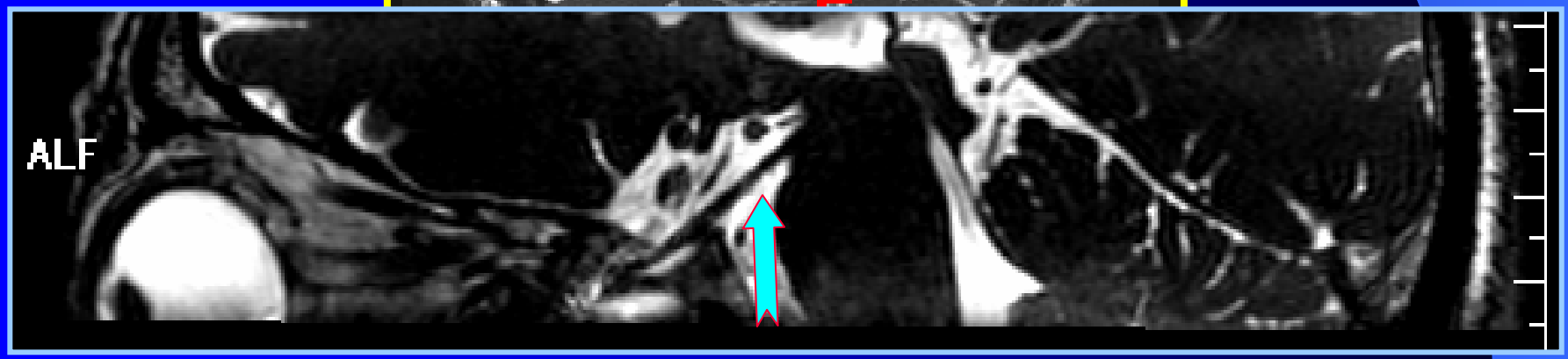





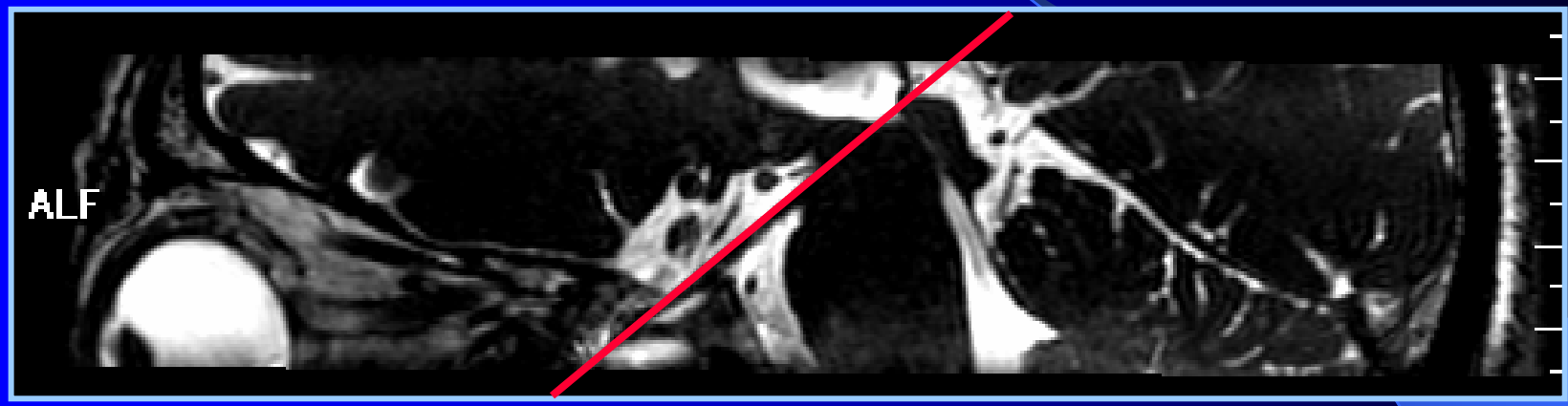
常规扫描显示动眼神经的不足

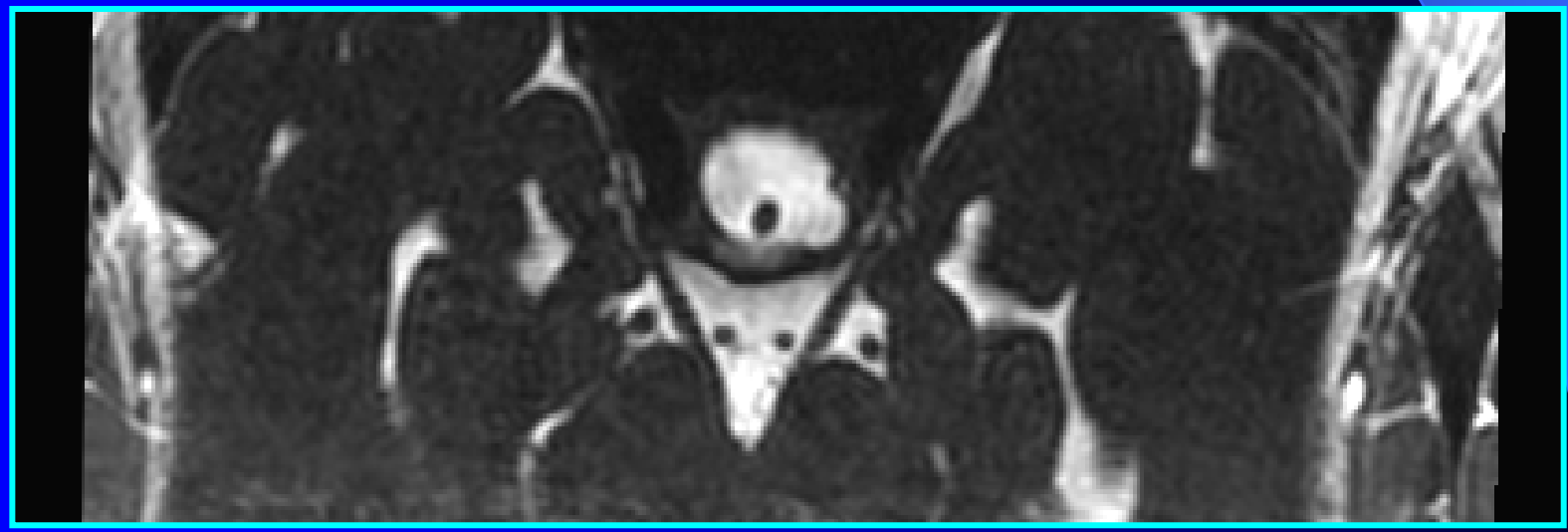
# 先以横断扫描为基础进行斜矢状重组





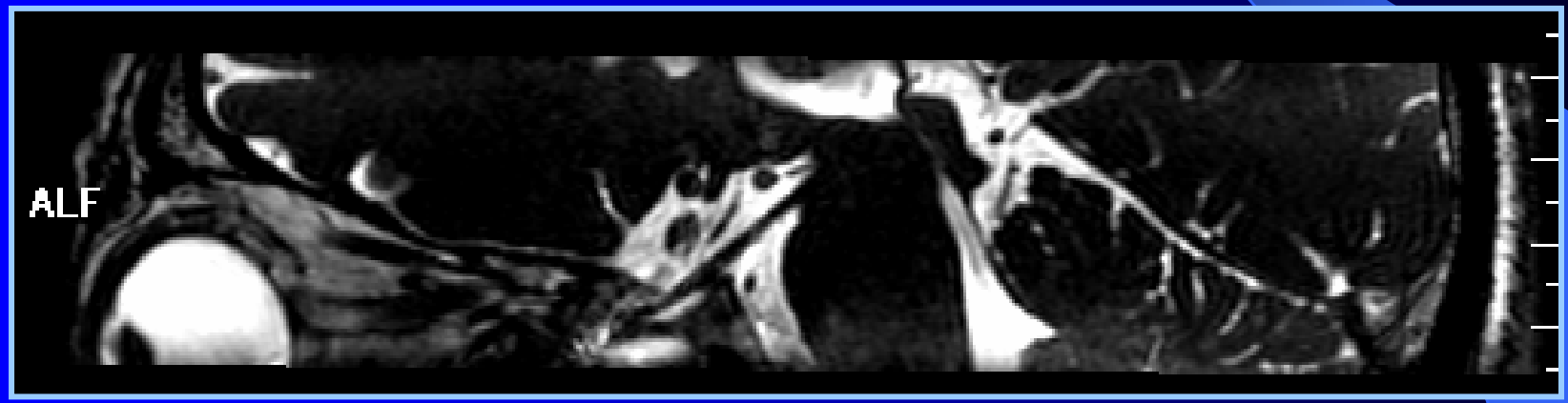
# 以矢状重组为基础再进行斜横断重组



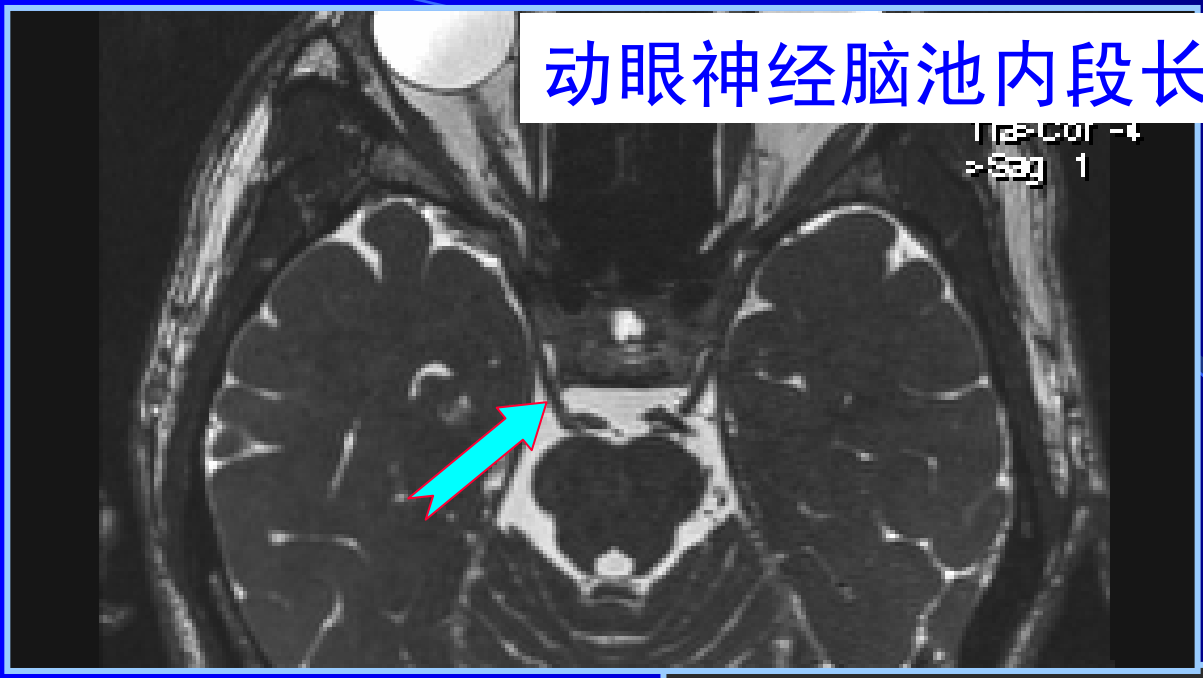



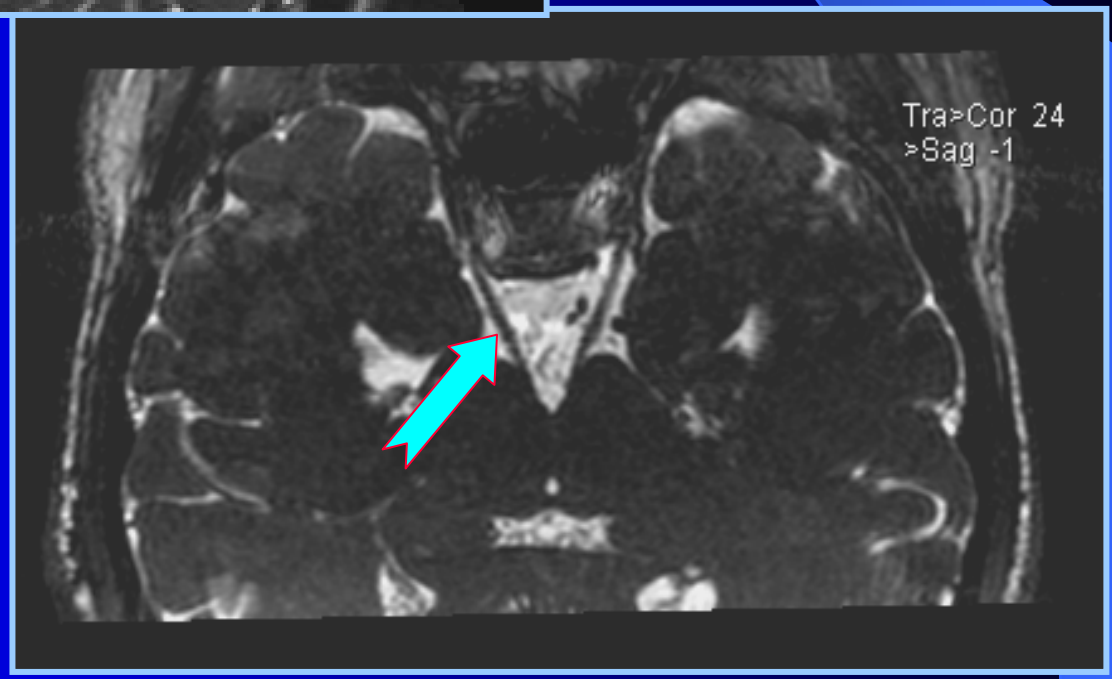
196例被检查者中有182例斜横断面重组能够完整显示两侧

196例双侧动眼神经的脑池段矢状面重建392侧全部显示

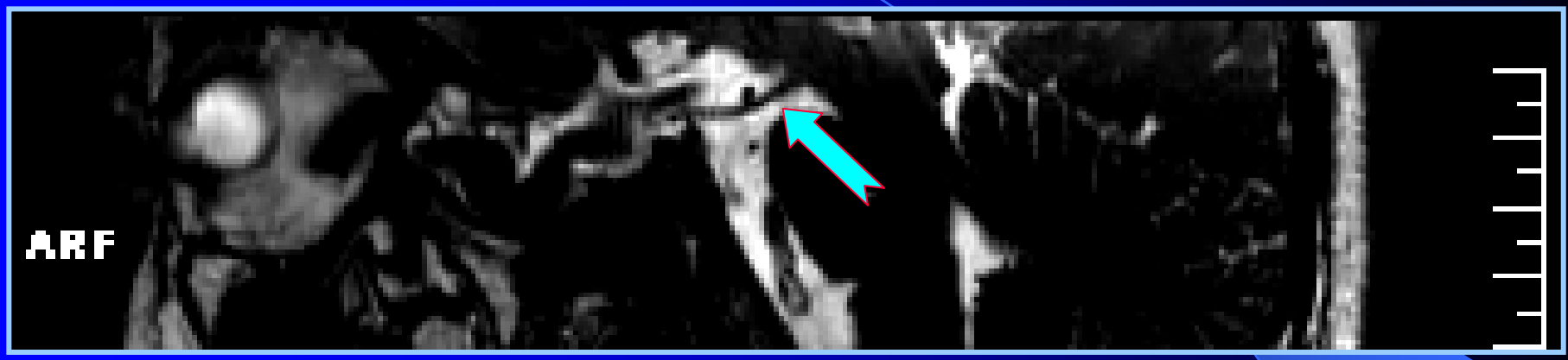


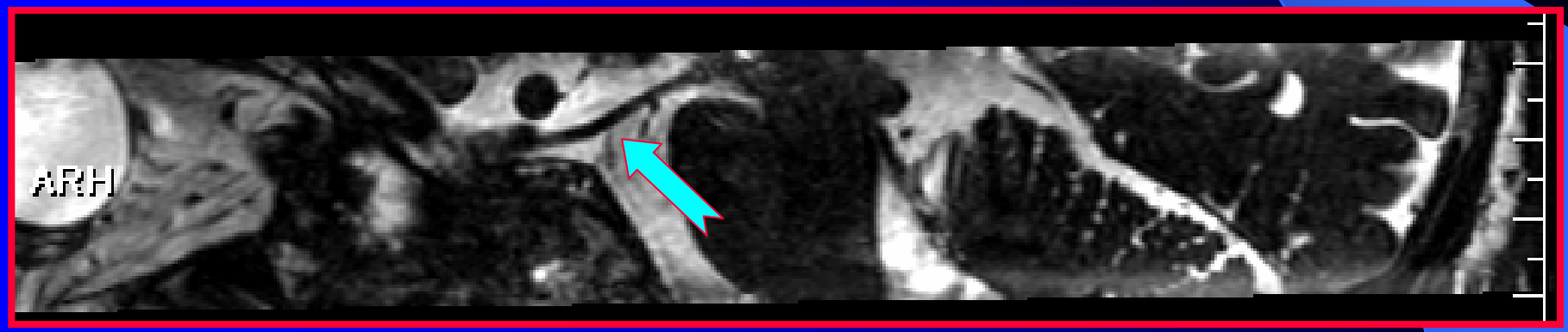
# 动眼神经脑池内段长度个体差异很明显



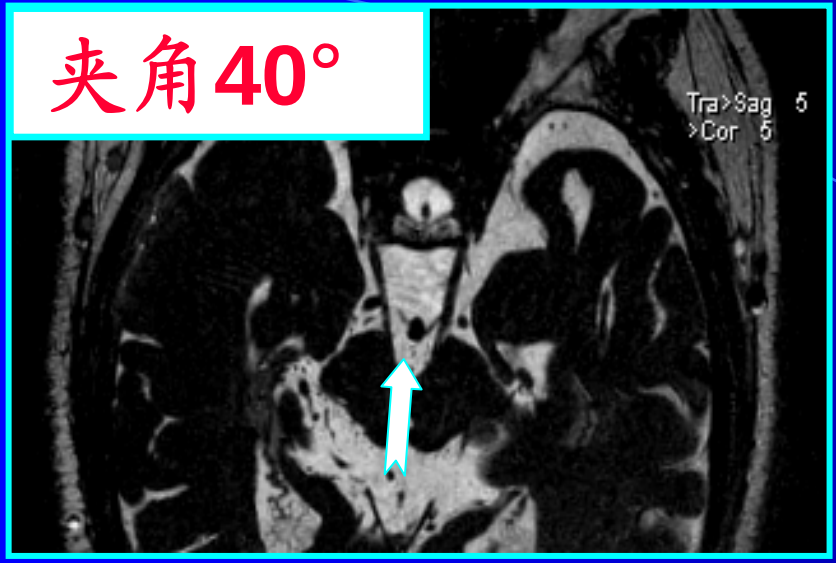



# 动眼神经脑池段的长度个体差异很明显

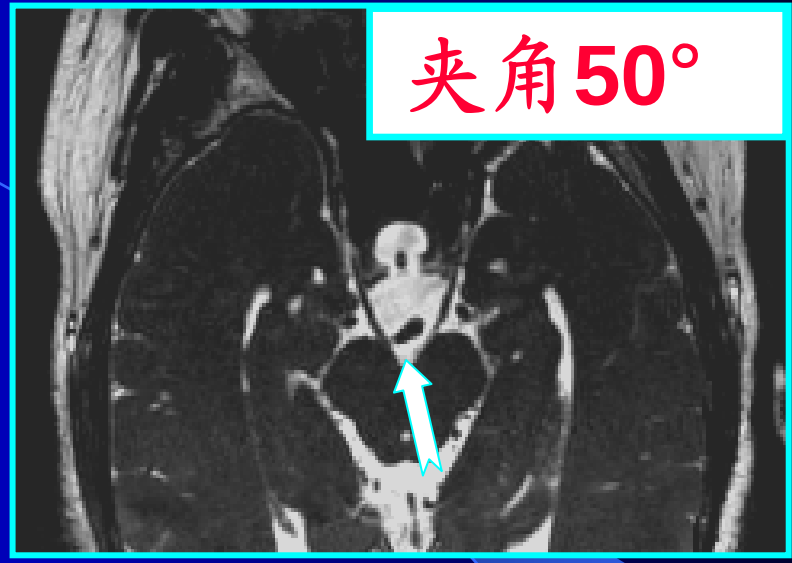


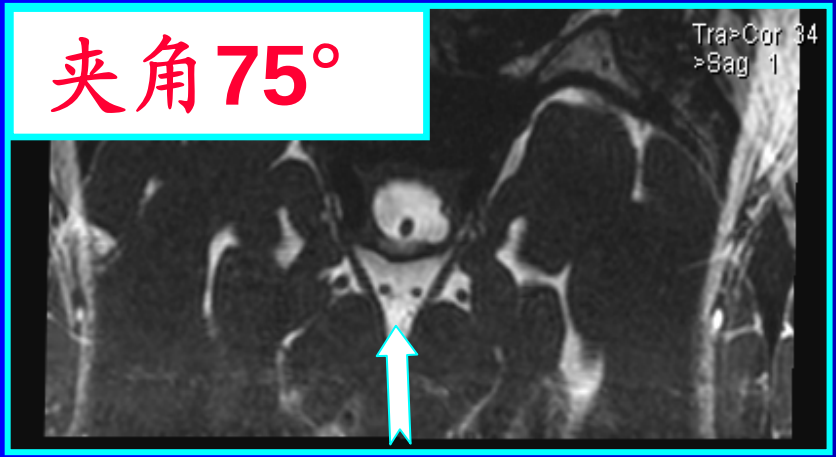
夹角40°



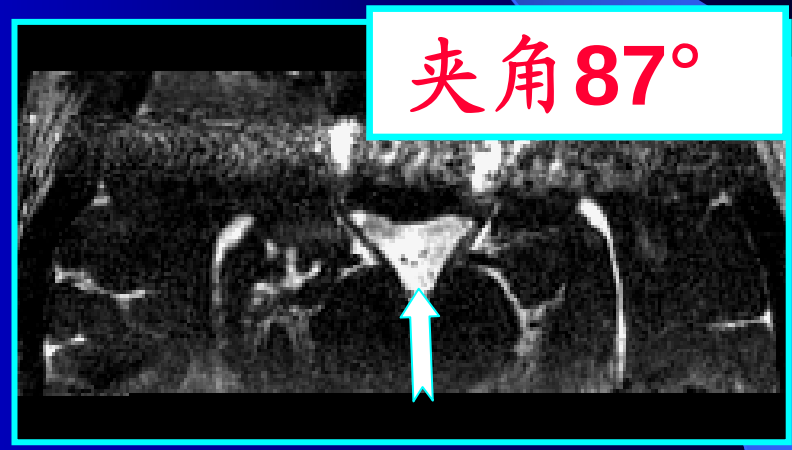

夹角50°



夹角75°

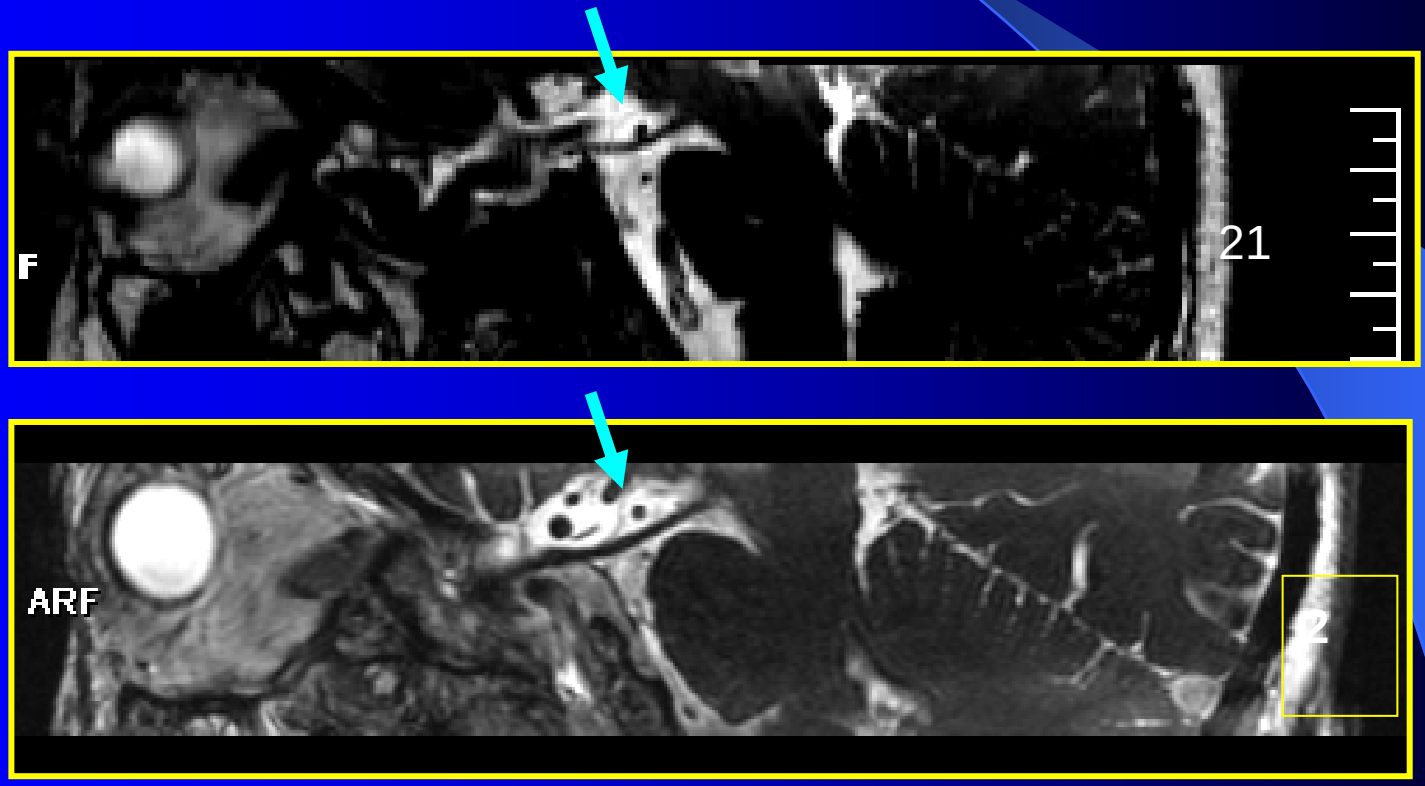



夹角87°



动眼神经之间的夹角大小个体差异很明显

# 与大脑后动脉PCA的解剖关系

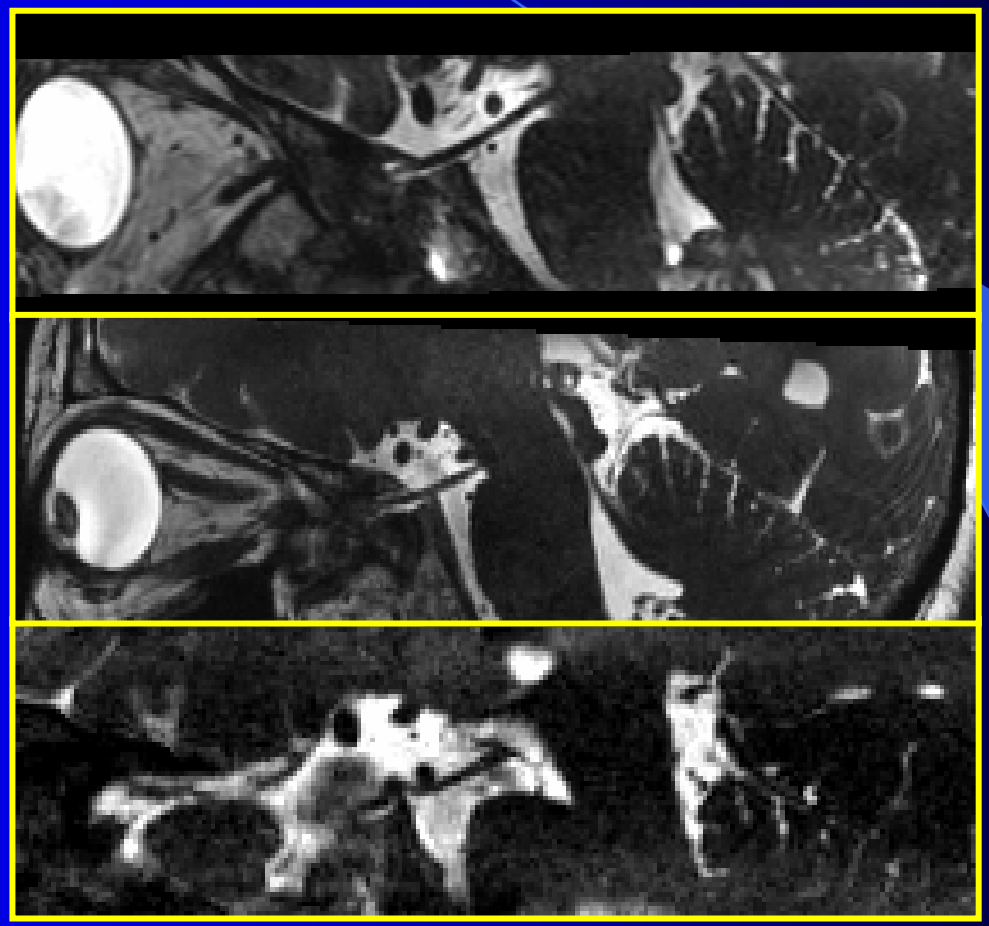


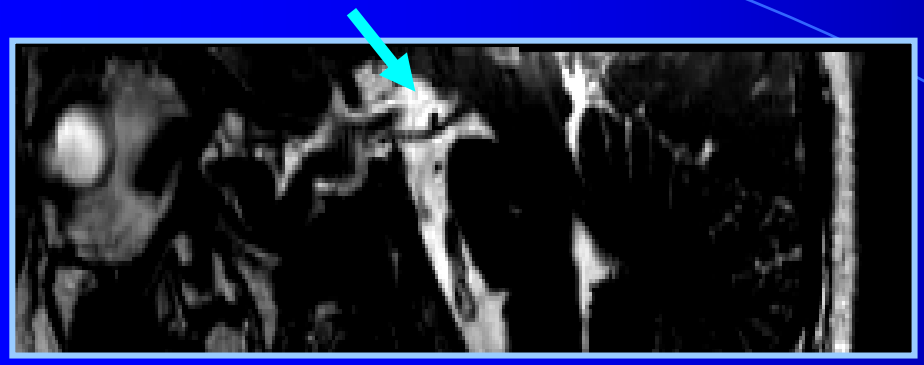
# 大脑后动脉的位置差异1

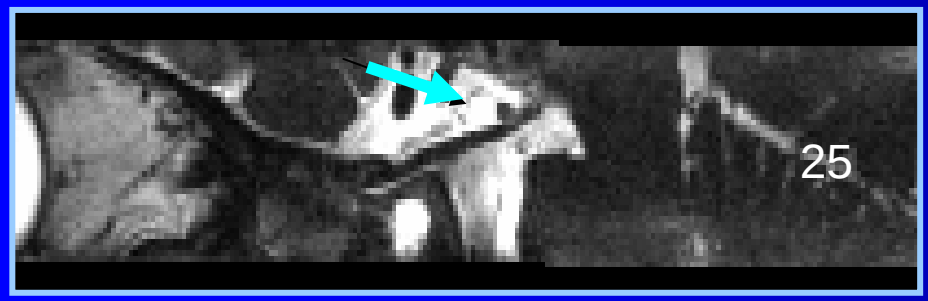
中间

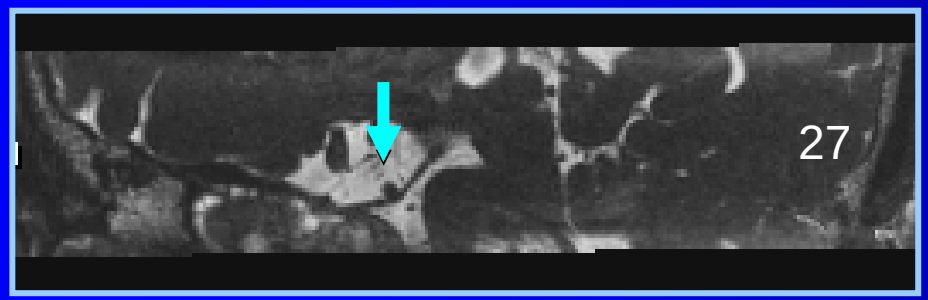
近端

远端







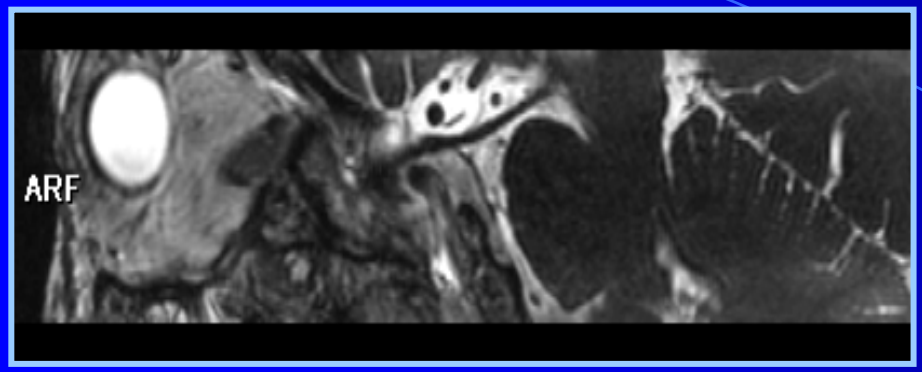



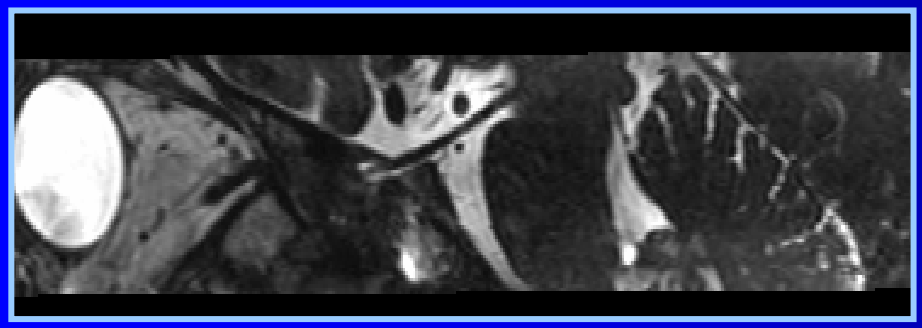

在无临床症状的**392**侧动眼神经中， **210**侧**(53.6%)**的大脑后动脉与动眼神经之间无间隙，紧贴神经表面或稍微压迫神经。

# 大脑后动脉的位置差异2

7侧（1.7%）

可见PCA压迫动眼神经成一压迹



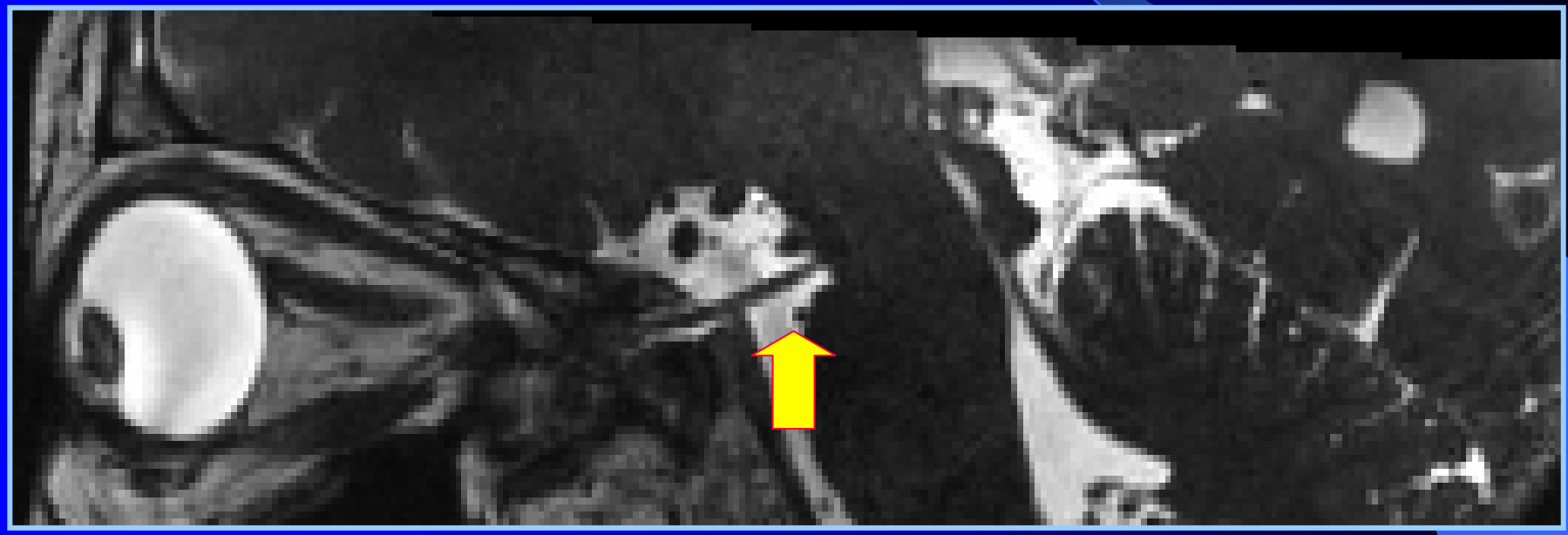



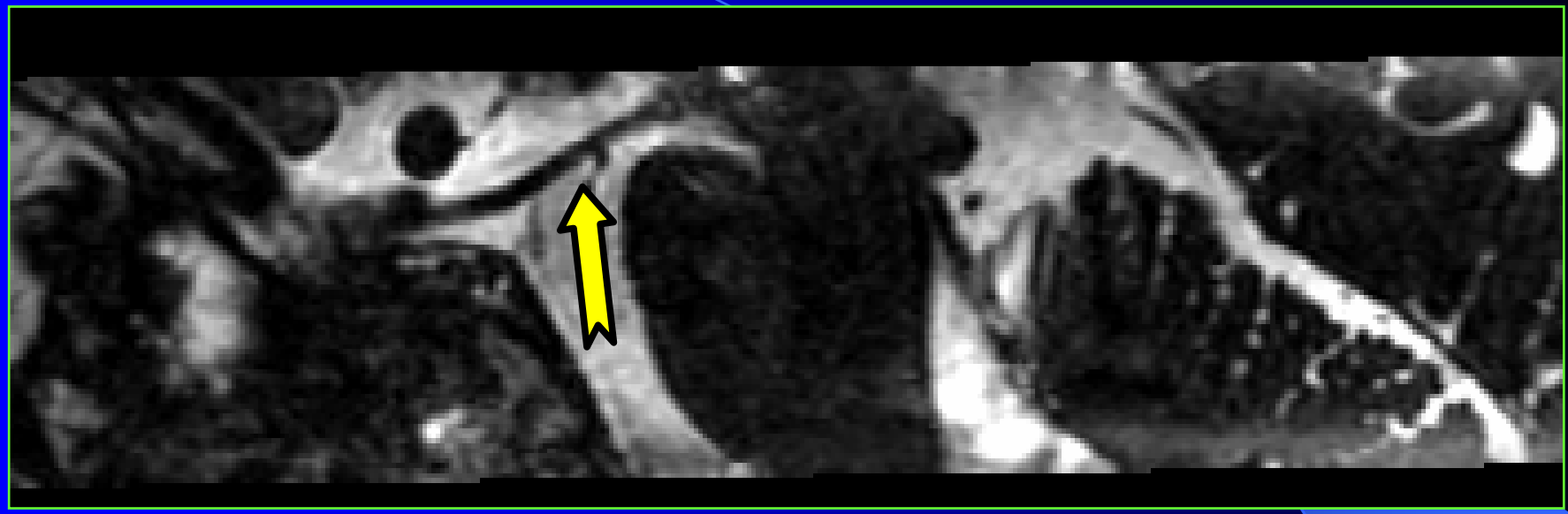
175侧

（ 44.6% ）

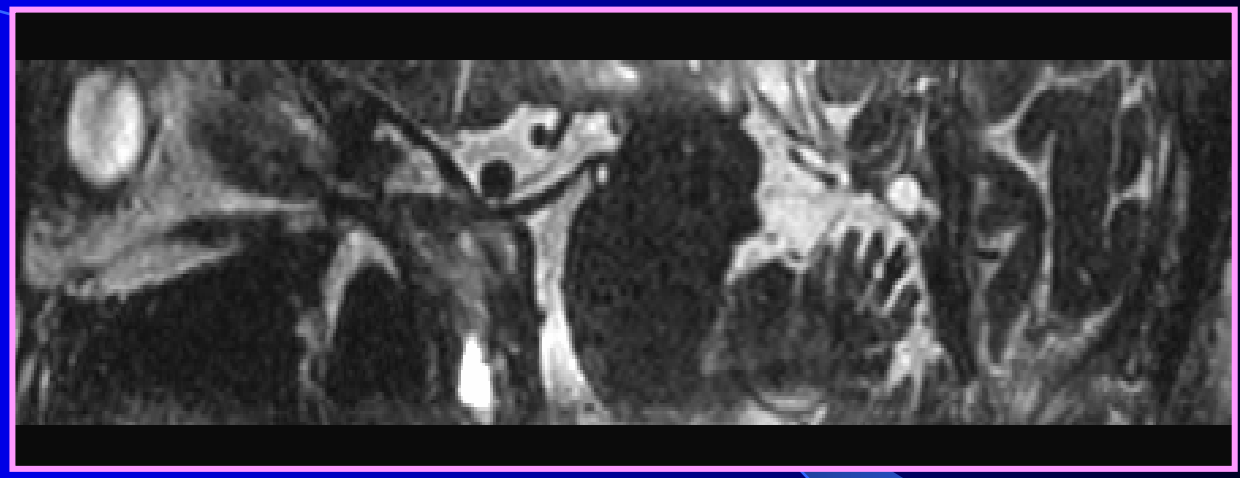
PCA与神经之间有一定的距离，距离最大者达7mm。

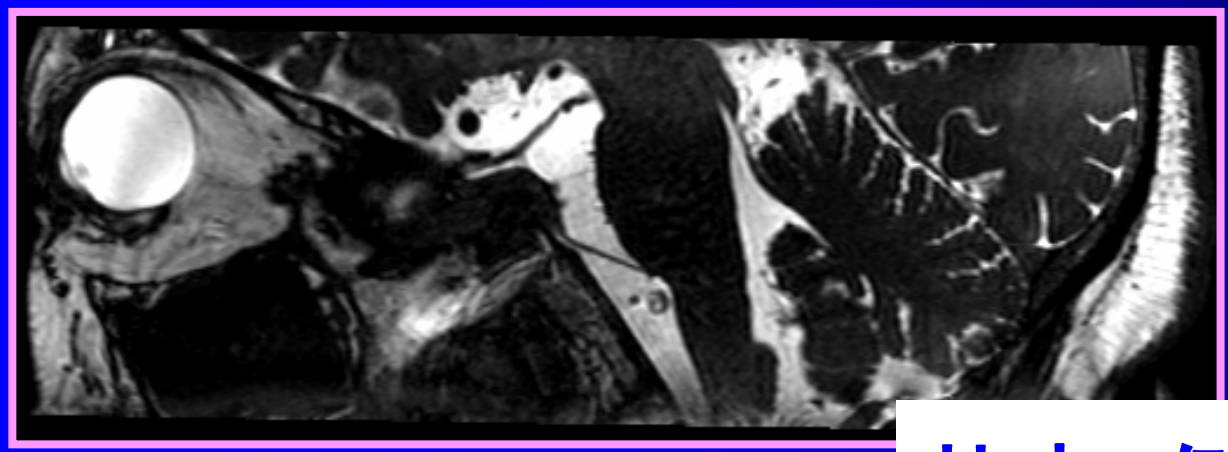
# 与小脑上动脉SCA的解剖关系



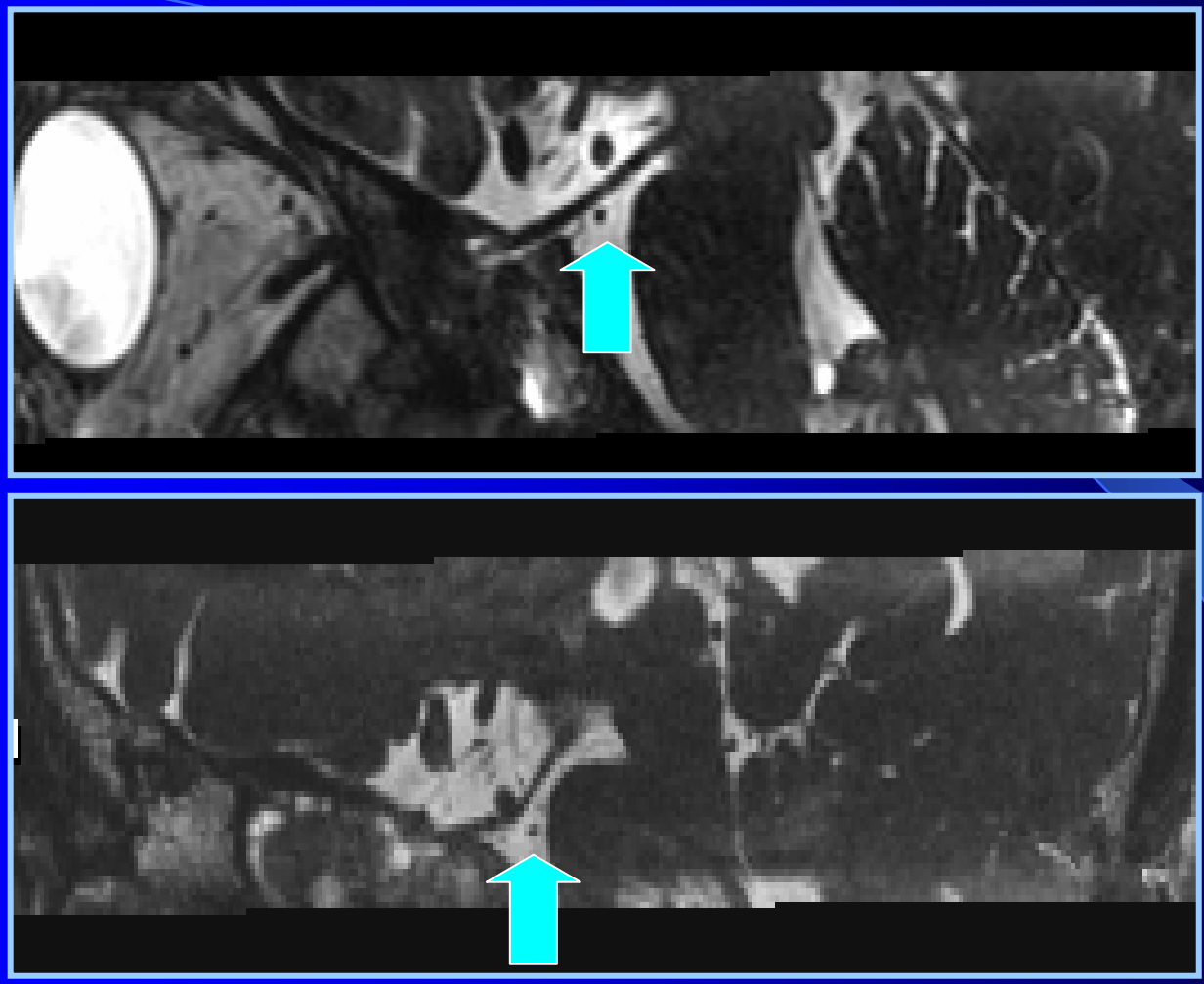


多数（236侧，60.2%）
紧贴动眼神经下表面

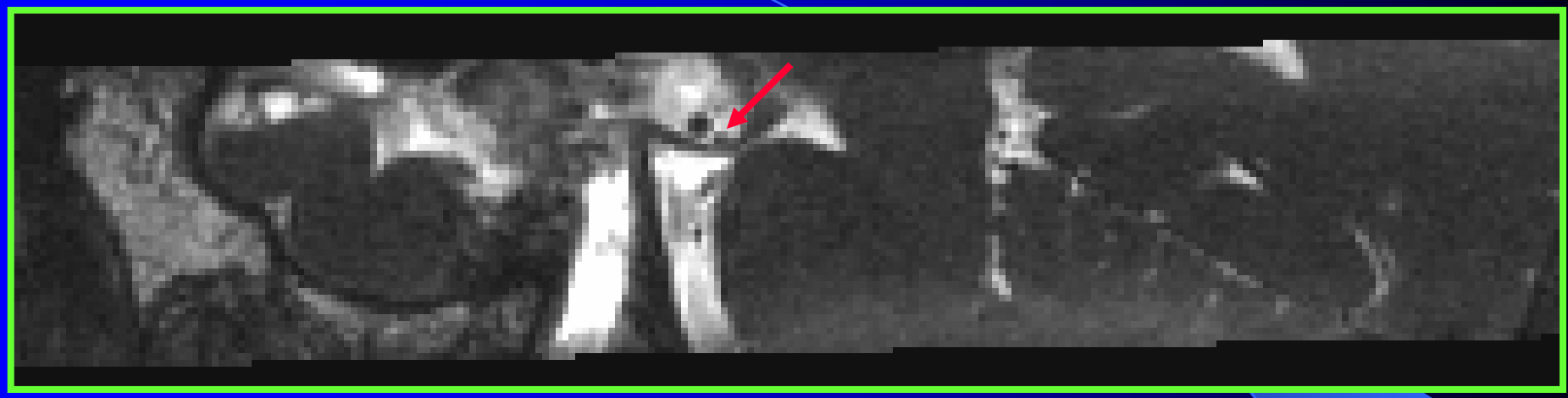




其中5例可见小脑上动脉压迫神经，向上形成明显的压迹



155侧（39.1%）与神经之间有一定的距离，最大6mm



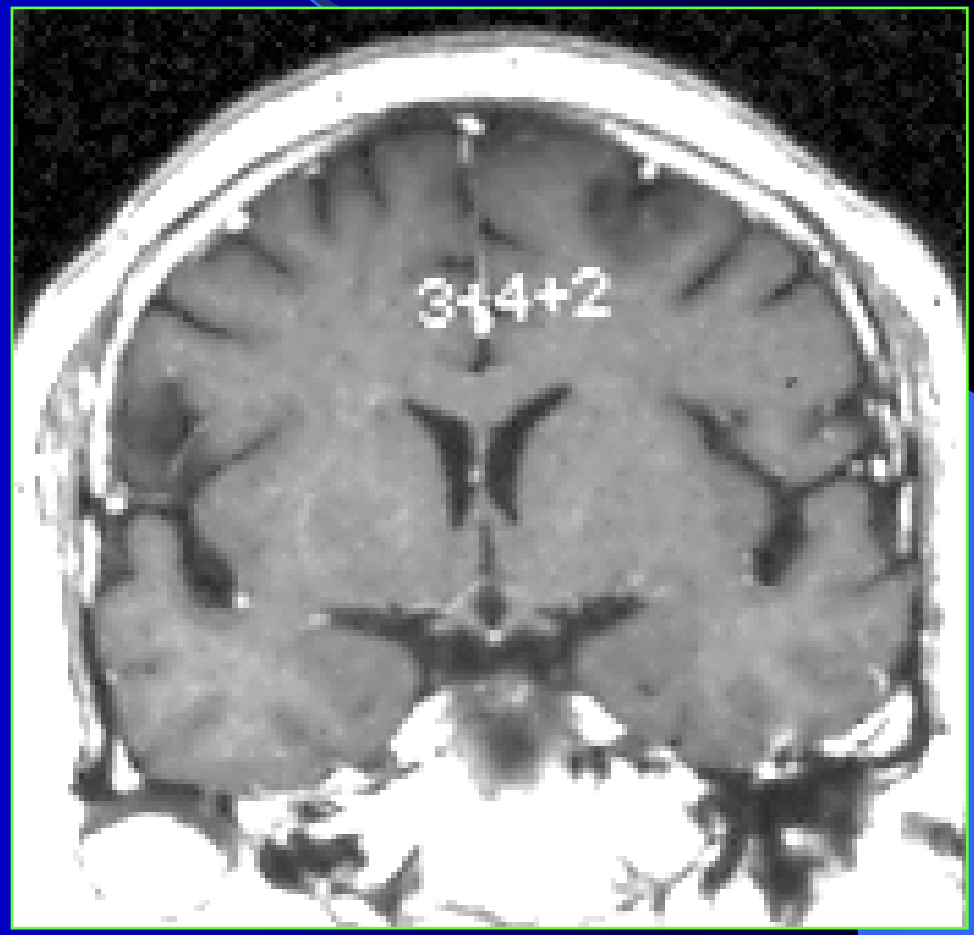
有1例SCA与PCA一起从动眼神经上方越过

# 2、滑车神经 trochlear nerve

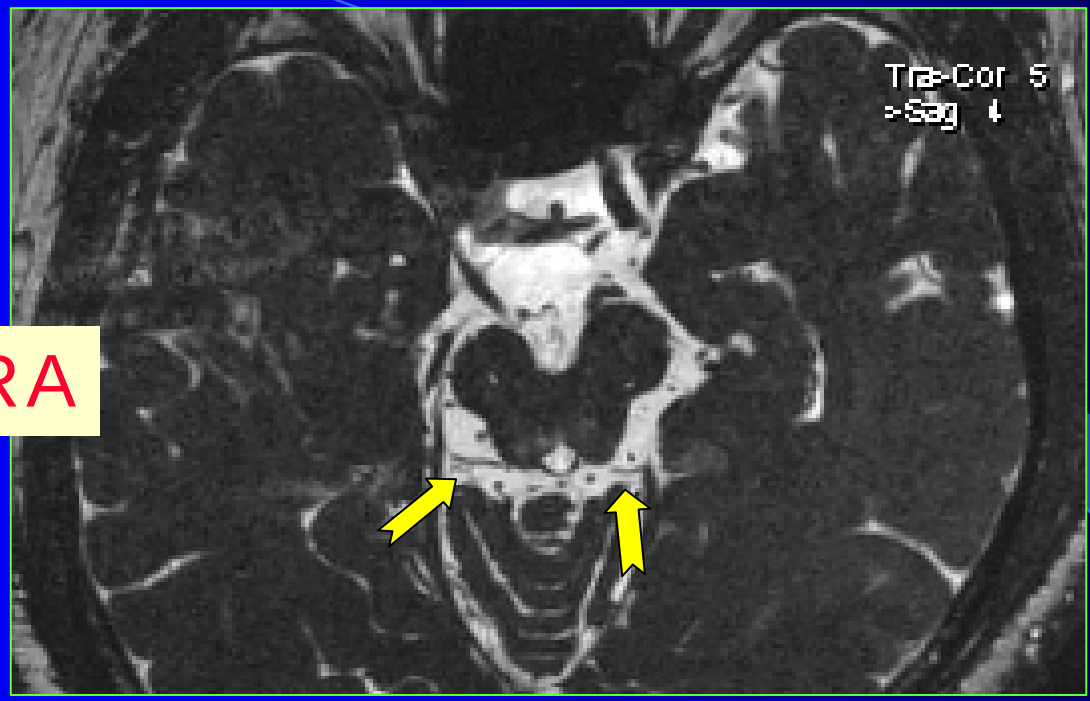
滑车神经是上斜肌的运动神经

起于中脑背面下丘下方，绕大脑脚外侧前行，经过环池，紧贴或隐藏在小脑幕的游离缘进入海绵窦的后外侧角，然后经眶上裂入眶。

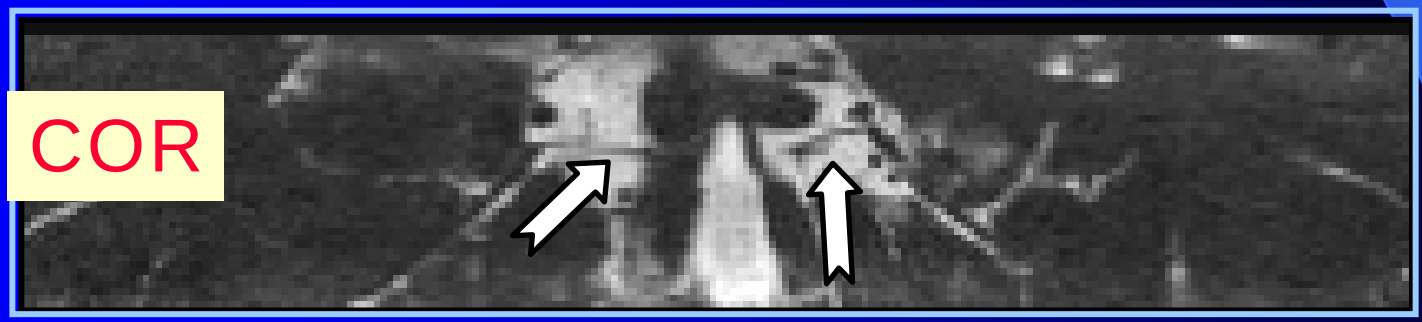
# 常规扫描显示滑车神经的不足



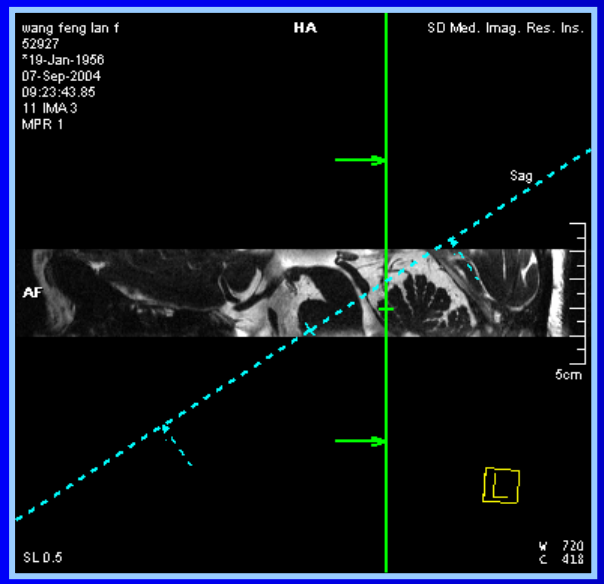
TRA




COR



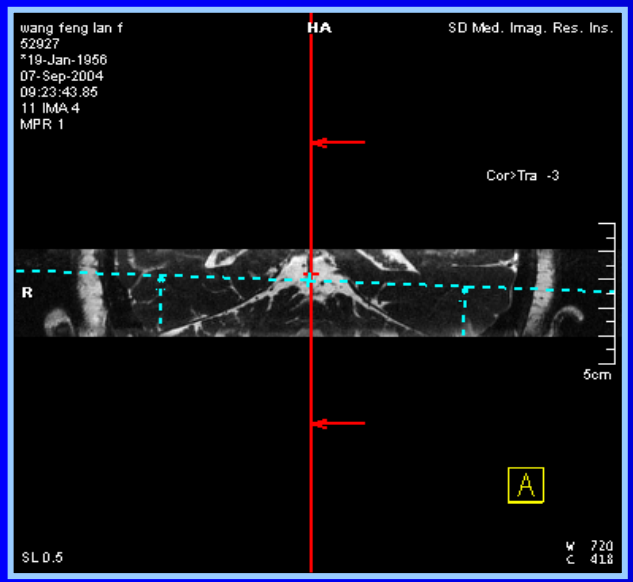
# 重组图像的技巧





## 第一步：显示滑车神经脑池段的长轴

# 第二步：调整双侧对称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11 IMA 4
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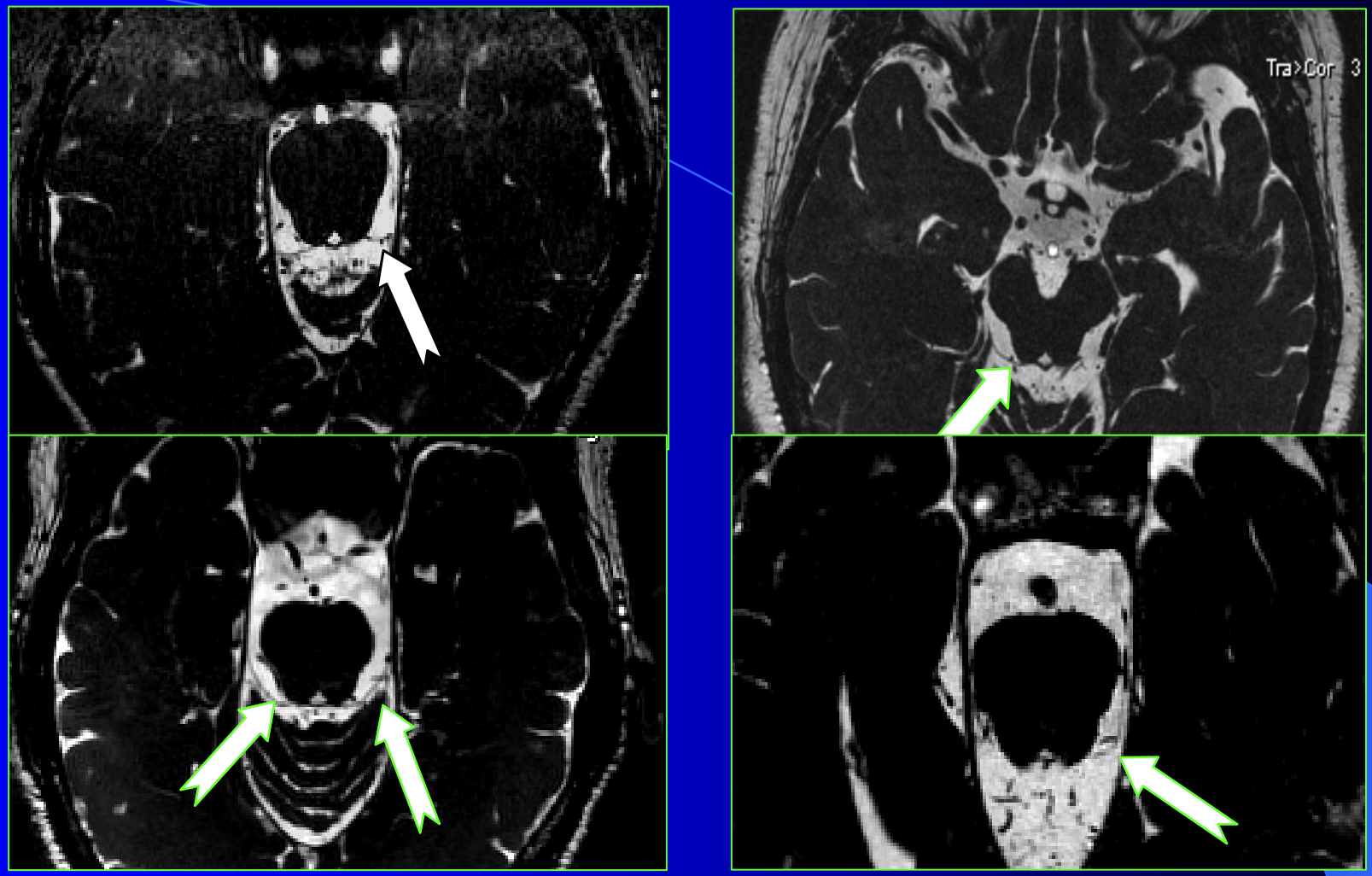
Cor>Tra -3
R
5cm
A
SL 0.5
W 720
C 418

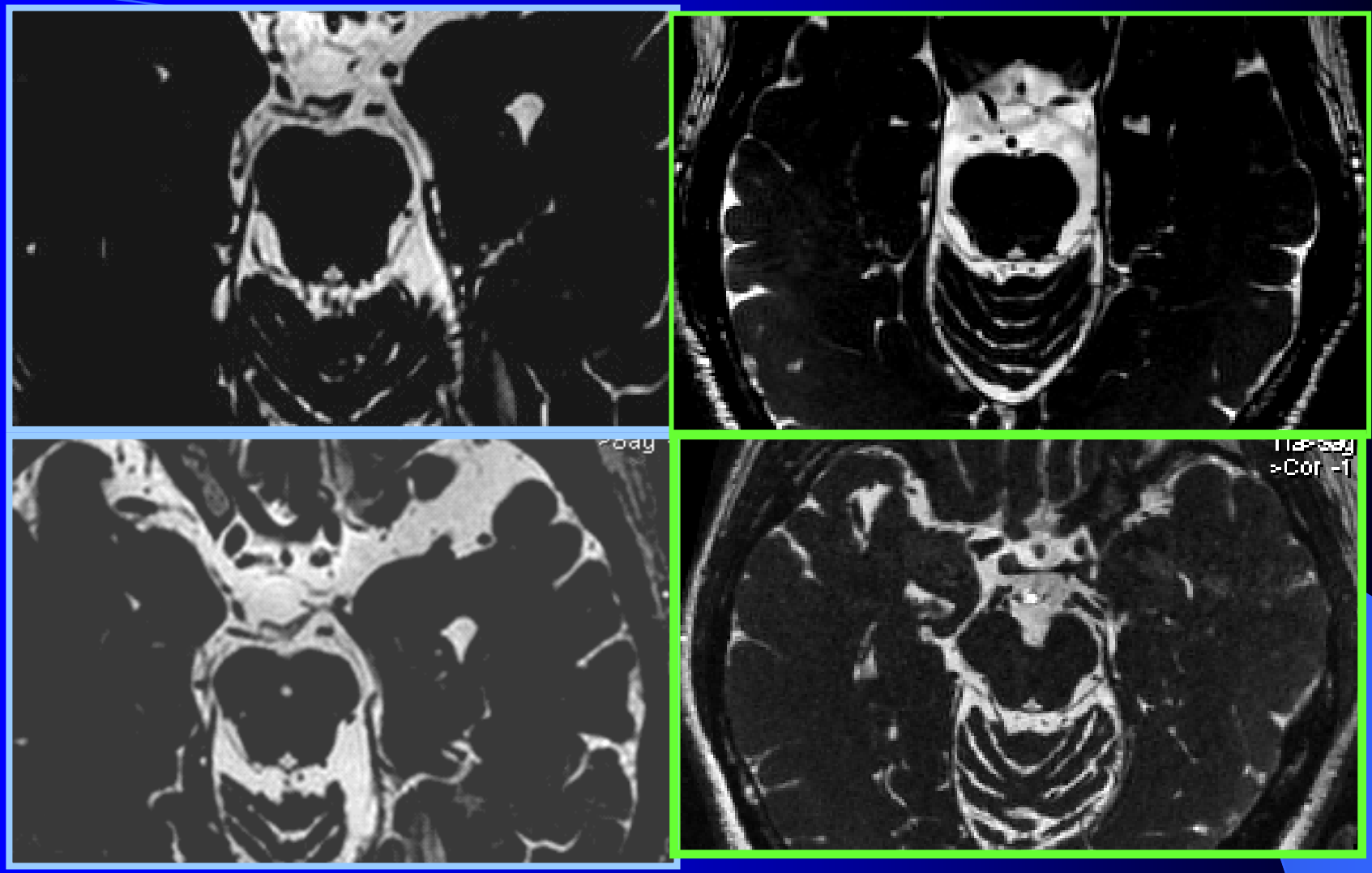
# 滑车神经走行的显示能力

74条中有69条显示了滑车神经的走行
28条先向侧方行向小脑幕的游离缘，然后向前走在小脑幕的下面
41条同时向前外两个方向行向小脑幕游离缘
7位14条的双侧不能在同一平面显示走行
5条由于在连续断面上不能彻底追踪而不能确定走行




69(93.2%)条显示了滑车神经的走行与小脑幕的关系,

5(6.8%)条无法追踪出关系.




7例（14条）双侧
不在一个平面上

30例（60条）双侧
在一个平面上显示

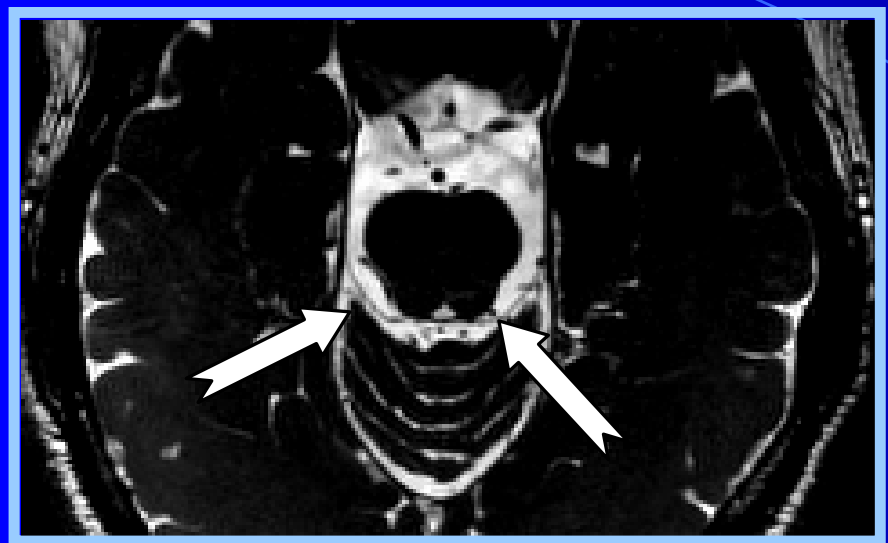
# 滑车神经走行的不同类型

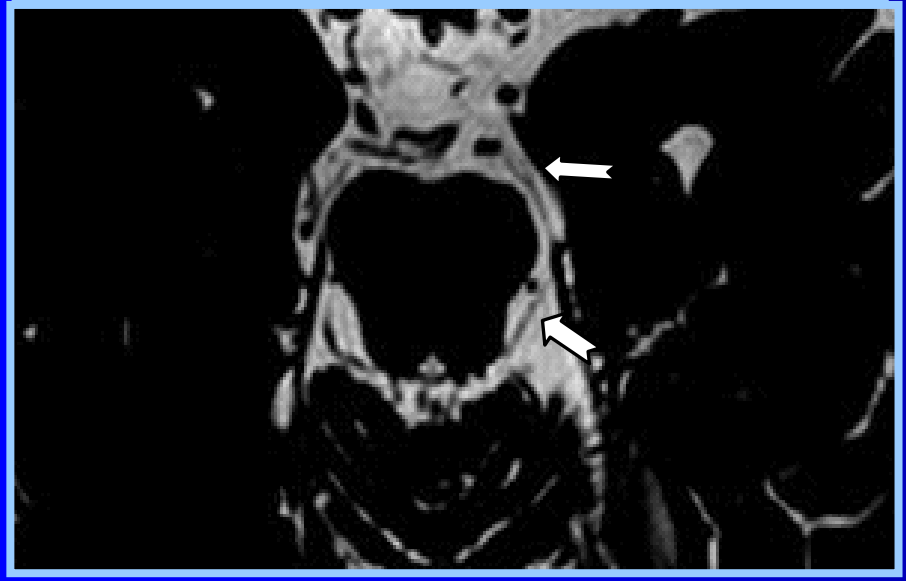
1、同时向前外两个方向行向小脑幕游离缘

**41/69(59.4%)**条

2、先向侧方行向小脑幕的游离缘，然后向前走在小脑幕的下面

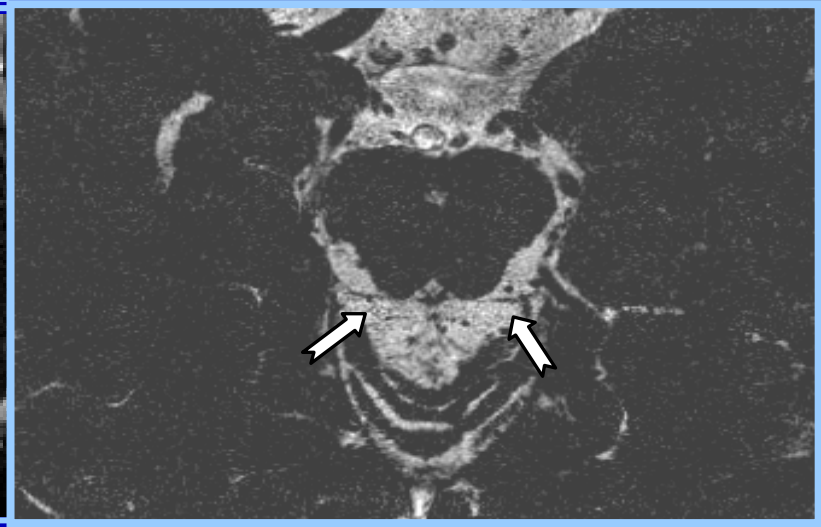
**28/69(40.6%)**条





41/69(59.4%)条滑车神经同时向前外两个方向行向小脑幕游离缘



28/69(40.6%)条滑车神经先向侧方行向小脑幕的游离缘，然后向前走在小脑幕的下面

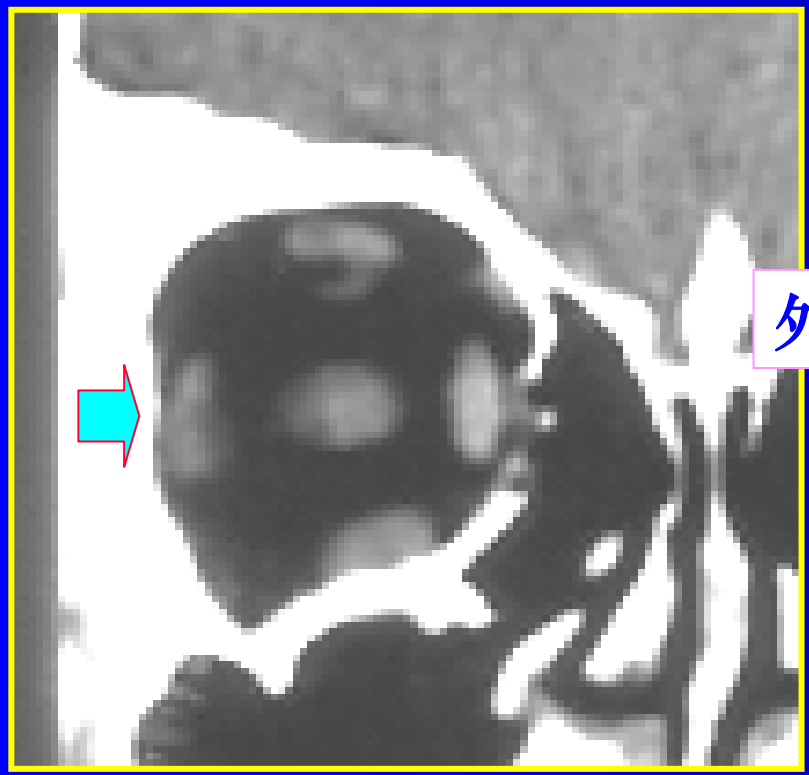
# 3、展神经　abducent nerve

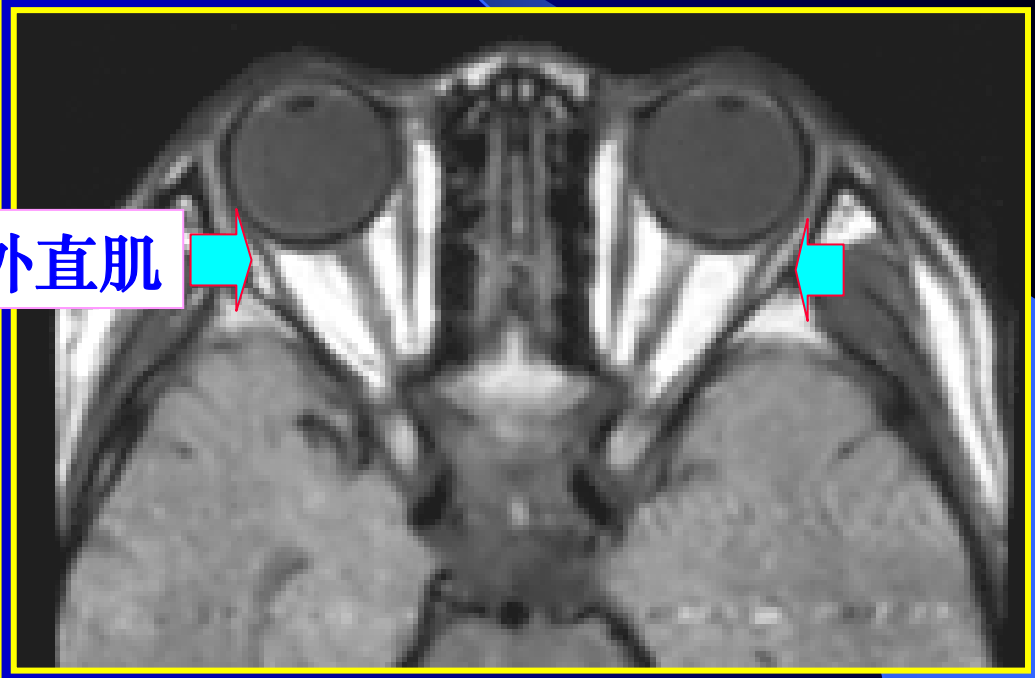
- 展神经根部纤维源于第四脑室底部下面脑桥内的神经核，此神经核和围绕它的面神经核形成面神经丘。展神经起于桥脑延髓沟中线附近。

# 展神经的走行和支配

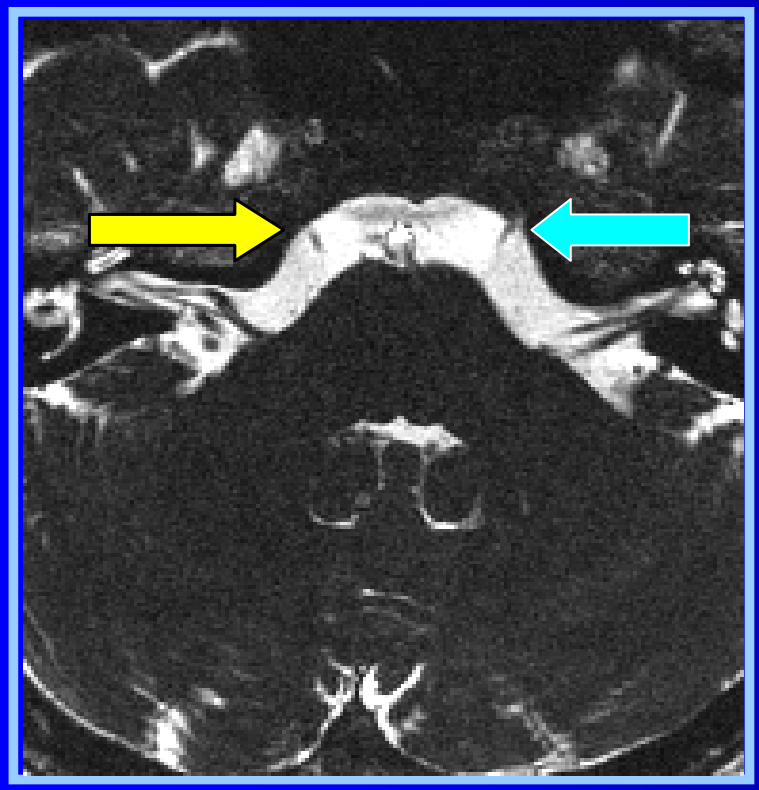
- 展神经的颅内行程可以分为5段：
- （1）以神经核为起点的脑桥内段；
- （2）以起自脑干的根部区域为起点的脑池段；
- （3）岩部斜坡段；
- （4）海绵窦段；
- （5）眶内段。

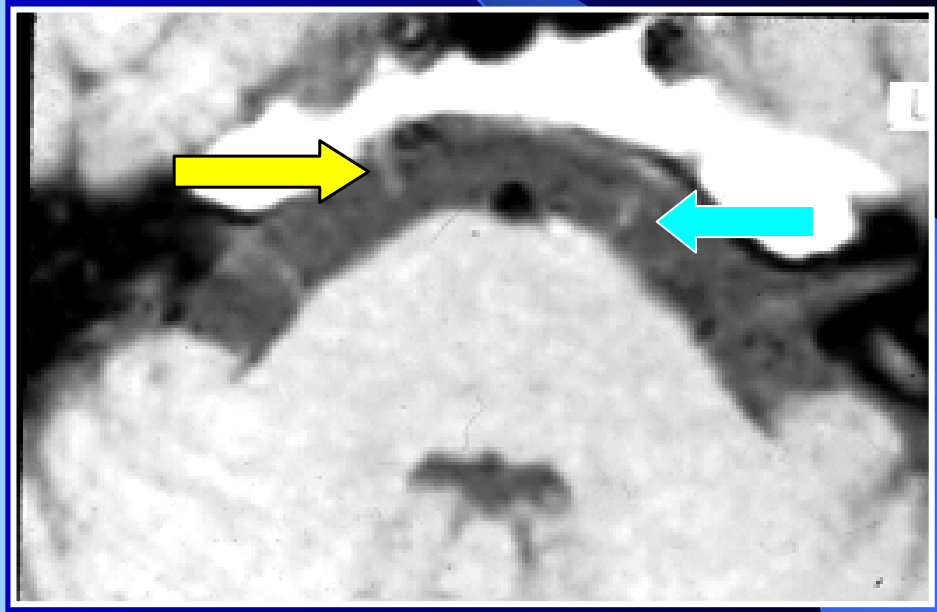
# 展神经的走行和支配



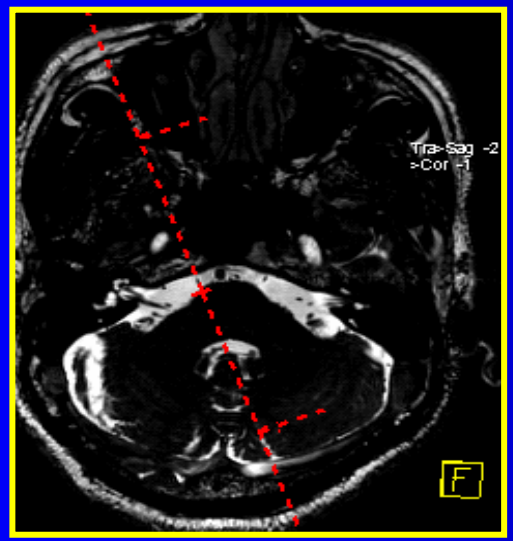


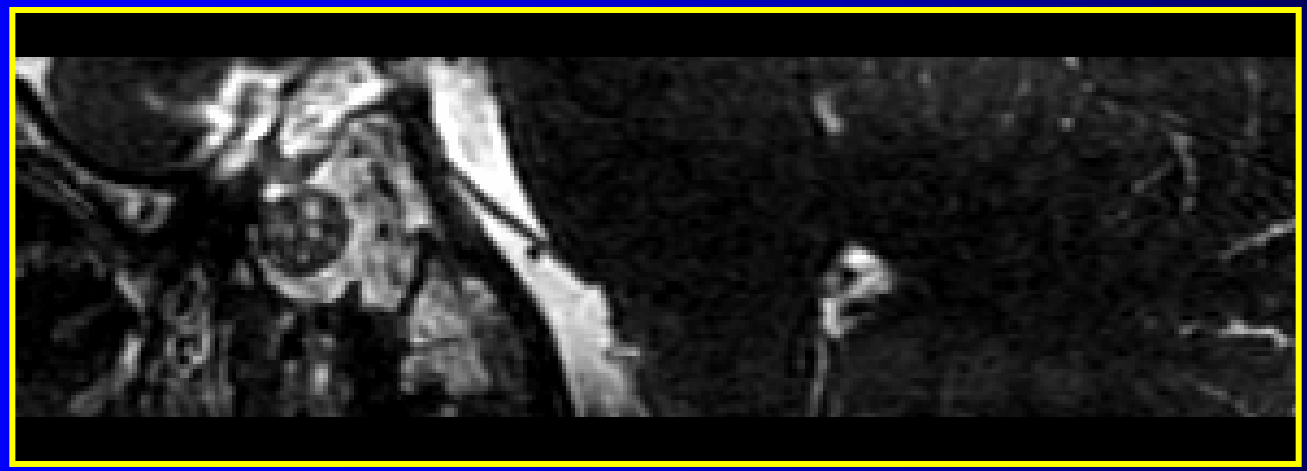
# 常规扫描难以与其长轴平行



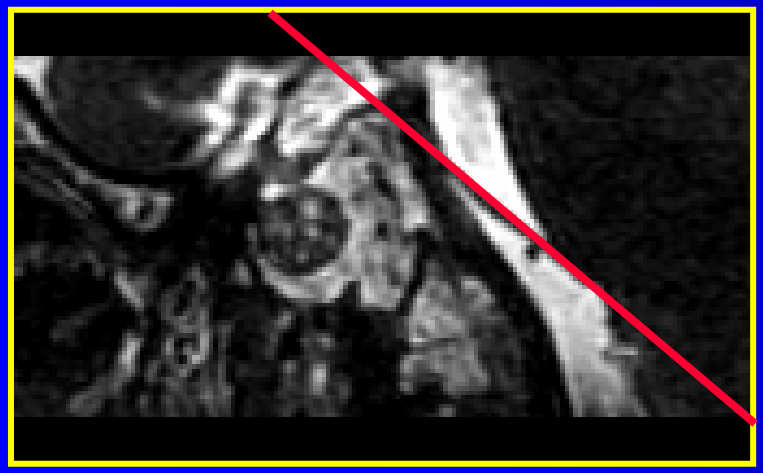


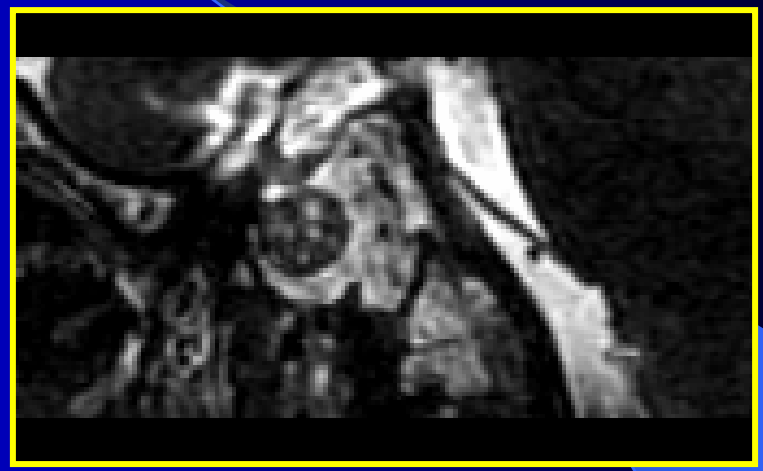
# 以横断面为基础的矢状位重组

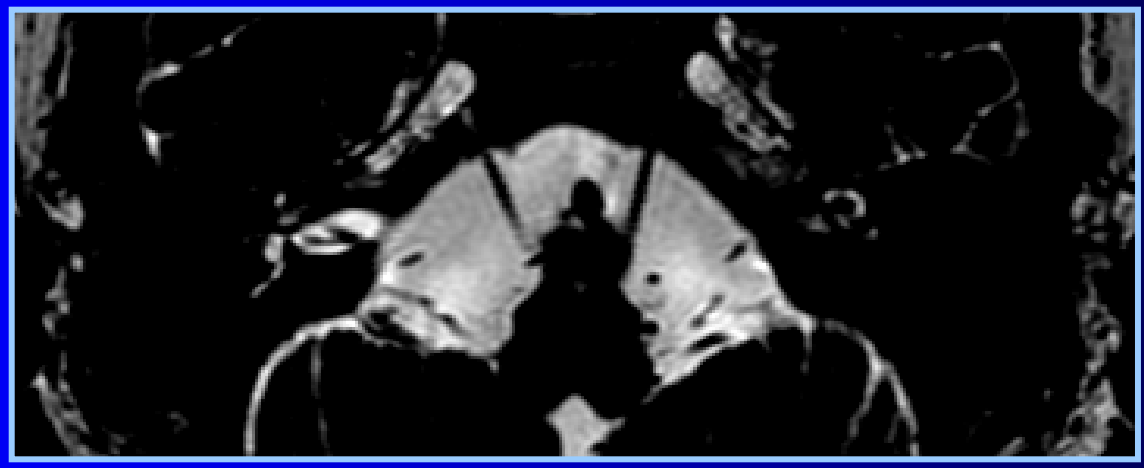


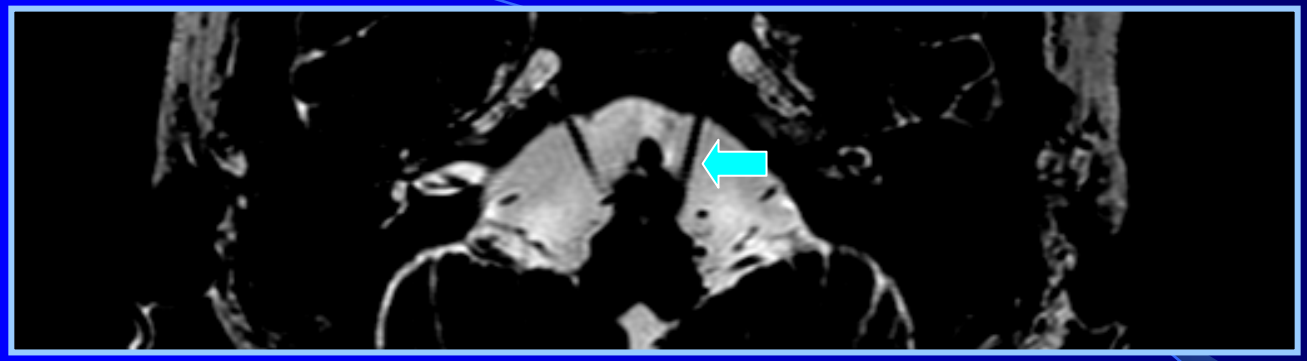



# 以矢状面为基础的横断位重组









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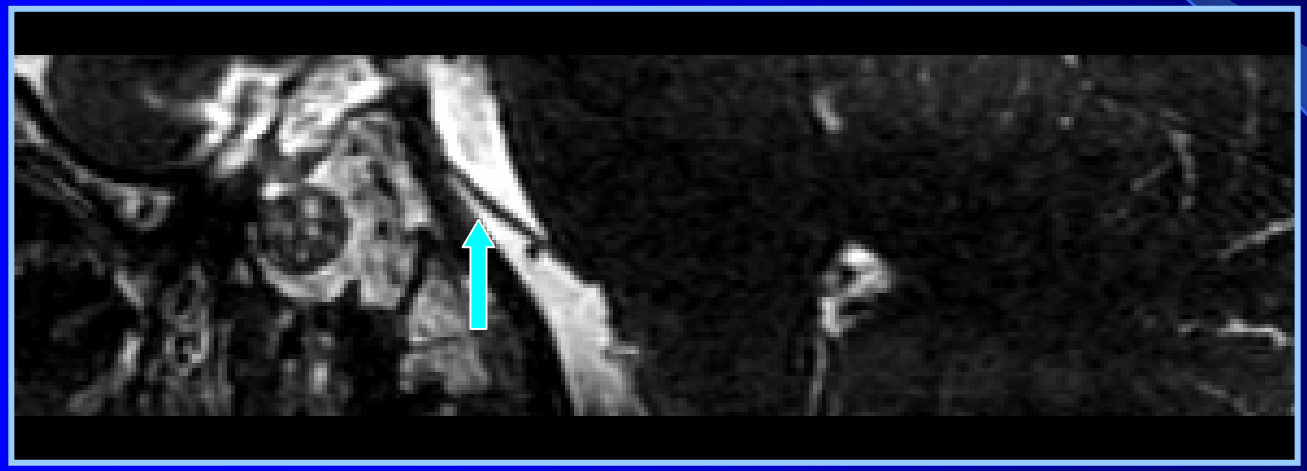

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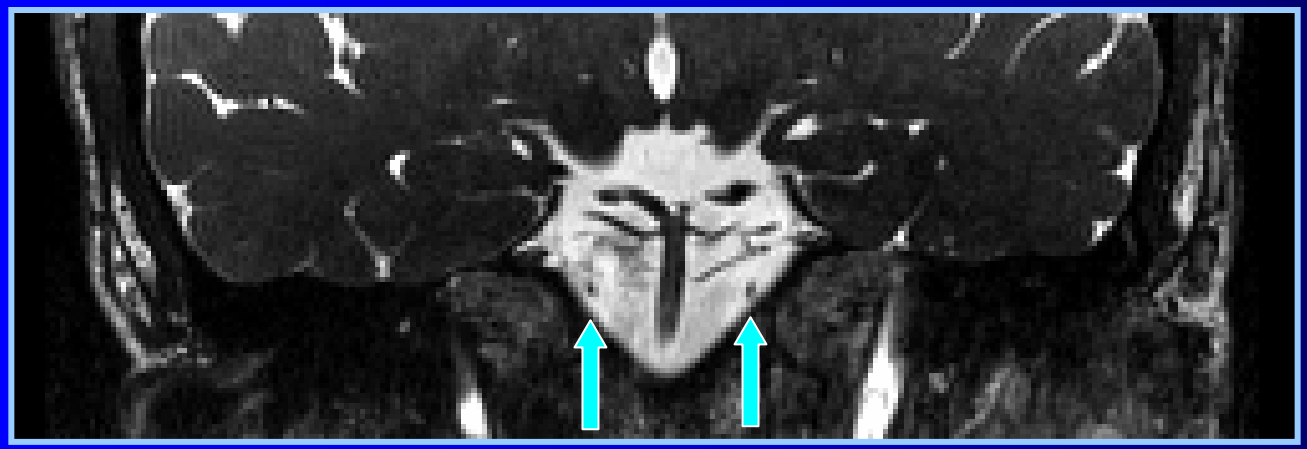
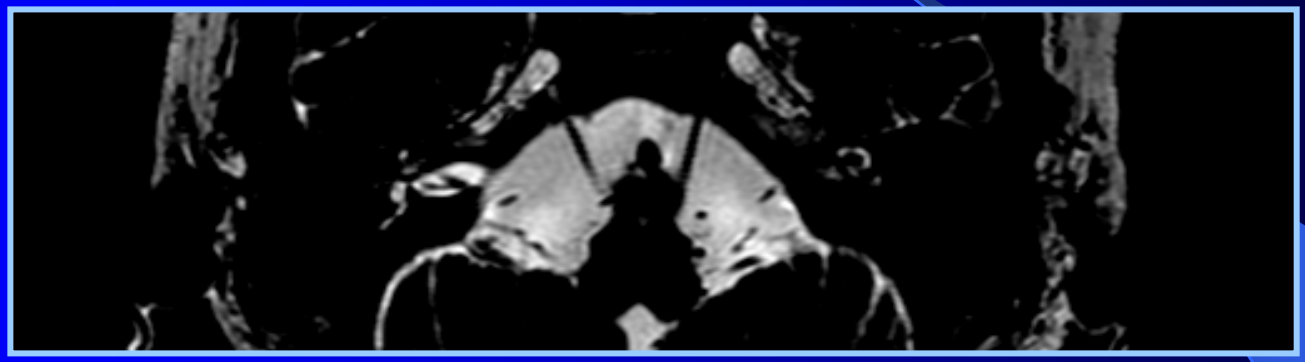
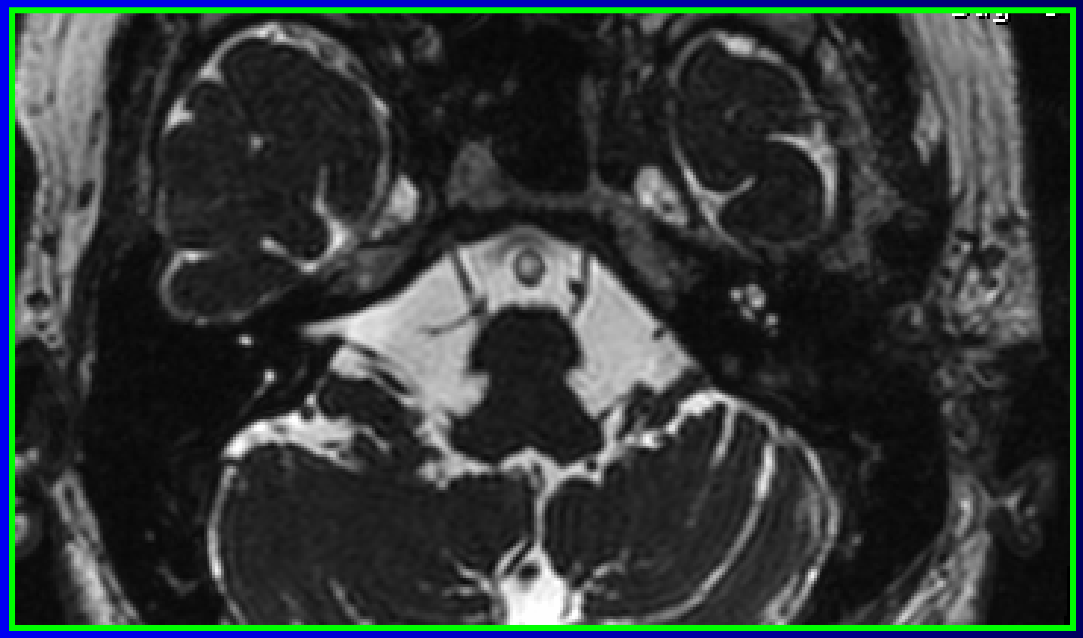


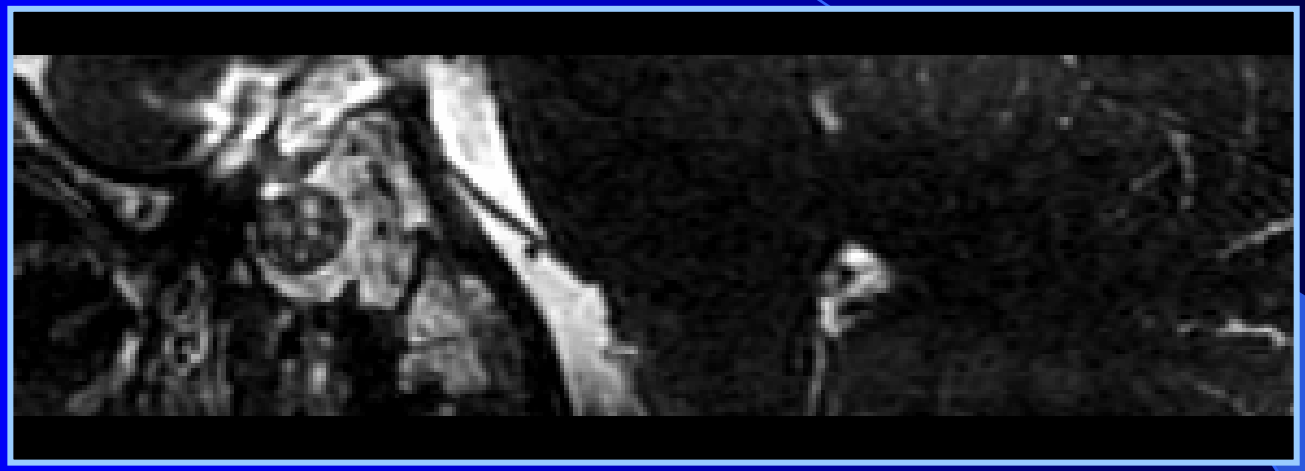
COR

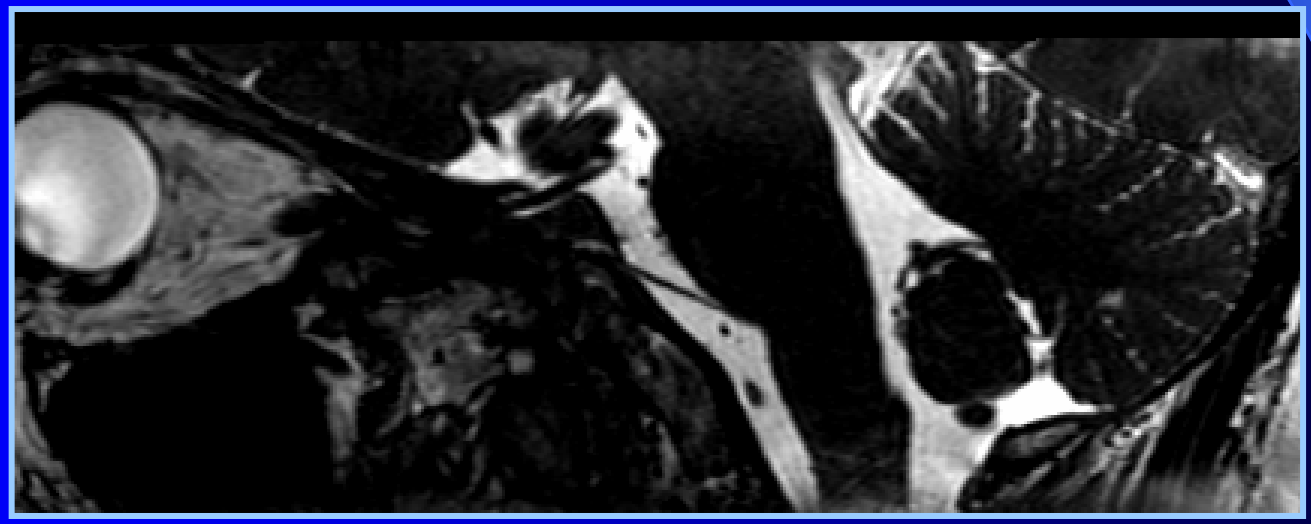
# 展神经在横断位
# 以97%（110）的几率显示



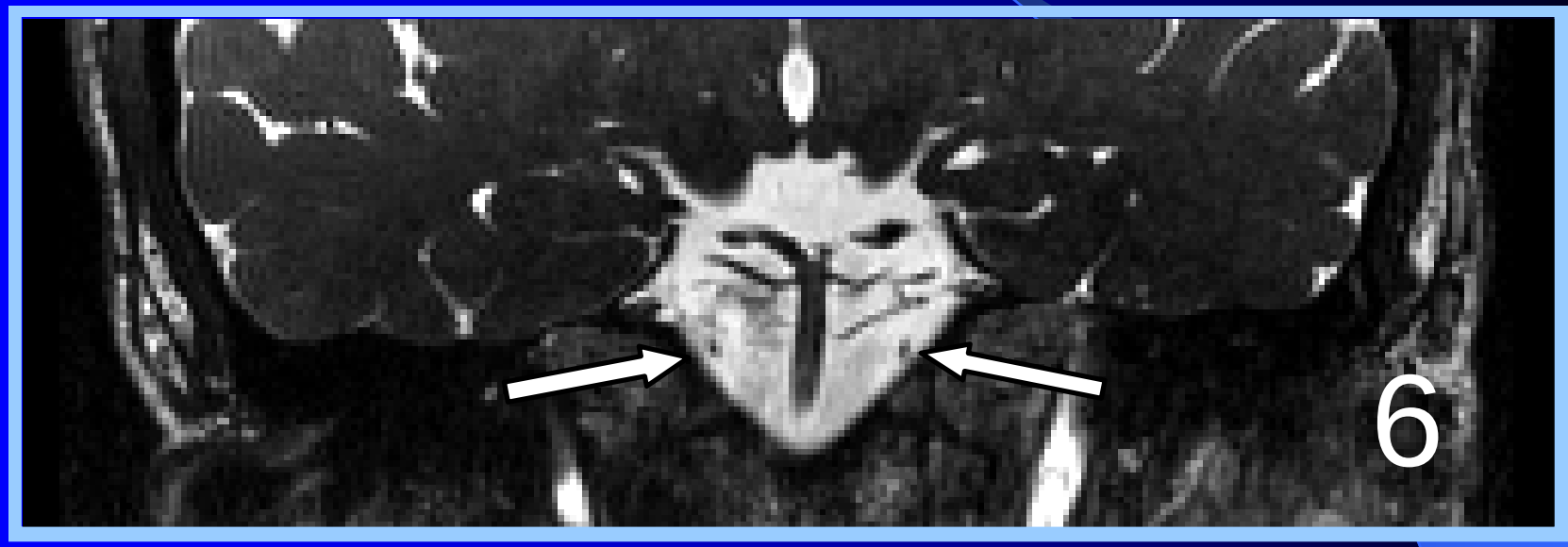


# 展神经在矢状位
# 以97%（110）的几率显示



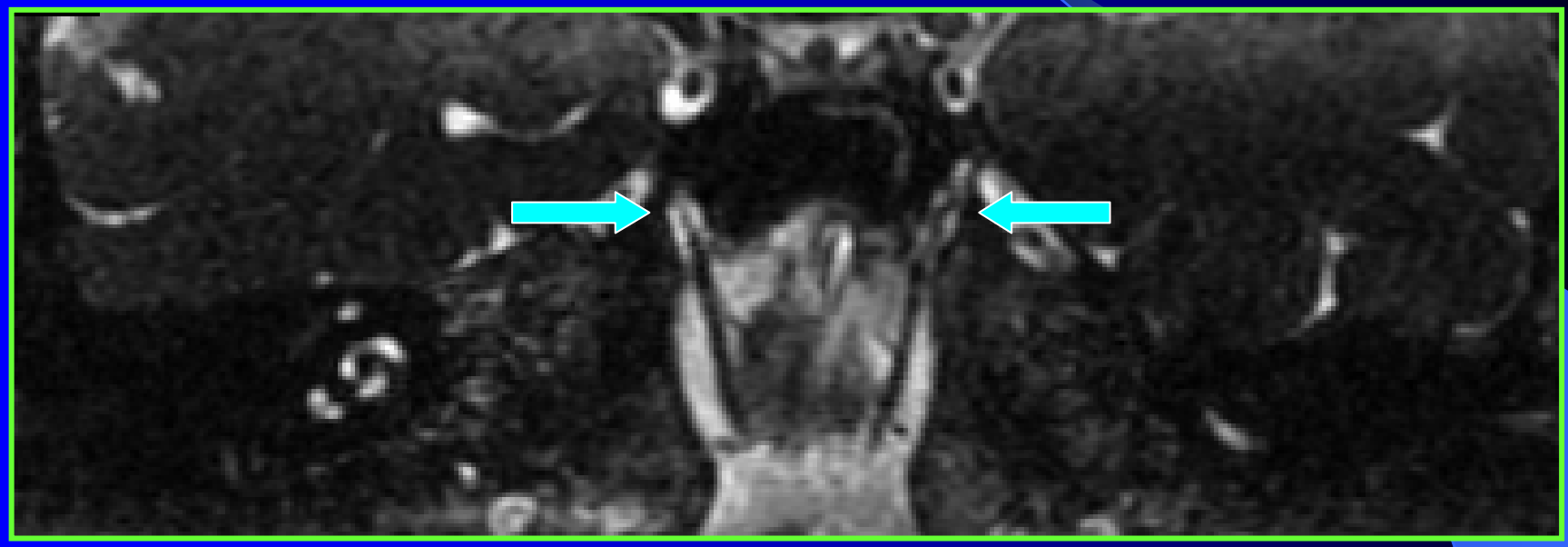


# 在冠状位以95%(108)的几率显示

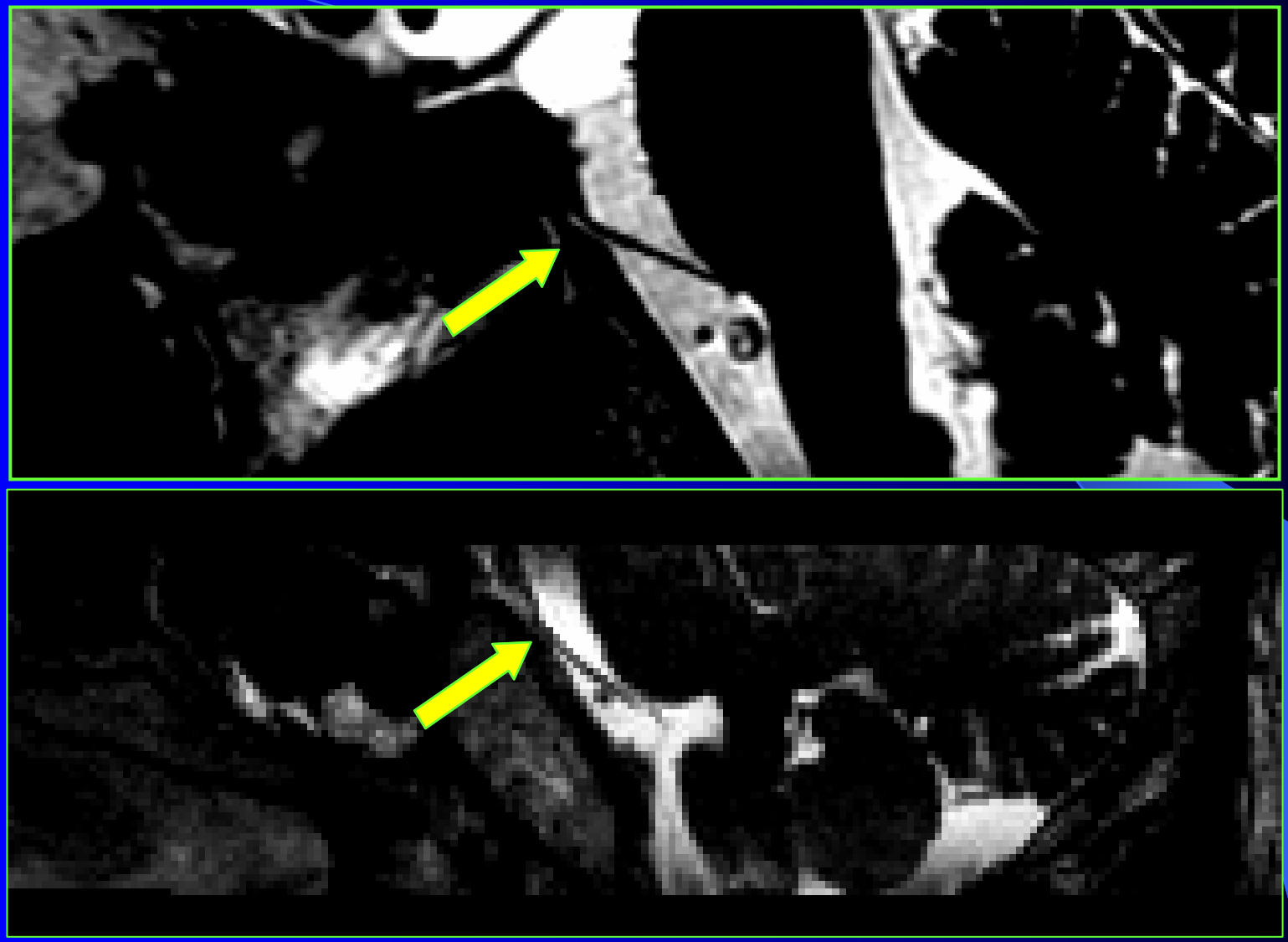



展神经短轴在冠状位呈点状显示

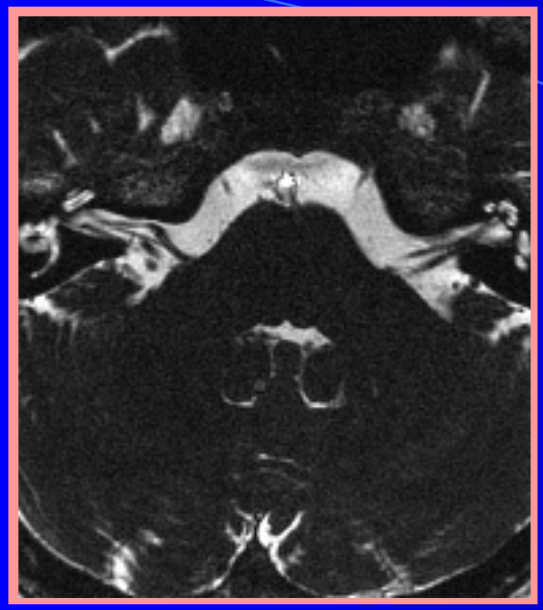
硬膜层之间的空间为岩部斜坡静脉汇合点（PVC）；
PVC被岩部蝶骨韧带分成两部分;
下面的部分为Dorello管，展神经从此进入岩骨斜坡段



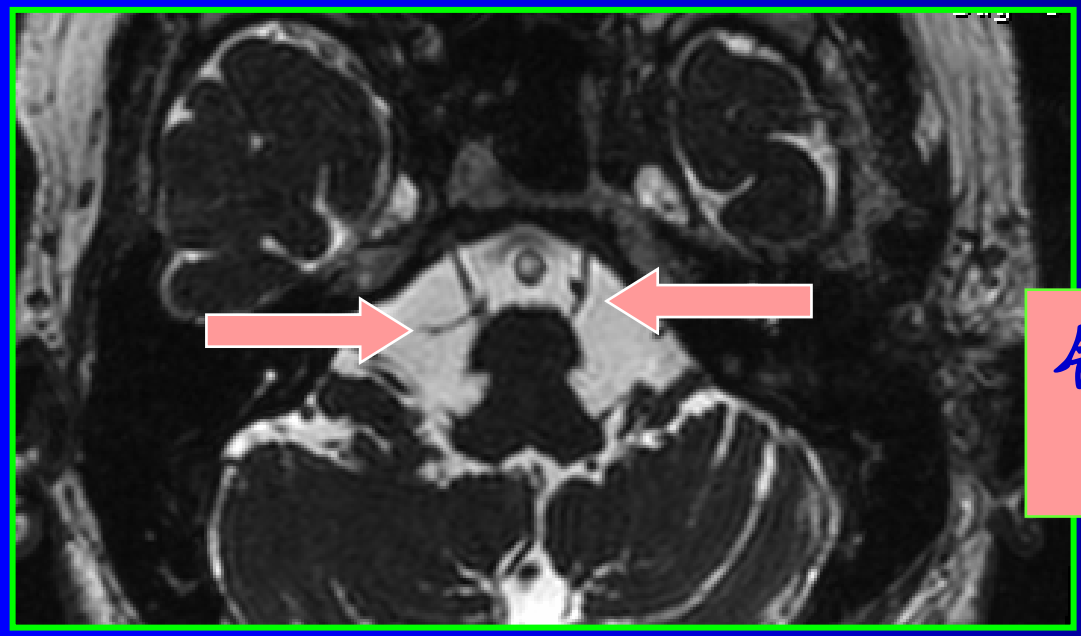
**MR首次显示展神经与Dorella管的关系**



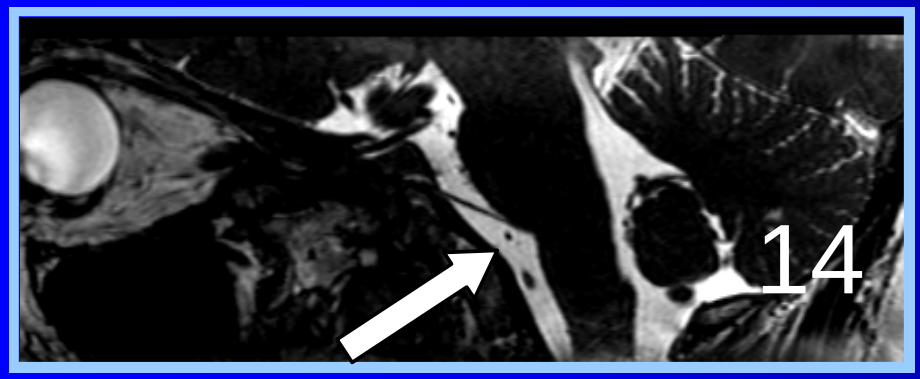
展神经与Dorella管（斜矢状位）

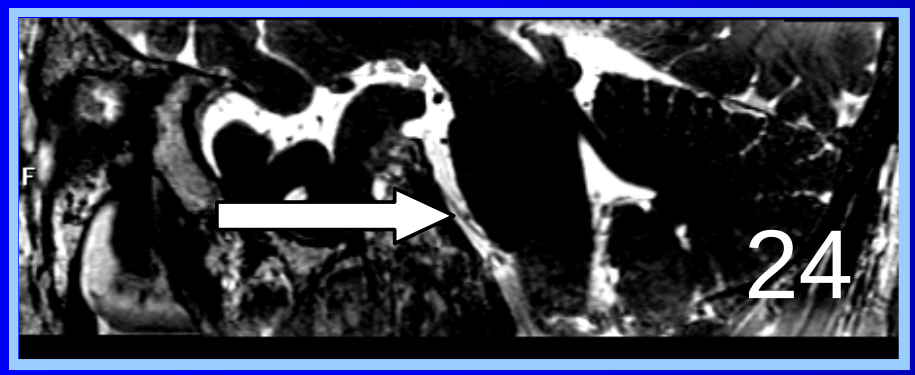


# 展神经与Dorella管（斜横断位）



展神经与小脑前下动脉AICA的关系




95/110条(86.4%)
小脑前下动脉
**(AICA)**
在展神经脑池段显示。

# 展神经与小脑前下动脉的位置关系

1、 小脑前下动脉（AICA）在展神经下方穿过

**63.1%（60/95）**

2、 小脑前下动脉（AICA）在展神经上方穿过

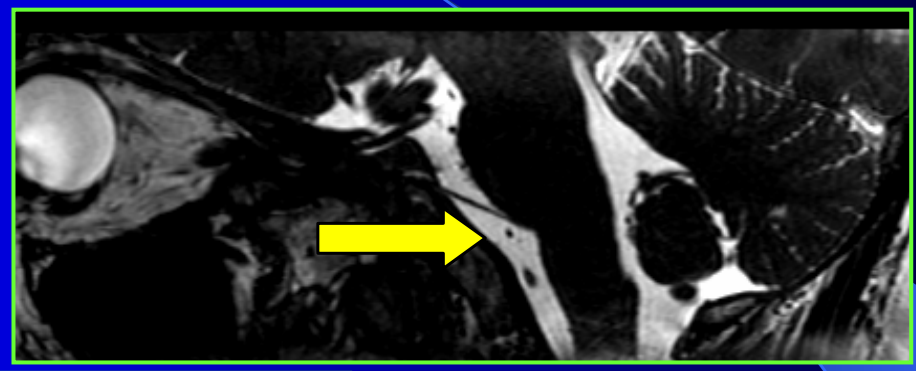
**31.6% (30/95)**

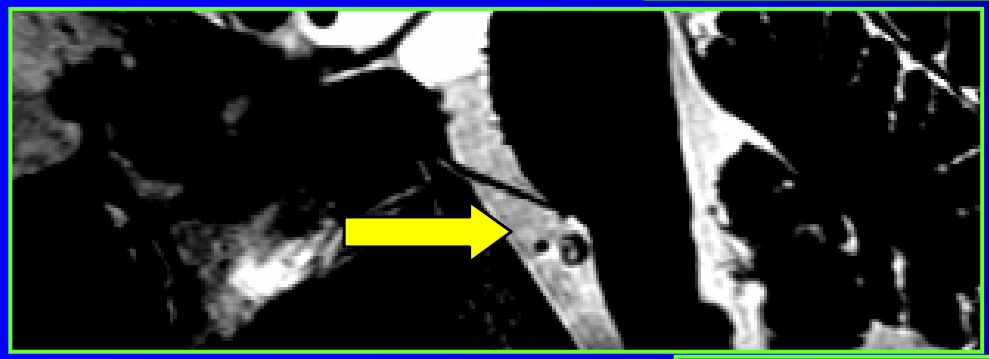
3、由于与血管接触密切而不能区分位置关系

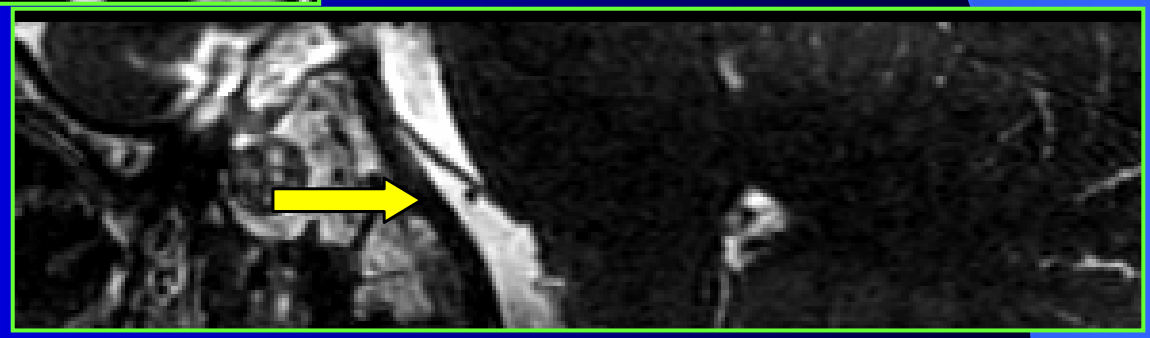
**5.3%（5/95）**

# 63.1%（60/95）小脑前下动脉（AICA）在展神经下方穿过

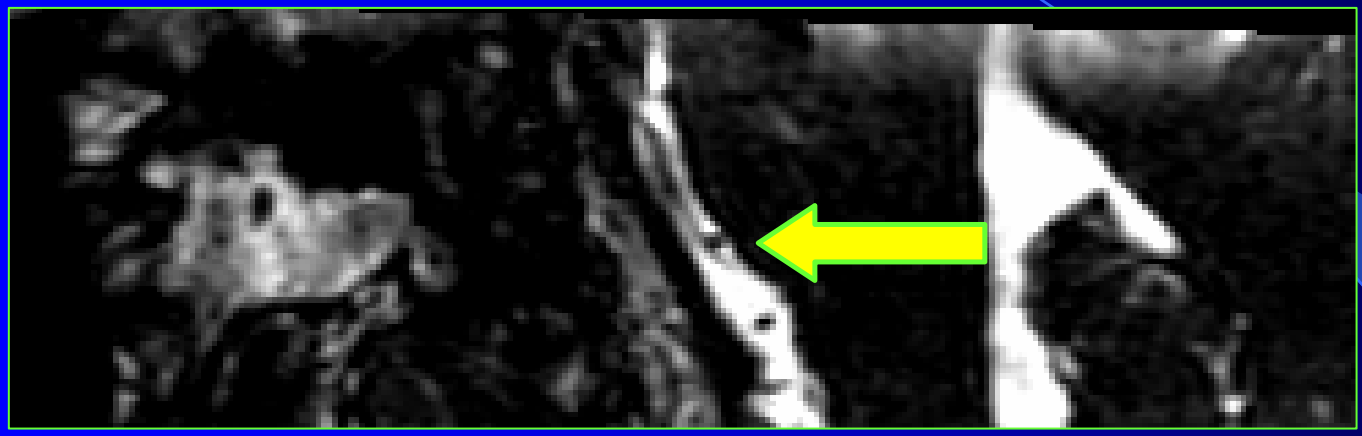
，

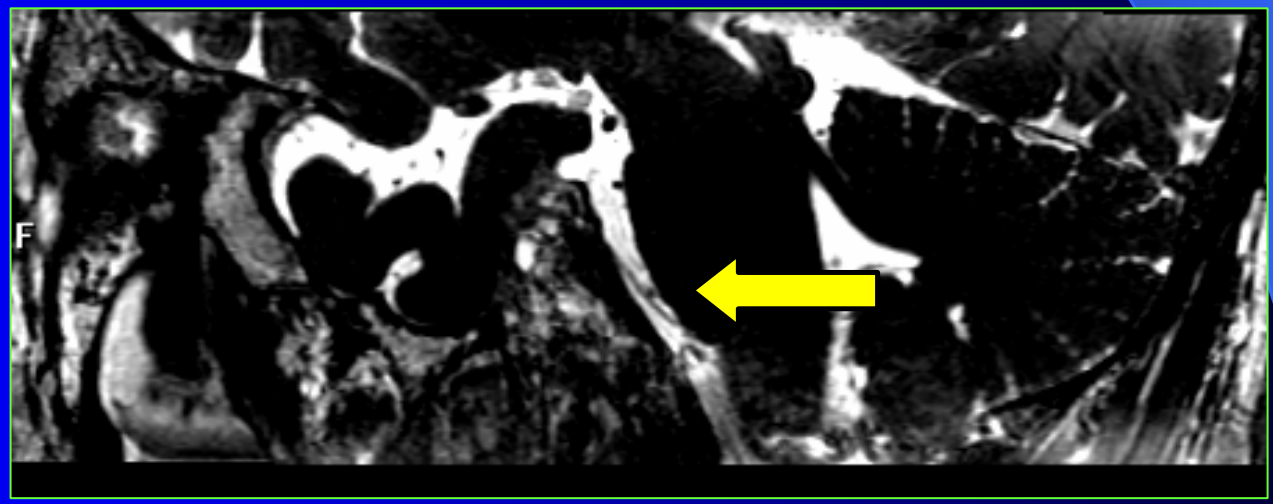




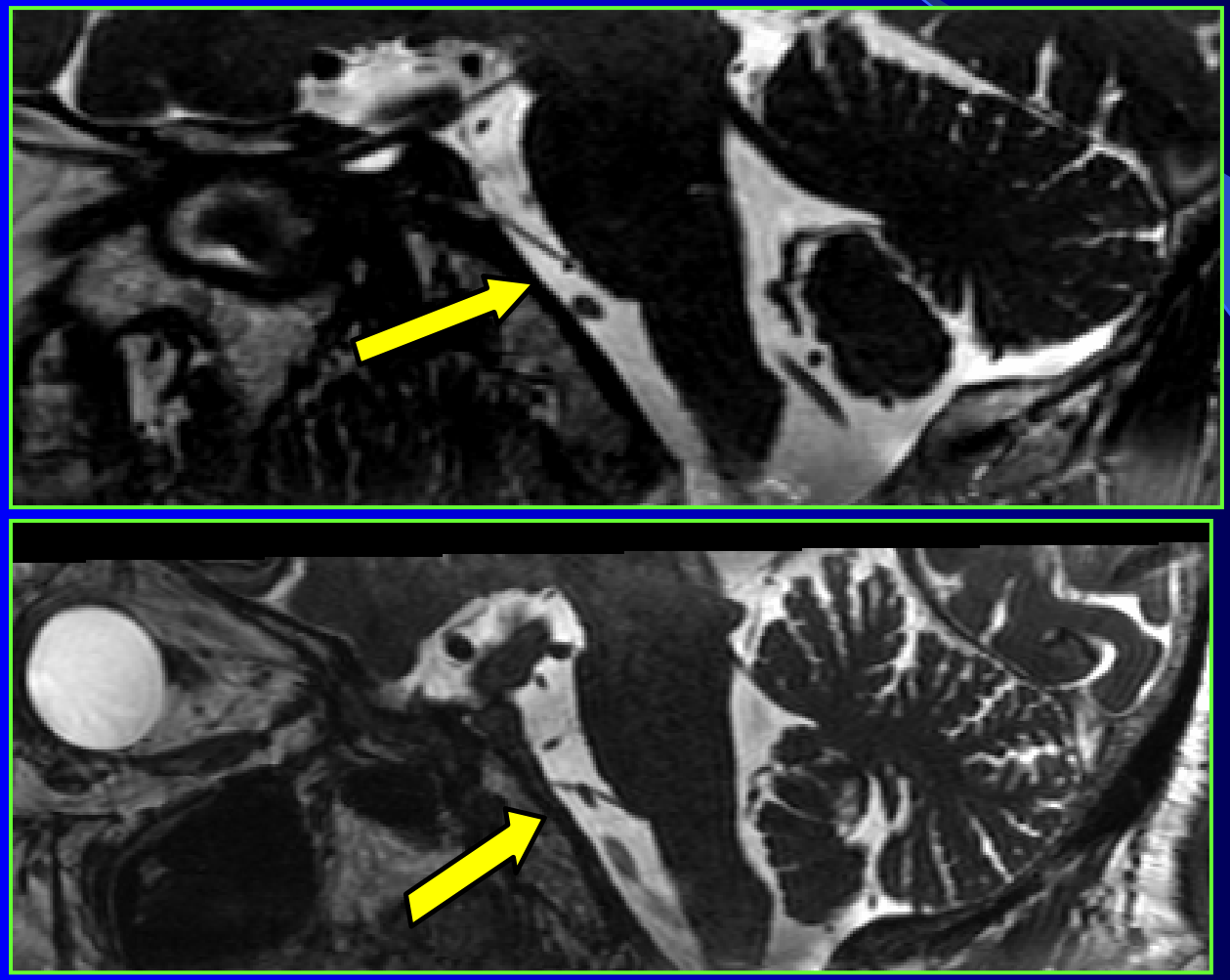


# 31.6% (30/95)小脑前下动脉AICA在展神经上方穿过

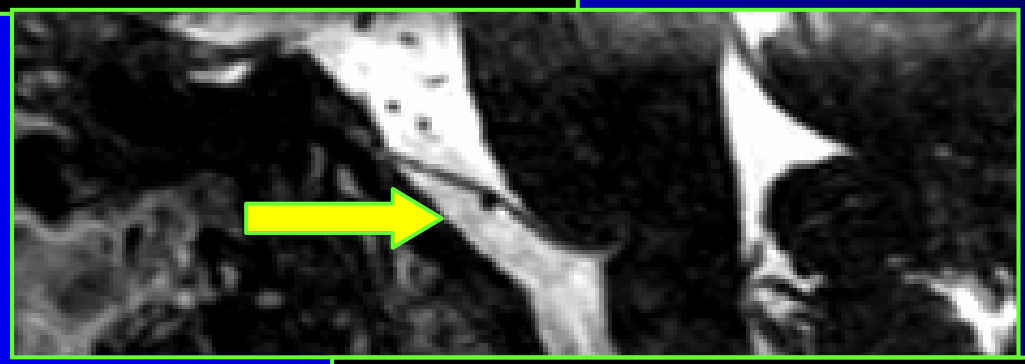


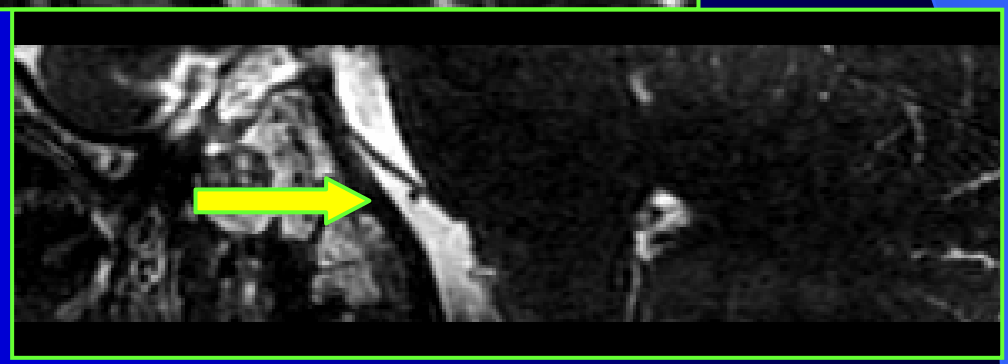


# 5条神经由于与血管接触密切，不能区分位置关系

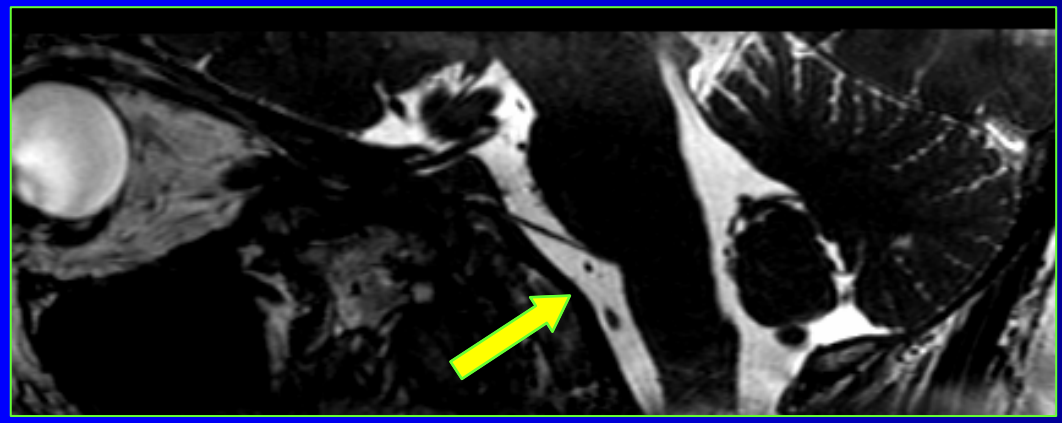


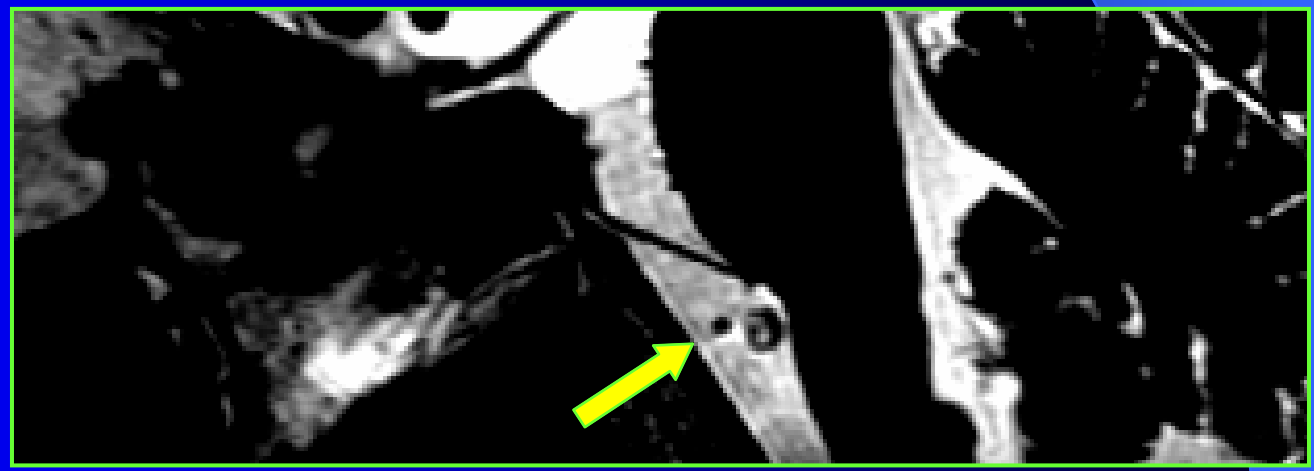
# 71/95 侧（74.7%）小脑前下动脉AICA与展神经紧密接触





# 24/95 侧（25.3%）小脑前下动脉AICA与展神经没有接触



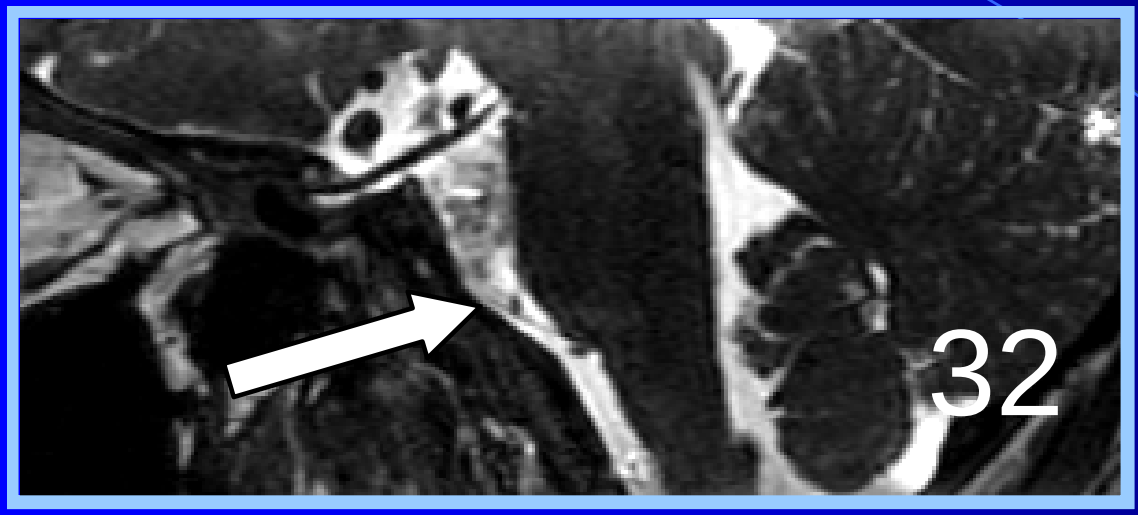


# 部分临床应用病例

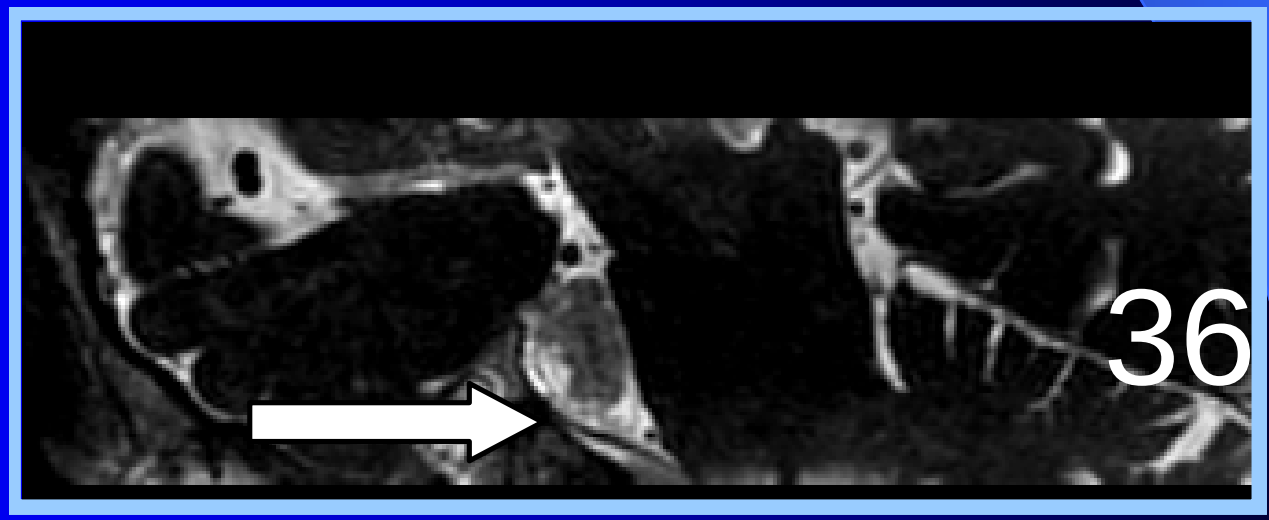
作用：

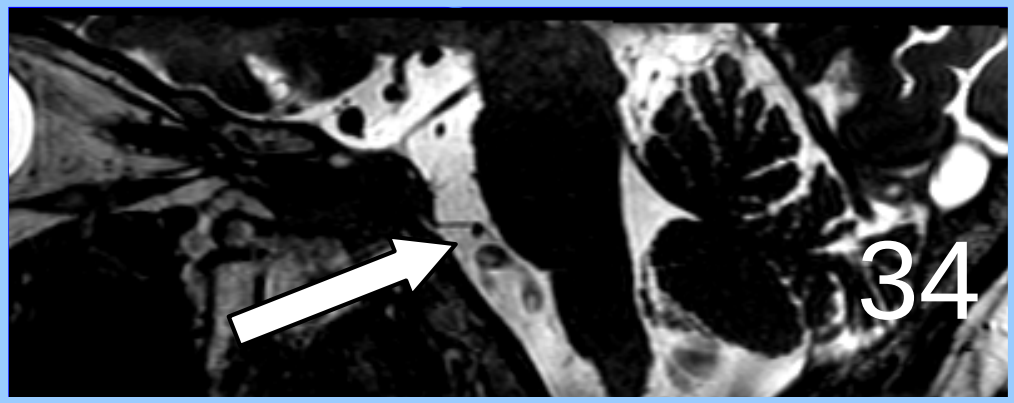
1、可以弥补以前不能直接显示病灶与神经之间的关系的缺陷。

2、可以显示血管压迫导致展神经。

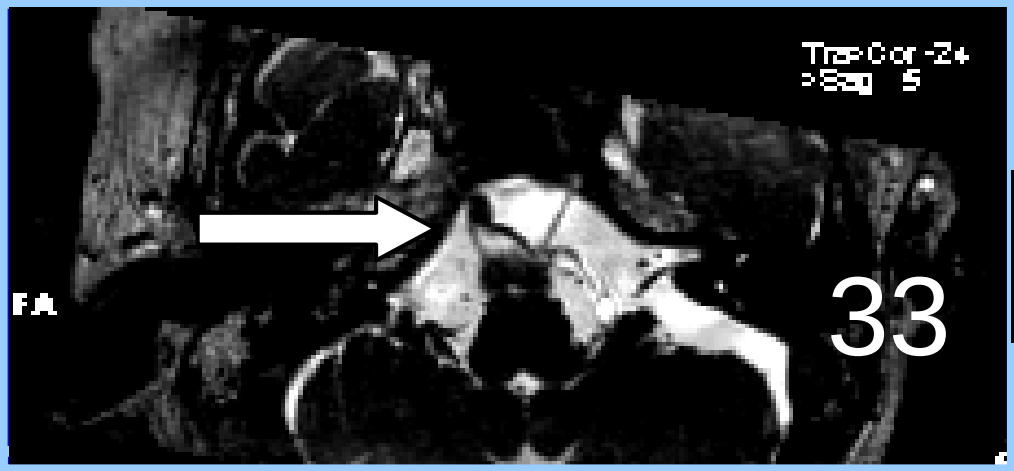



非血管压迫

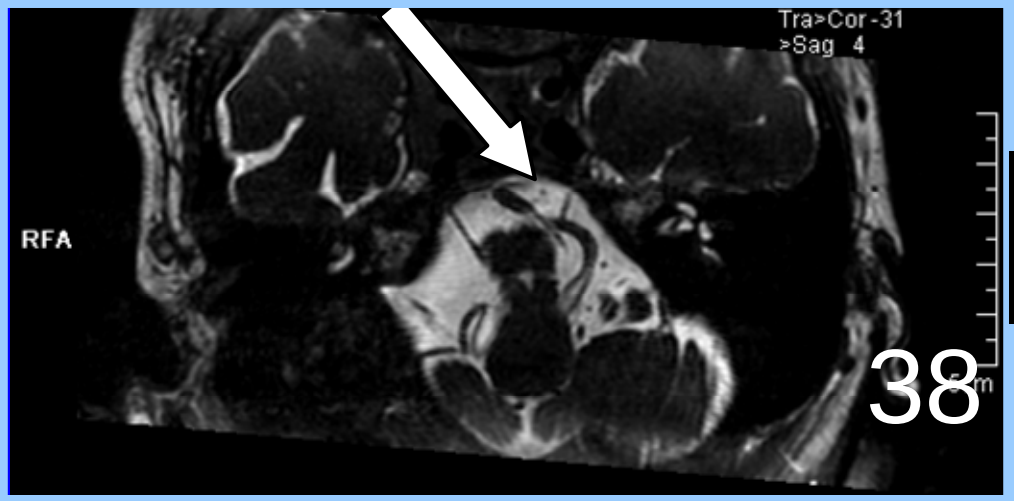





展神经被AICA
向上重度推移




基底动脉偏移压
迫右侧外展神经




左椎动脉压迫脑
池段展神经根部

血管压迫

# 小　　结

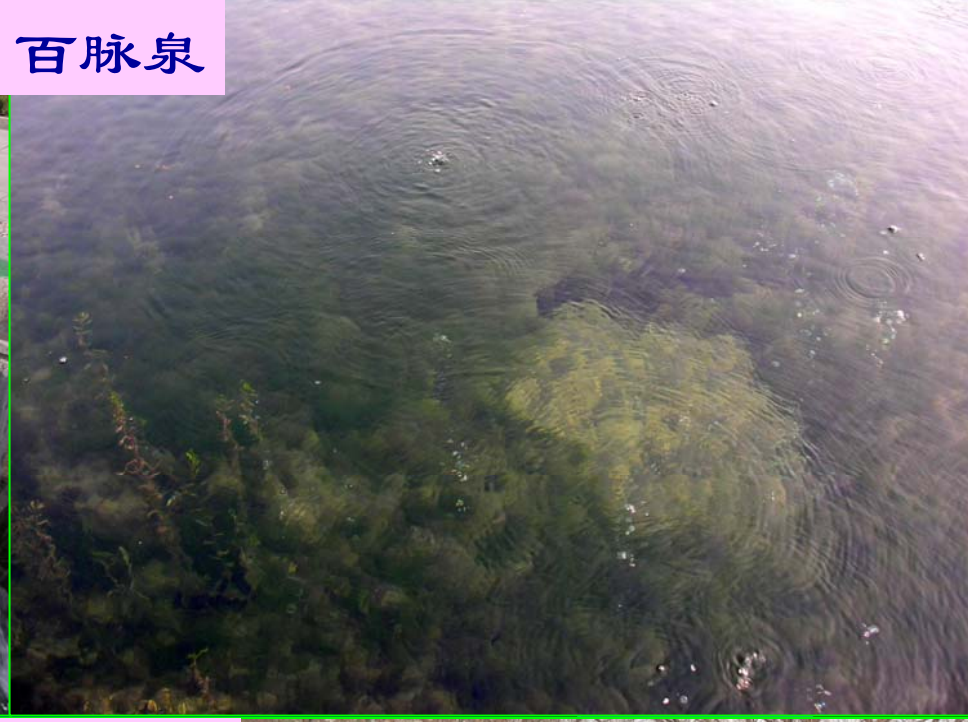
1、3D-CISS序列与MPR技术相结合，可以显示部分颅神经脑池段的正常走行特点。

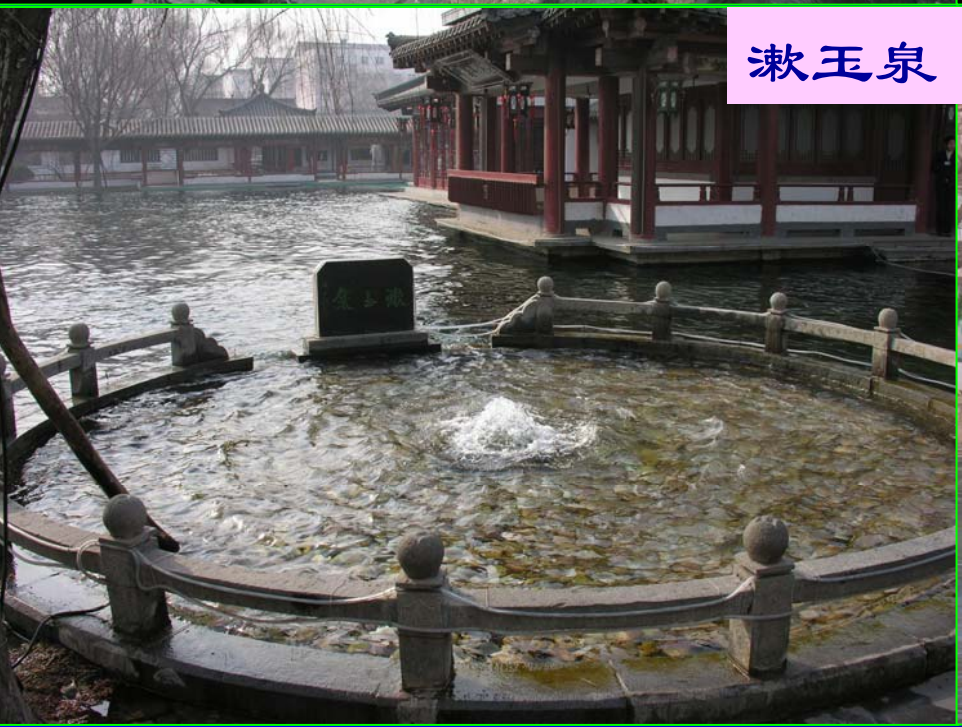
2、可以显示脑池段颅神经与邻近血管的关系。

3、无法显示脑池段以外的颅神经走行是这种方法的不足。

4、困惑是正常人也可以看到血管与颅神经紧密接触。

墨 泉 百脉泉





漱玉泉 梅花泉