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 tumor 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 glabelar 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
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 fontal 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:
Drain 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!

Initial view of the dura

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

CSF release. The brain is slack... 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 peripheral 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

Optic nerves and chiasm (*)

Olfactory Groove Meningiomas
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:

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- adjusted to tumor's size and extension
- patient’s visual impairment
- provide exposure of important anatomical structures
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- allow for reconstruction
- good cosmetic outcome
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The frontolateral approach allows for:

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