



# The 8<sup>th</sup> Annual International Neurosurgery Conference

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## Olfactory Groove Meningiomas: operative technique

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- **Arise from the midline of the anterior fossa:  
at the cribriform plate and the frontosphenoid suture**
- **Comprise 9–13% of all intracranial meningiomas**
- **May achieve considerable size before becoming symptomatic**



## Most common presenting symptoms:

- headache
- personality changes
- anosmia
- visual impairment
- intracranial hypertension
- seizures



## **The optimal surgical approach** *(literature data):*

- ? Allow for **complete and safe tumor removal**
- ? **adjusted** to tu size and extension/ **patient's** symptoms
- ? provide **exposure of important anatomical structures**
- ? **minimal brain retraction/ injury to frontal lobes**
- ? must be combined with modern **skull base techniques**
- ? allow for **reconstruction**
- ? good **cosmetic outcome**
- ? **low approach-related morbidity**



## Controversy:

Do we need to adapt the approach to the tumor 's/ patient 's characteristics?

Do we need to expose all adjacent anatomical structures initially in order to gain more security?

Do we need skull base techniques in olfactory meningiomas?



## Goal of surgery:

- Complete tumor removal
- Avoidance of new neurological morbidity
- Preservation of neurological functions
- Avoidance of approach-related complications
- Good cosmetic outcome



## Pterional approach

- early CSF release
- early visualization of all critical neurovascular structures
- minimal frontal lobe injury
- low CSF leak risk (avoids entry into frontal sinus)

### Drawbacks:

- poor access to the upper and/or contralateral tumor parts



## Bilateral subfrontal approach

- direct access to the tumor from different perspectives
- affords early devascularization
- adequate exposure for cranial base reconstruction

### Drawbacks:

- late visualization of the optic nerves, ICA and anterior cerebral complex
- risk of CSF leak (wide opening of frontal sinus)
- bilateral frontal lobe injury
- risk of venous complications (interruption of the superior sagittal sinus)





## Unilateral subfrontal approach

- spares the superior sagittal sinus
- no risk of injury to the contralateral frontal lobe

### Drawbacks:

- CSF leak (opening the frontal sinus)
- injury to the ipsilateral frontal lobe



## Skull base approaches

*Extended bifrontal/subcranial/transbasal approaches*

*Craniofacial resection*

*Additional orbitotomies, e.g. fronto-orbitozygomatic approach*

...

- minimize brain retraction
- early devascularization
- access to possible extracranial extension

Drawbacks:

- High procedure-related morbidity rate



**Endoscopic approaches**, *e.g. extended endonasal endoscopic approach or endoscopic glabellar approach*

- avoidance of brain retraction
- early tumor vascularization
- direct tumor access
- avoidance of manipulation of the vulnerable optic apparatus

Disadvantages:

- high rate of CSF leakage and the related high infection rate
- ... (limited experience, small case series)



## Frontolateral approach: *Rationale*

**no need of initial exposure of the whole tumor and its surrounding structures!**

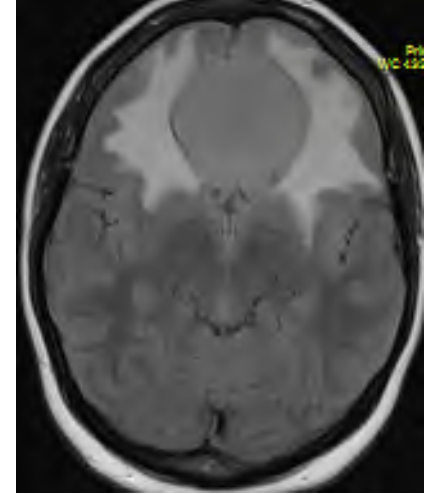
The approach allows for:

- Sufficient **access** to the tumor
- Early **identification of the ipsilateral optic nerve and ICA**; then - of the chiasm and contralateral optic nerve
- Repeated cycles of **tumor debulking, dissection of its capsule and stepwise removal**



## Frontolateral approach: advantages

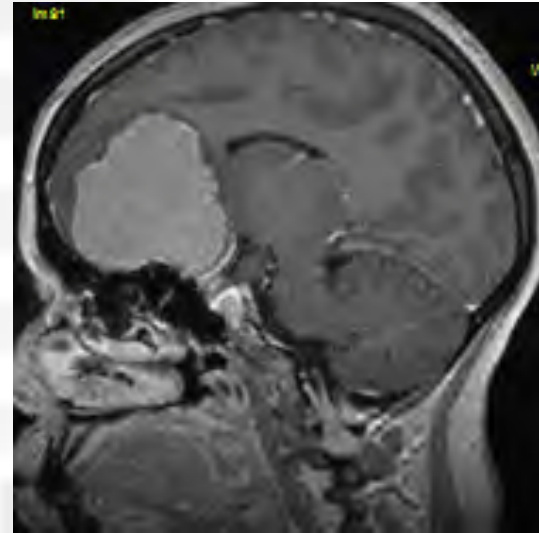
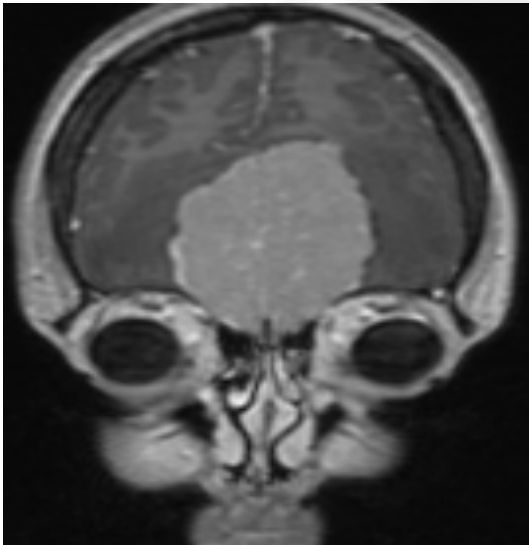
- Good **cosmetic** outcome
- Preservation of **temporal muscle** and avoidance of related risks (muscle atrophy, temporomandibular joint dysfunction, facial nerve injury)
- The small bone opening **protects the frontal lobes**;  
no risk of frontal lobe herniation through the craniotomy in large meningiomas
- The **frontal sinus** is usually not opened– low CSF leak rate
- Even large and giant olfactory meningiomas can be **safely removed**





## Frontolateral approach: technique

Typically – from the **right side**



*Exception: unusual olf. Mg with major unilateral growth on the left side*



## Frontolateral approach: technique

### Skin incision:

- Hair line skin incision: *preferred due to optimal cosmetic outcome*

### Bald patients:

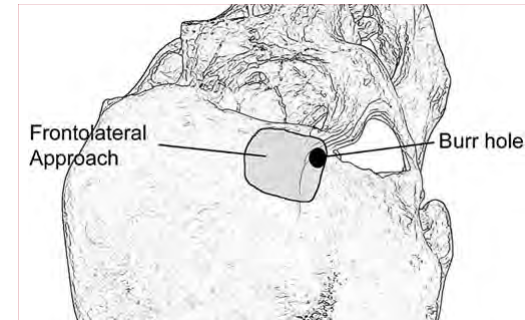
- incision in a skin fold
- eyebrow incision: *incise parallel to the hair follicles to avoid cutting the follicles*



## Frontolateral approach: technique

### Head position

- slight retroflexion to allow the frontal lobe to fall from the frontal base (less need of brain retraction)
- rotation to the contralateral side: 10- 20 degrees
- the head should be above the heart level



*From Nakamura 2007*



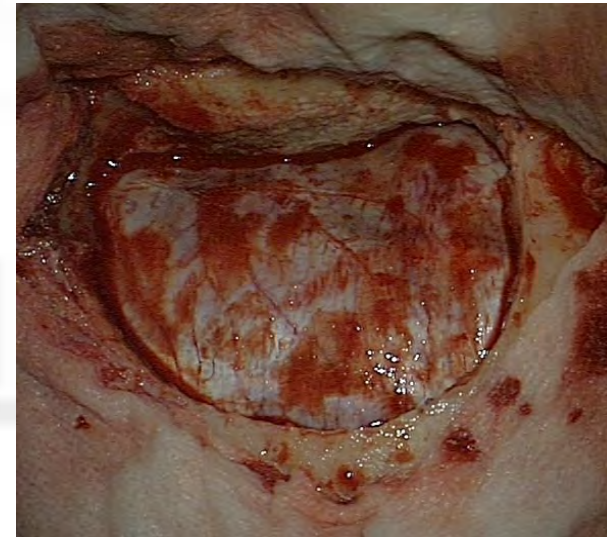
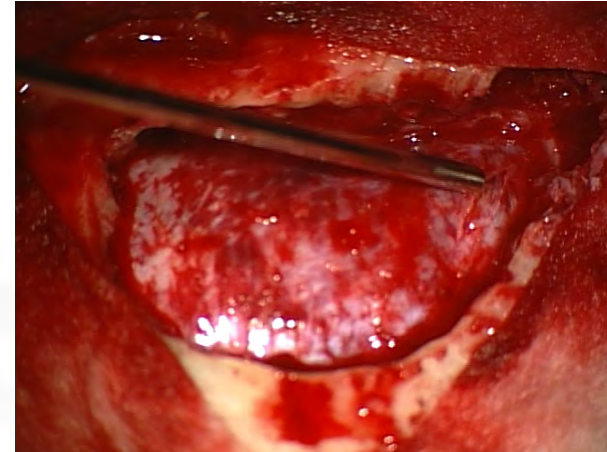


## Craniotomy

- **single burr hole** - just posterior to the anterior temporal line (minimal dissection of the temporal muscle attachment)
- avoid opening of the periorbita
- small craniotomy (**2.5-3.5cm**) **flush** to the orbital roof

### Optimizing the working angle:

The inner part of the frontal bone (supraorbital rim) and any bony elevations of the orbital roof are drilled off extradurally





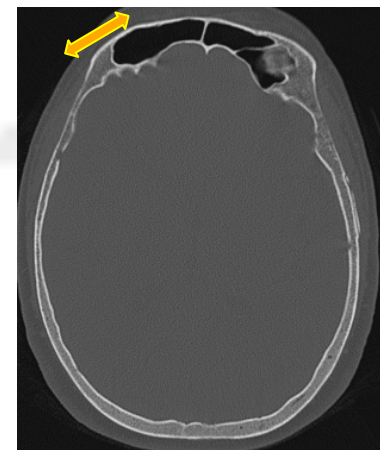
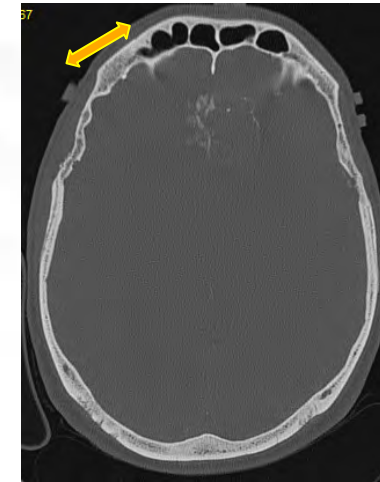
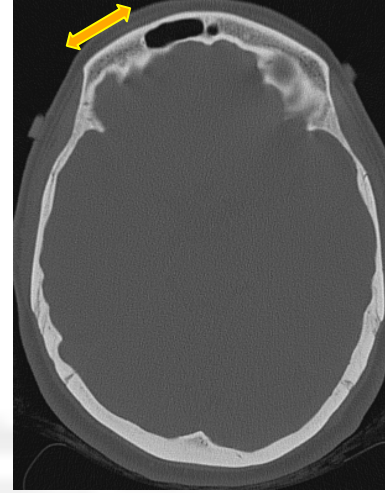
## The frontal sinus

- Its wide opening can be usually avoided
- Small opening and intact mucosa: no need of reconstruction
- In > sinus: the craniotomy is placed more laterally (up to 1cm lateral to the burr hole)
- **Very large sinus** - inevitable opening:

During surgery: tamponade the sinus with iodine-soaked cottonoids

Removal of the mucosa

Reconstruction with an anterior based pericranial flap

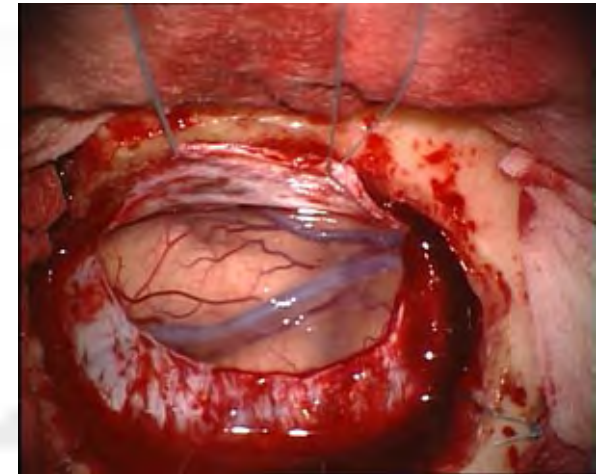
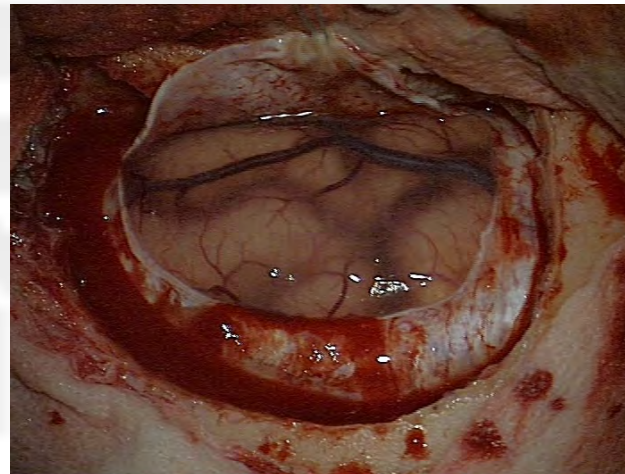
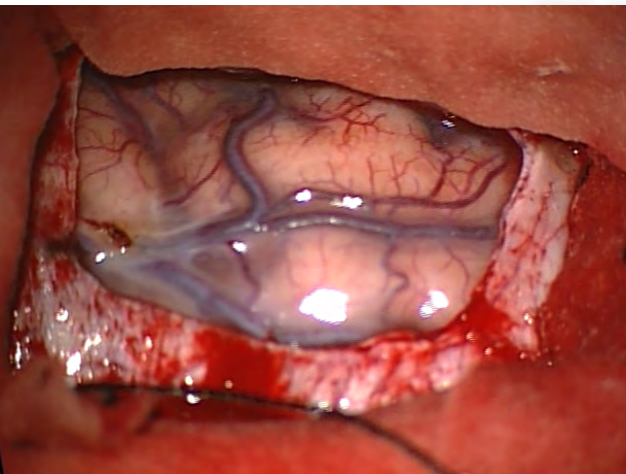




## Frontolateral approach: technique

### Dura opening

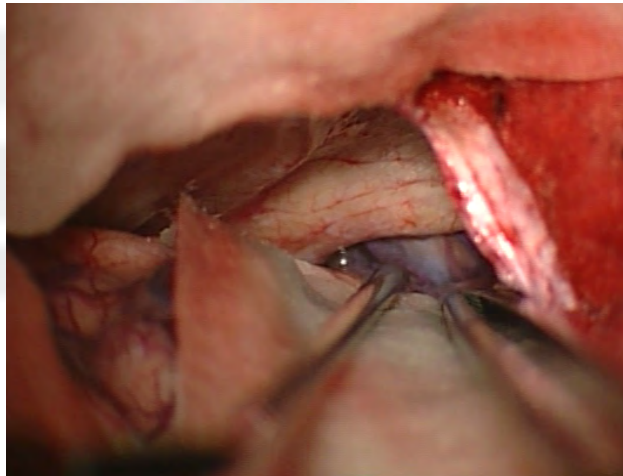
in a curved fashion with its base to the supraorbital rim





## **CSF release: crucial step in avoiding frontal lobe injury and in providing good tumor exposure**

- Drain sufficient CSF by opening the proximal Sylvian cistern:  
use a forceps, suction and a cottonoid only

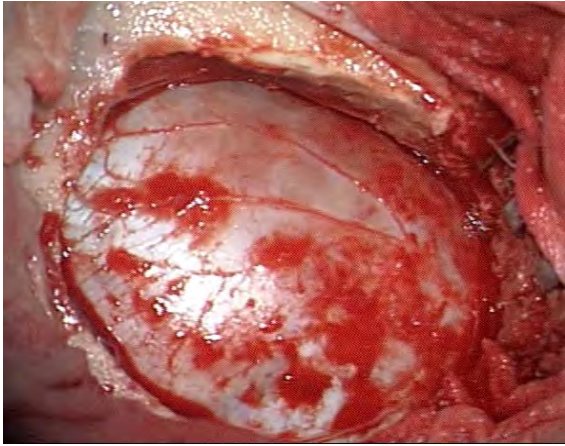


**Do not place the retractor until the brain is absolutely slack!**



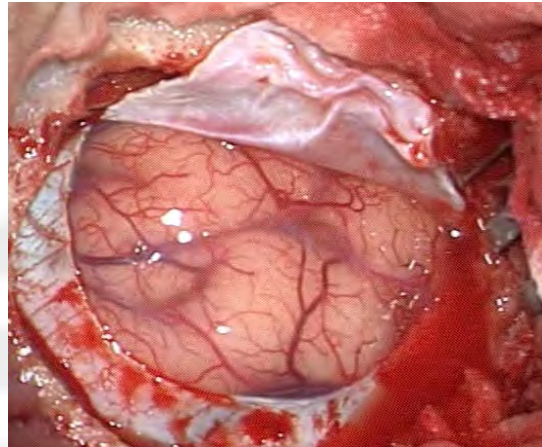
**Take your time to release as much CSF as necessary!**

1



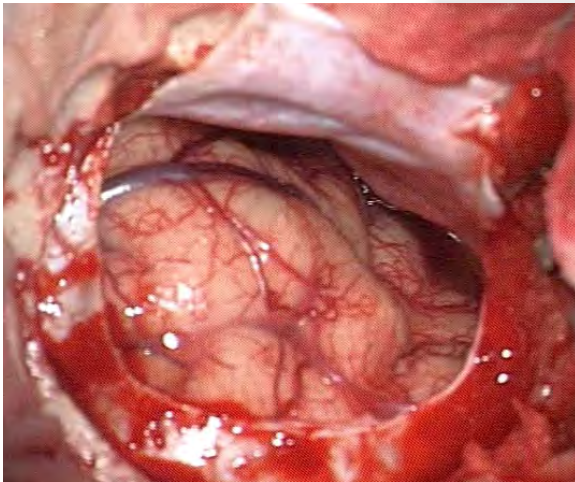
*Initial view of the dura*

2



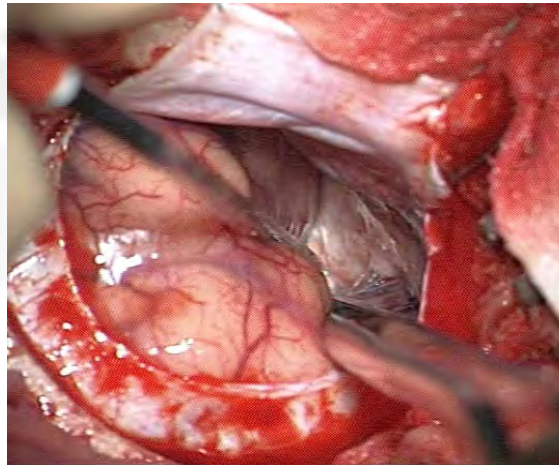
*Note the tense brain. The remaining frontal lobe is, however, protected under the bone*

3



*CSF release. The brain is slack...*

4



*and the tumor can be seen even w/o using a retractor*



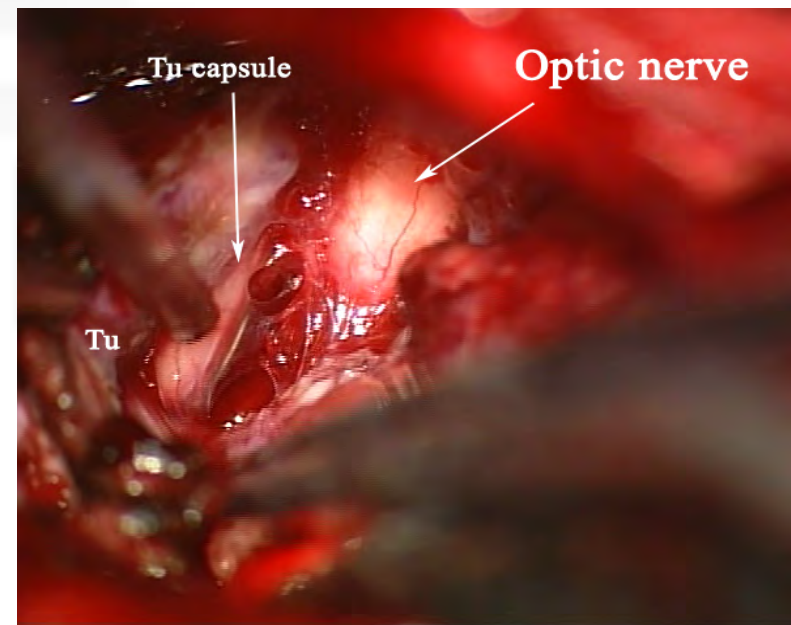
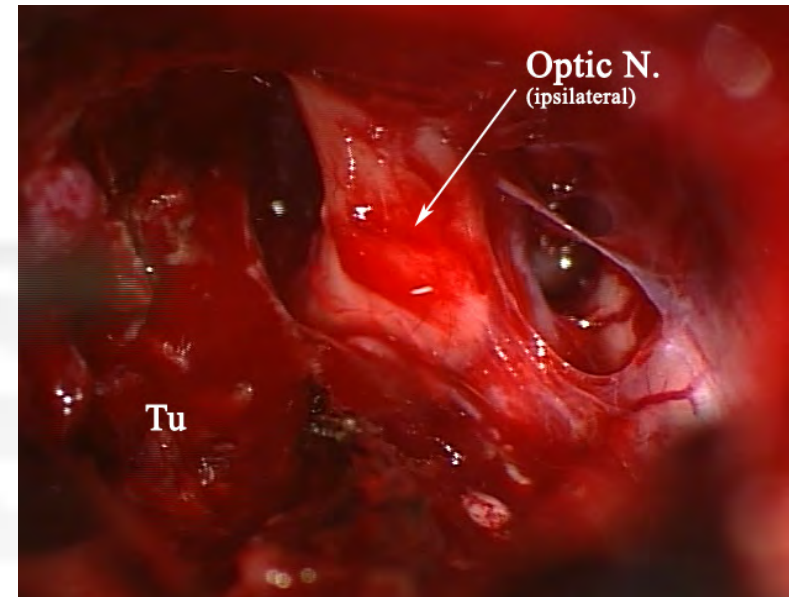
## Tumor removal

### First step:

Identification of the **ipsilateral optic nerve**  
and then – of the ipsilateral **ICA**

Small-medium meningiomas: straightforward

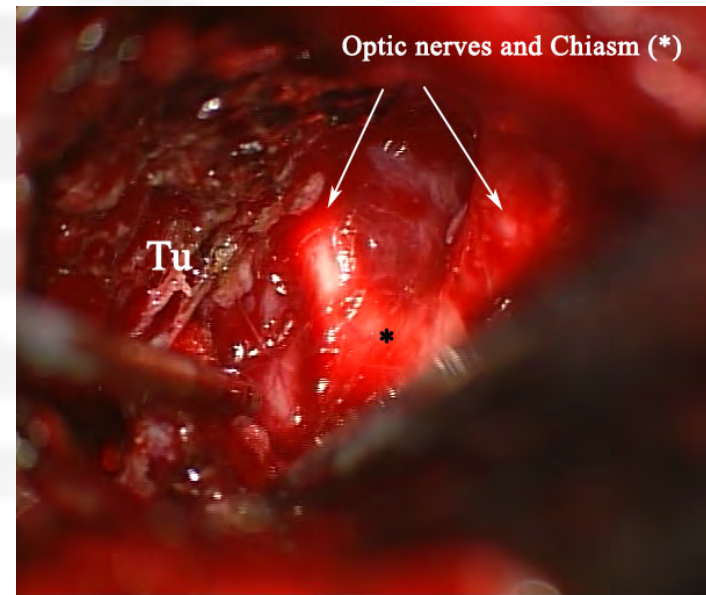
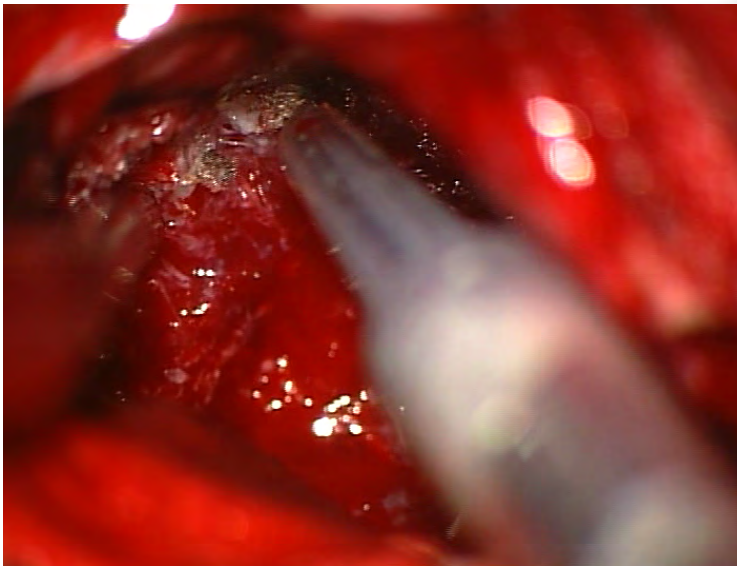
Large meningiomas: initial tumor debulking  
and removal to gain access to these structures





## Tumor removal

### Further debulking and removal

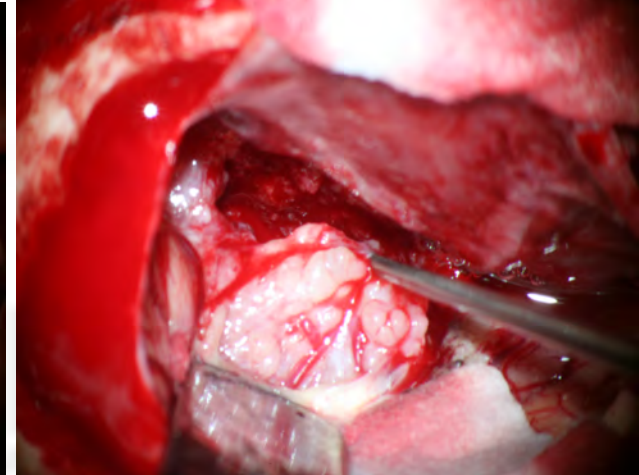
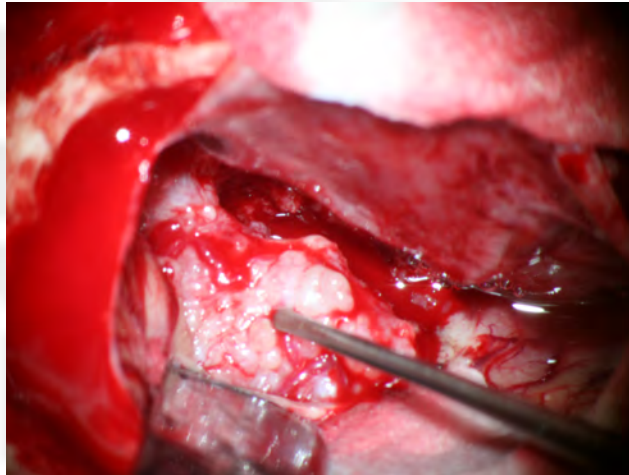
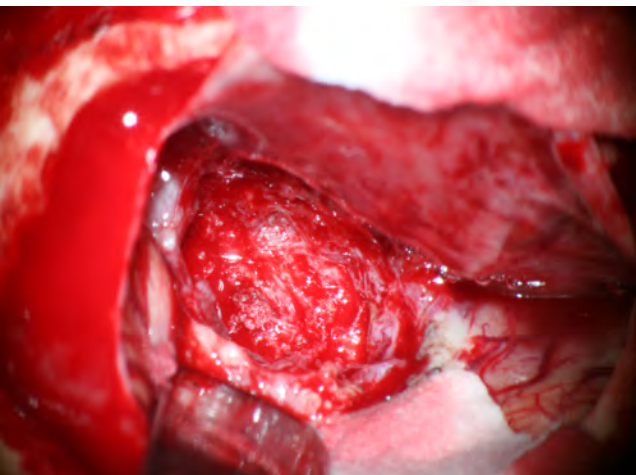


Dissection from the chiasm and  
contralateral optic nerve



## Tumor removal

- The more periferal tumor parts can be well mobilized/luxated following sufficient debulking



*Bring the tumor to you; don 't go around it!*

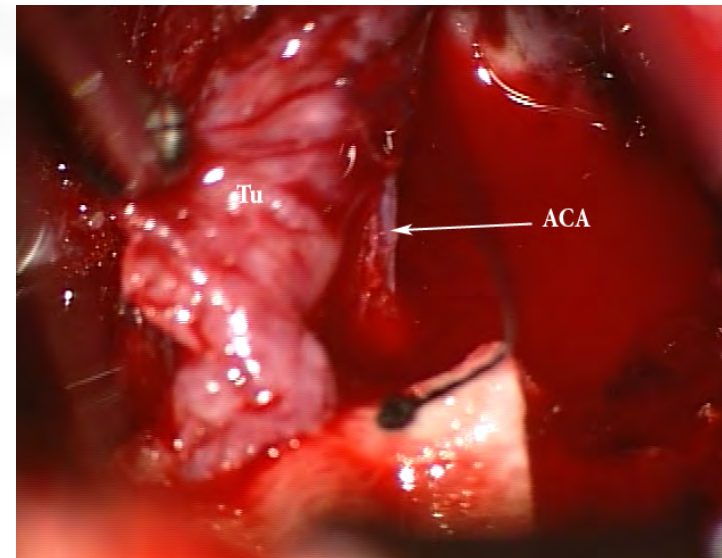
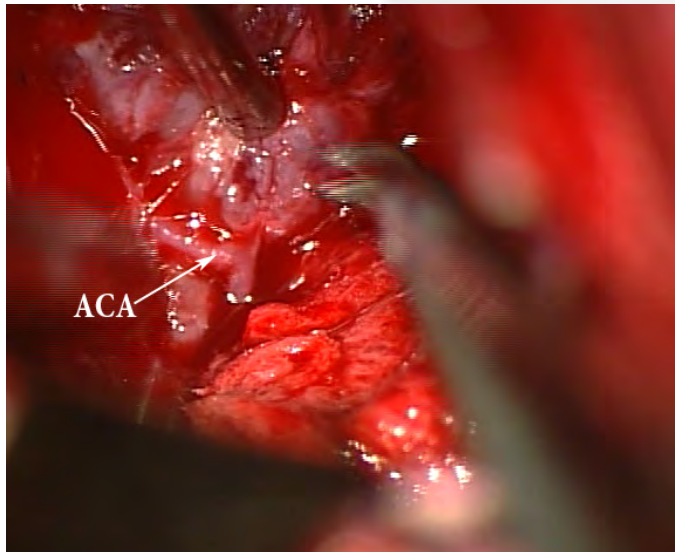
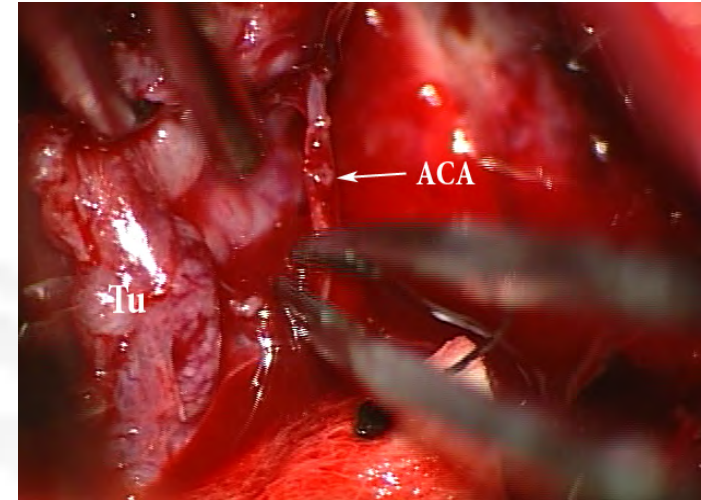




## Tumor removal

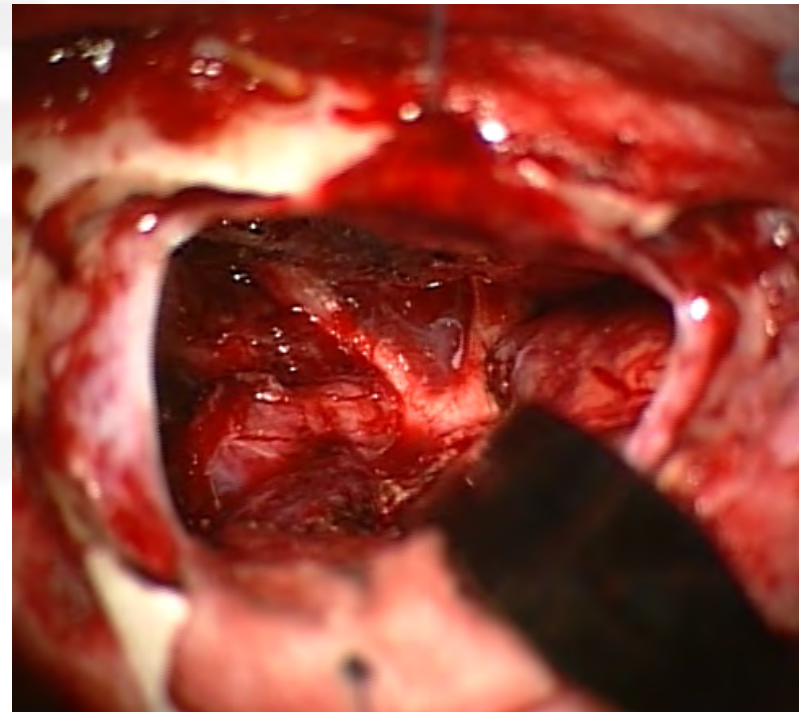
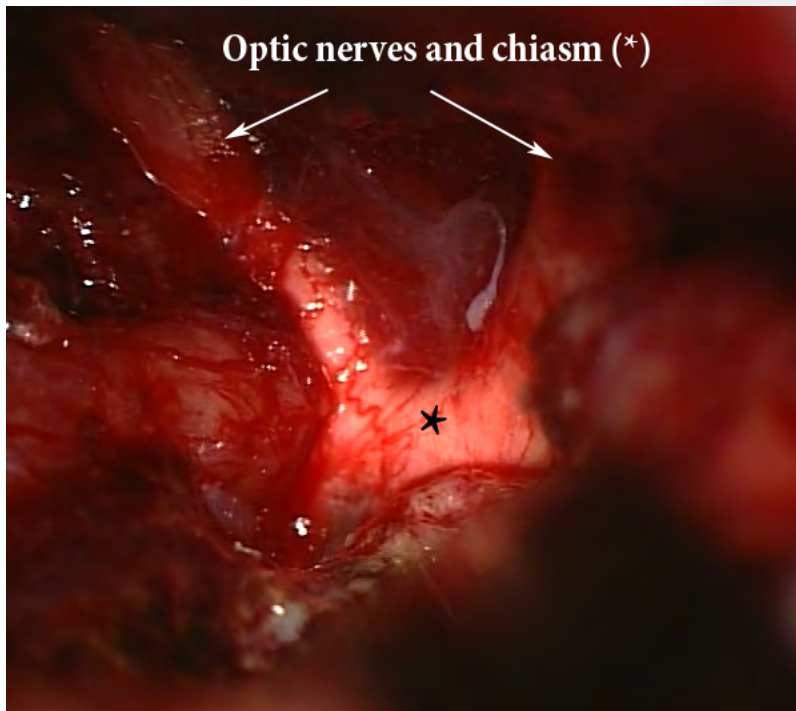
If gentle traction of the remaining capsule is applied and dissection in the arachnoid layer is performed, the **anterior cerebral vessels** are safely identified

**Sharp dissection** of the vessel from the tumor!





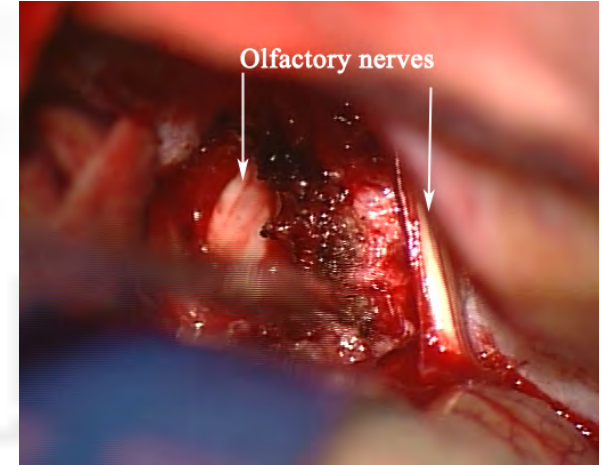
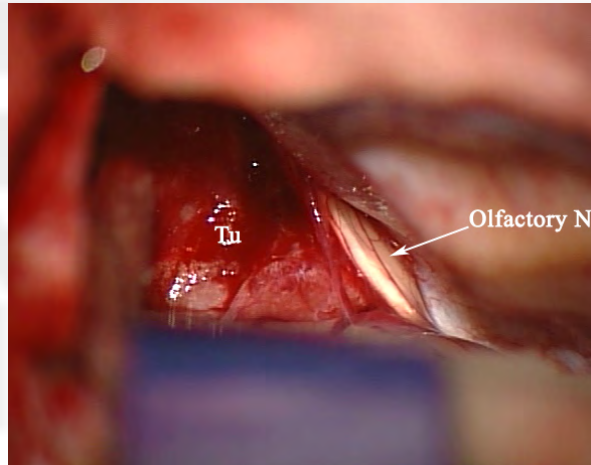
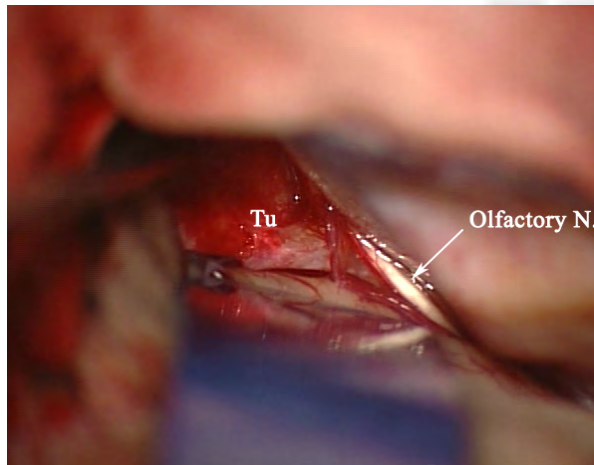
## Tumor removal



Overview of the surgical field following complete tumor removal



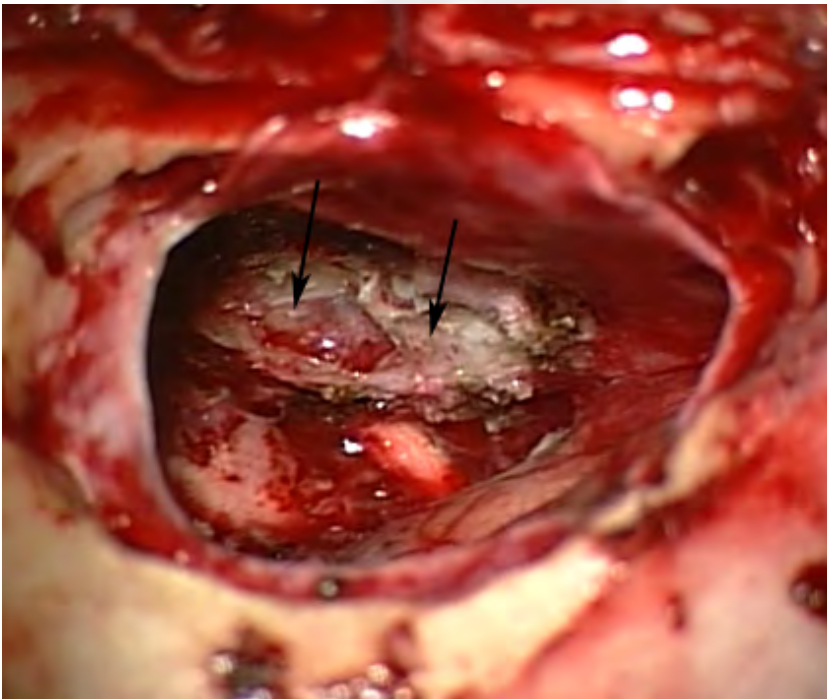
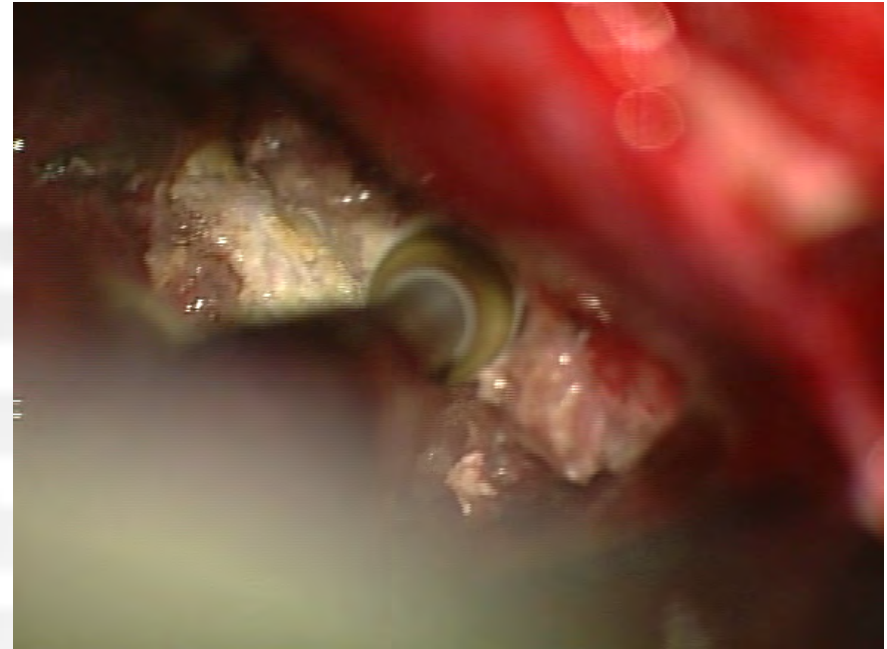
Smaller meningiomas: both **olfactory nerves** might be preserved





## Tumor removal

The tumor matrix is coagulated and the basal dura resected



In the case of hyperostosis or bony tumor involvement, this site is removed with a diamond drill.



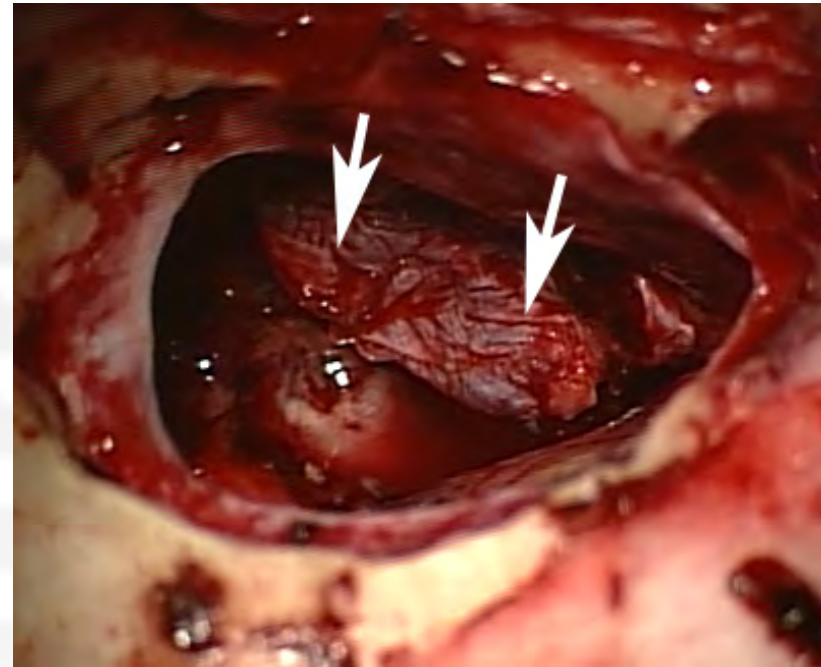
## CSF leak prevention

**Pericranial flap** is used to seal the anterior cranial fossa

The **size of the flap** is tailored to the tumors ' matrix size

It should be slightly larger in order to **overlap its edges**

**Fibrin glue** is used to fixed it – apply **both under and over the edges** of the flap

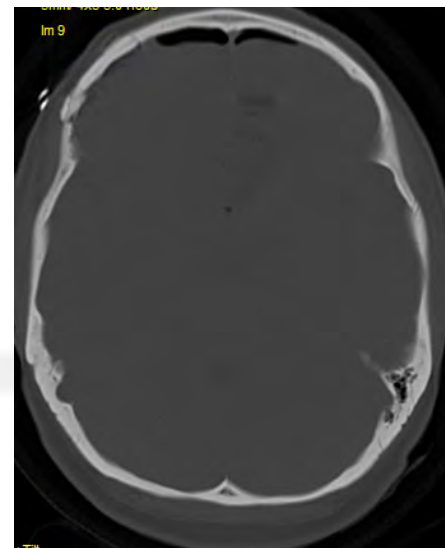
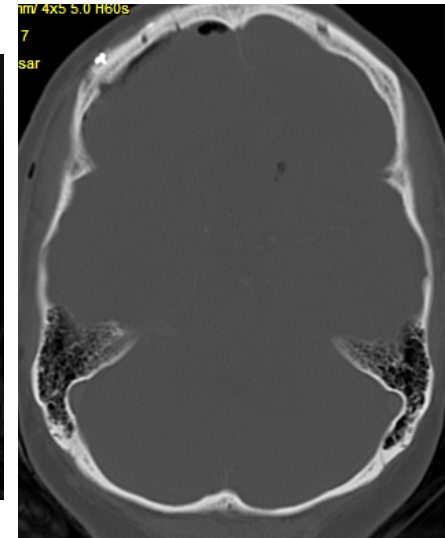
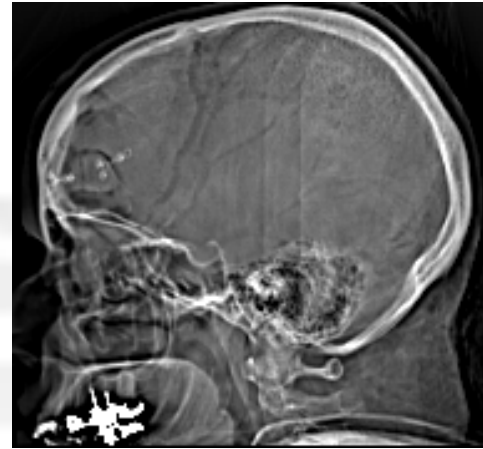




## Skull reconstruction:

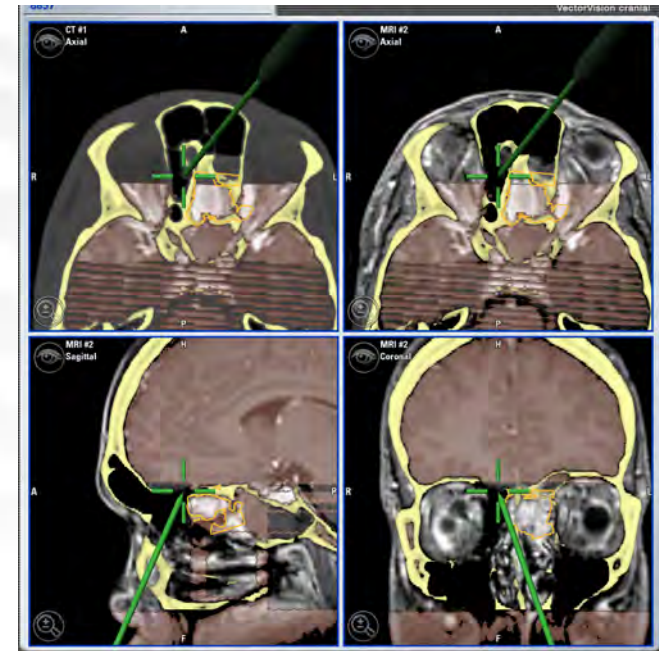
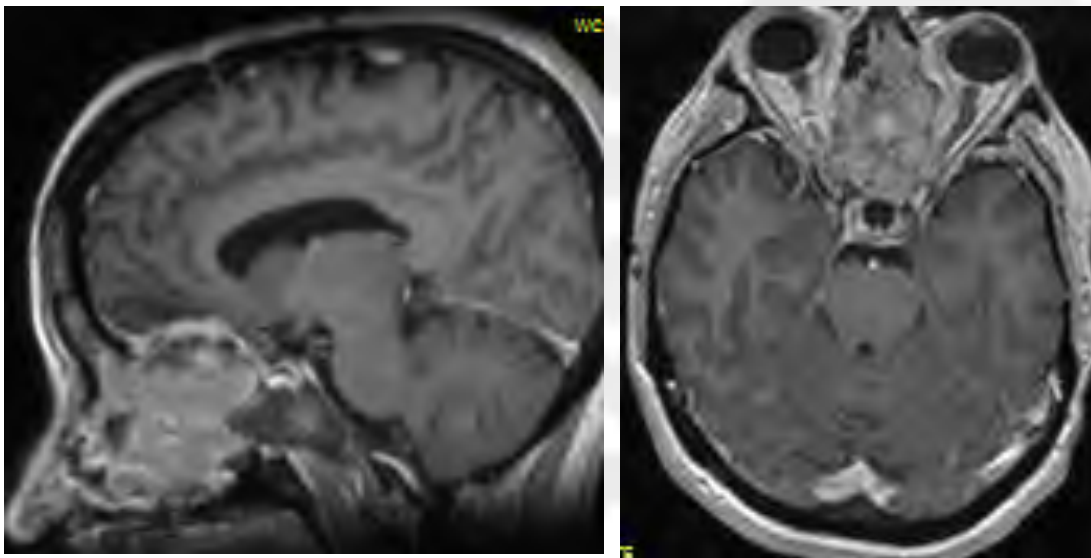
Fixation of the bone flap with Craniofix  
or miniplates

Use of bone cement (Methylmethacrylate) if  
necessary to fill the gaps/burr hole site  
(*cosmetic effect!*)





*Extension into the nasal cavity, paranasal sinuses - up to 15% of pts.*



## **Surgery via 2 approaches:**

1. Removal of the cranial tumor part (as described earlier) and reconstruction of the skull base with pericranial flap
2. Endoscopic resection of the nasal/ paranasal tumor part



## The optimal surgical approach :

- **allow for complete and safe tumor removal**
  - ? adjusted to tumor's size and extension
  - ? patient 's visual impairment
  - ? provide exposure of important anatomical structures
- **minimal brain retraction/ injury to frontal lobes**
  - ? must be combined with modern skull base techniques
- **allow for reconstruction**
- **good cosmetic outcome**
- **low approach-related morbidity**





## **The frontolateral approach** allows for:

- Complete tumor removal
- Avoidance of new neurological morbidity
- Preservation of neurological functions
- Low approach-related complications
- Good cosmetic outcome