# Endoscopic skull base surgery complications

- Recurrent Cerebrospinal Fluid Rhinorrhea Secondary to a Seizure-Induced Skull-Base Defect: An Unusual Complication of Epilepsy
- The Role of Comprehensive Structural Preservation Strategy in Skull Base Reconstruction Following Endoscopic Endonasal Surgery for Pituitary Neuroendocrine Tumors: A Retrospective Single-Center Study
- Two walls versus three wall orbital decompression for thyroid eye disease: A systematic review and meta-analysis
- Congenital nasal meningoencephalocele in an adolescent: A case report
- Endoscopic interventions for gunshot craniocerebral injuries
- Risk analysis for delayed cerebrospinal fluid leak as a late complication of endoscopic transnasal surgery: effects of irradiation and insights into reconstruction methods
- Exploring factors behind Arginine-Vasopressine deficiency in endoscopic endonasal surgery for PitNET: a single-center analysis of 349 patients
- Comparing Flaps and Artificial Dermis for Skull Base Osteoradionecrosis Repair in Nasopharyngeal Carcinoma

Endoscopic skull base surgery is a minimally invasive technique that provides improved visualization and access to the skull base compared to traditional open approaches. However, like any surgical procedure, it carries potential complications. These complications can be broadly categorized into intraoperative and postoperative complications<sup>1)</sup>

# Retrospective case series combined with a literature review

Akins et al in a retrospective case series examine early and late complications in 60 patients undergoing open and endoscopic skull base and craniofacial surgeries at a single institution, compared to a database of 2,143 craniotomies. Acute complications occurred in 38% of cases, while 17% experienced delayed complications, including cerebrospinal fluid leaks, diabetes insipidus, and infections. Illustrative vignettes highlight complex cases. A literature review broadens the scope, emphasizing the need for multidisciplinary approaches, longitudinal follow-up, and improved perioperative protocols to address unique risks and optimize outcomes in complex skull base pathology <sup>2)</sup>

# **Intraoperative Complications**

### Vascular Injuries

- **Carotid Artery Injury**: A life-threatening complication requiring immediate management, such as vessel repair, packing, or endovascular stenting.

- **Other Major Vessels**: Injuries to vessels like the anterior cerebral artery or cavernous sinus can lead to significant bleeding and potential ischemia.

#### **Neural Injuries**

- **Cranial Nerves**: Damage to cranial nerves (e.g., optic nerve, abducens nerve) during dissection can lead to visual deficits or diplopia.

- **Brain Tissue Injury**: Manipulation or accidental penetration into brain tissue, particularly during tumor resection.

#### **Dural Tears**

- Unintentional breaches in the dura can lead to cerebrospinal fluid (CSF) leakage.

#### Instrumentation Issues

- Damage caused by surgical tools, including thermal injuries from cautery devices.

## **Postoperative Complications**

#### **CSF Leak**

- One of the most common complications, resulting from incomplete repair of dural defects. This can predispose patients to **meningitis**.

see Cerebrospinal fluid fistula after endoscopic skull base surgery.

#### Infection

- **Meningitis**: Due to persistent CSF leaks or contamination. - **Sinusitis**: Secondary to disruption of sinonasal anatomy.

#### **Vascular Complications**

- Pseudoaneurysm: Formation in vessels like the internal carotid artery due to intraoperative injury.
- Stroke: Due to vessel injury, vasospasm, or embolism.

#### **Endocrine Disorders**

- If the pituitary gland is involved, complications may include:

1. **Diabetes Insipidus**: From damage to the pituitary stalk or hypothalamus.

- 2. **Hypopituitarism**: Partial or complete loss of pituitary function.
- 3. Syndrome of Inappropriate Antidiuretic Hormone Secretion (SIADH).

#### **Vision Changes**

- Worsening vision or new deficits due to optic nerve injury, swelling, or vascular compromise.

#### **Scarring and Adhesions**

- In the sinonasal cavity, leading to chronic nasal obstruction or loss of olfactory function.

#### **Cosmetic Deformities**

- Rare but may include nasal deformities or changes in the facial contour.

# **Patient-Related Risk Factors**

- **Preexisting Conditions**: Previous surgery, radiation therapy, or infections can increase complication risks.

- Tumor Characteristics: Large, vascular, or invasive lesions increase procedural difficulty.
- Anatomical Variations: Variations like a low-lying optic nerve or abnormal vessel course.

### **Prevention and Management**

#### - Preoperative Planning:

- 1. Use of imaging (CT, MRI) for anatomical and pathological assessment.
- 2. Multidisciplinary team involvement, including ENT surgeons and neurosurgeons.

#### - Intraoperative Techniques:

- 1. Navigation systems for precise localization.
- 2. Adequate repair of dural defects using grafts and sealants.

#### - Postoperative Monitoring:

- 1. Vigilant monitoring for signs of CSF leak, infection, or neurological changes.
- 2. Endocrine function assessments, particularly after pituitary surgeries.

#### - Emergency Preparedness:

1. Access to endovascular interventions for vascular injuries.

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# **Retrospective observational studies**

A retrospective study that included patients who underwent endoscopic skull base surgery with the creation of a nasoseptal flap, assessing for the presence of the following post-surgical complications: cerebrospinal fluid leak, meningitis, mucocele formation, nasal synechia, septal perforation (before posterior septectomy), internal nasal valve failure, epistaxis, and olfactory alterations.

Results: The study assessed 41 patients undergoing surgery. Of these, 35 had pituitary adenomas (macro- or micro-adenomas; sellar and suprasellar extension), three had meningiomas (two tuberculum sellae and one olfactory groove), two had craniopharyngiomas, and one had an intracranial abscess. The complications were cerebrospinal fluid leak (three patients; 7.3%), meningitis (three patients; 7.3%), nasal fossa synechia (eight patients; 19.5%), internal nasal valve failure (six patients; 14.6%), and complaints of worsening of the sense of smell (16 patients; 39%). The olfactory test showed anosmia or hyposmia in ten patients (24.3%). No patient had mucocele, epistaxis, or septal perforation.

The use of the nasoseptal flap has revolutionized endoscopic skull base surgery, making the procedures more effective and with lower morbidity compared to the traditional route. However, although mainly transient nasal morbidities were observed, in some cases, permanent hyposmia and anosmia resulted. An improvement in this technique is therefore necessary to provide a better quality of life for the patient, reducing potential complications <sup>3)</sup>.

In a retrospective review of patients undergoing endoscopic resection of paranasal sinus or skull base neoplasm from 2007 to 2013. Setting Massachusetts General Hospital/Massachusetts Eye and Ear Infirmary Cranial Base Center. Participants Fifty-eight consecutive patients. Main Outcome Measures Postoperative complications were categorized as cerebrospinal fluid leak, pituitary, orbital, intracranial, or sinonasal. Complications were temporally categorized as "perioperative" (within 1 week), "early" (after 1 week and within 6 months), or "delayed" (after 6 months). The most common perioperative complications were diabetes insipidus (19.0%), CSF leak (5.2%), and meningitis (5.2%), with resolution rates of 75%, 100%, and 100%, respectively. Overall, CSF leaks occurred in 13.8% of patients and was resolved in all cases. A total of 53.8% of all complications were evident within 1 week of surgery. Chronic rhinosinusitis was the most common delayed complication (3.4%). Hypopituitarism and delayed complications were less likely to resolve (p = 0.014 and p = 0.080, respectively). Monitoring of complications after endoscopic skull base surgery should focus on neurologic complications and CSF leak in the early postoperative period and the development of chronic rhinosinusitis in the long term. Late-onset complications and hypopituitarism are less likely to resolve <sup>4)</sup>

The study provides valuable insights into the temporal distribution and resolution of complications following endoscopic skull base surgery. However, its findings are limited by the retrospective design, small sample size, and single-center setting. Future studies with larger, multicenter cohorts and prospective methodologies are needed to validate these results and further refine perioperative and long-term management strategies for these patients.

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