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CLASSIFICATION, CLINICAL PICTURE, AND DIFFERENT APPROACHES TO SURGICAL TREATMENT IN CRANIOPHARYNGIOMAS (LITERATURE REVIEW)

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Abstract. 40 academic sources reflecting the classification, diagnostics, clinics and treatment methods of craniopharyngiomas (CP) were analayzed. Craniopharyngiomas (CP) are rare, slow-growing, epithelial tumors that develop from remnants of Rathke's pouch cells. Primarily located in the sellar and parasellar regions and close to vital neurovascular structures (optic chiasm, hypothalamus, pituitary thus making complete surgical resection challenging. Despite being histologically benign, these tumors tend to infiltrate critical parasellar structures and can behave aggressively, leading to serious disability and even mortality (even after successful treatment) [6,24,29]. Histologically, craniopharyngiomas are classified into adamantinomatous (ACP) and papillary (PCP) types, found in children and adults, respectively. While the genetic causes of craniopharyngiomas are not fully understood, ACP development is associated with CTNNB1 mutations, which result in β-catenin forms resistant to degradation and activation of the WNT/β-catenin pathway. PCP, on the other hand, is often linked to the BRAF V600E mutation[6,24].Currently, complete tumor resection provides the best outcomes in CP treatment, and the most optimal surgical approach is selected based on the tumor's location, size, consistency, and the patient's overall condition. This article reviews surgical approaches to treating craniopharyngiomas and attempts to identify the most effective approach.

Keywords. Craniopharyngioma, Rathke's pouch remnants, adamantinomatous, papillary, preinfundibular, transinfundibular, retroinfundibular, cyst aspiration, extended endoscopic transnasal transsphenoidal approach.

Epidemiology of Craniopharyngiomas

Craniopharyngiomas, or Rathke's pouch tumors, are considered a congenital condition. They develop from embryonic cells—protrusions of the mucous membrane of the posterior

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pharyngeal wall, known as Rathke's pouch. In 1925, Cushing described the clinical picture of these tumors and gave them their name. Craniopharyngiomas are relatively rare among brain tumors [2].

The incidence is 0.13 cases per 100,000 people annually. They account for approximately 2-5% of all primary brain tumors and 5.6-15% of brain tumors in children [4,7,11]. Despite craniopharyngiomas being the most common tumors affecting the hypothalamic-pituitary system in children, nearly half of all cases are diagnosed in adults. These tumors can occur at any age, including prenatal and neonatal periods, and have a bimodal age distribution: the highest incidence is observed in children aged 5-14 years and adults aged 50-74 years [4].

Pathogenesis of Craniopharyngiomas

The pathogenesis of craniopharyngiomas is not fully understood. According to one source, these tumors develop as a result of neoplastic transformation of embryonal squamous cells in the craniopharyngeal canal (adamantinomatous type) [32], while another source suggests they result from the metaplasia of adenohypophyseal cells in the pituitary stalk or gland (papillary type) [17].
Some of these tumors have a monoclonal origin and exhibit various chromosomal abnormalities, including translocations, deletions, and increased DNA copy number [6,9,29]. The exact causes that trigger the blastomatous process are still unknown.

Craniopharyngiomas can develop in any area of pituitary formation, but they most commonly arise from the following sources:

1. Epithelial cell clusters at the floor of the third ventricle and the pituitary stalk—these tumors grow in the suprasellar area.
2. Cell clusters in the pituitary stalk (under the diaphragm)—such craniopharyngiomas may be located within the Turkish saddle (intrasellar), extend beyond it, or combine both variants (intrasuprasellar).
3. Epithelial cell clusters in the sphenoid sinus—these tumors are called intrasphenoidal [2].

Classification of Craniopharyngiomas

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According to the World Health Organization (WHO) classification, there are two morphological types of craniopharyngiomas: adamantinomatous and papillary. Both types are classified as Grade I tumors in terms of malignancy. In children, 95% of craniopharyngiomas are of the adamantinomatous type, whereas in adults, 35% of tumors are of the papillary (squamous) type (Karavitaki, Merchant, 2005).

Several classifications of craniopharyngiomas exist, depending on their localization.

For pediatric craniopharyngiomas, a special MRI classification system has been proposed, where the main criterion is the degree of involvement of hypothalamic structures.

M.G. Yasargil classified craniopharyngiomas based on their spread: Intrasellar, Infradiaphragmatic, Intra-suprasellar, Infra-supradiaphragmatic, Suprasellar, Parachiasmal, Extraventricular, Intra- and extraventricular, Paraventricular (relative to the third ventricle), and purely intraventricular (intraventricular) craniopharyngiomas [33].

Additionally, tumors are classified by size into four groups: Small (<2 cm), Medium (2-4 cm), Large (4-6 cm), and Giant (>6 cm) [2].

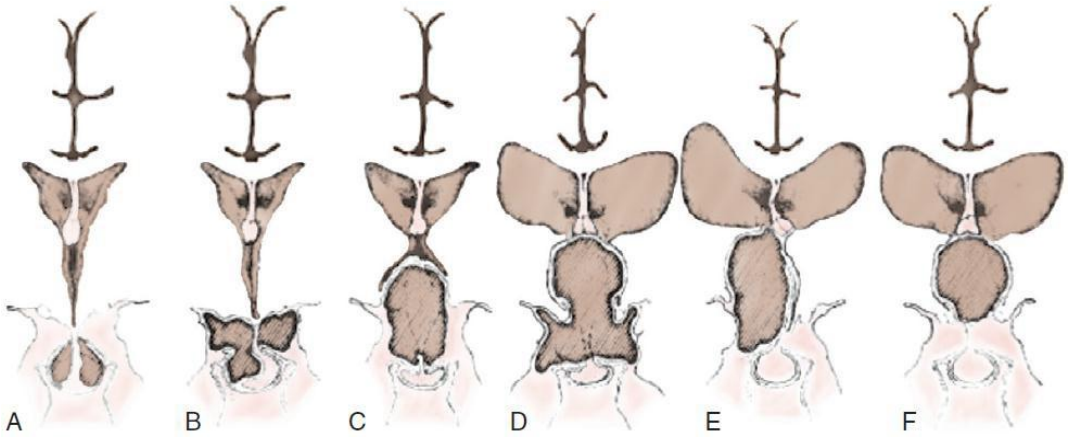

Fig. 1. Variants of location of craniopharyngiomas in the sella turcica (according to M. G. Yasargil).

A. Intrasellar-infradiaphragmatic.
B. Intrasellar-suprasellar, infra-supradiaphragmatic.
C. Supradiaphragmatic, parachiastmal, extraventricular.
D. Intraventricular and extraventricular.

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E. Paraventricular, around the third ventricle.
F. Completely intraventricular.

The classification of craniopharyngiomas can be used to determine tumor treatment strategies as well as to select surgical approaches.

Kassam and others proposed a classification of craniopharyngiomas based on the tumor location and its origin (infundibulum):

- **Type I** – Preinfundibular craniopharyngiomas, located in front of the pituitary stalk. They push the optic chiasm backward and upward and become visible immediately after the dura mater is opened.
- **Type II** – Transinfundibular craniopharyngiomas, which envelop the pituitary stalk and usually grow along its axis.
- **Type III** – Retroinfundibular craniopharyngiomas, located behind the pituitary stalk. They typically grow upward into the third ventricle (subtype IIIa) or backward and downward into the interpeduncular or prepontine cisterns (subtype IIIb).
- **Type IV** – These craniopharyngiomas are tumors located exclusively within the third ventricle [11,22,25,37].

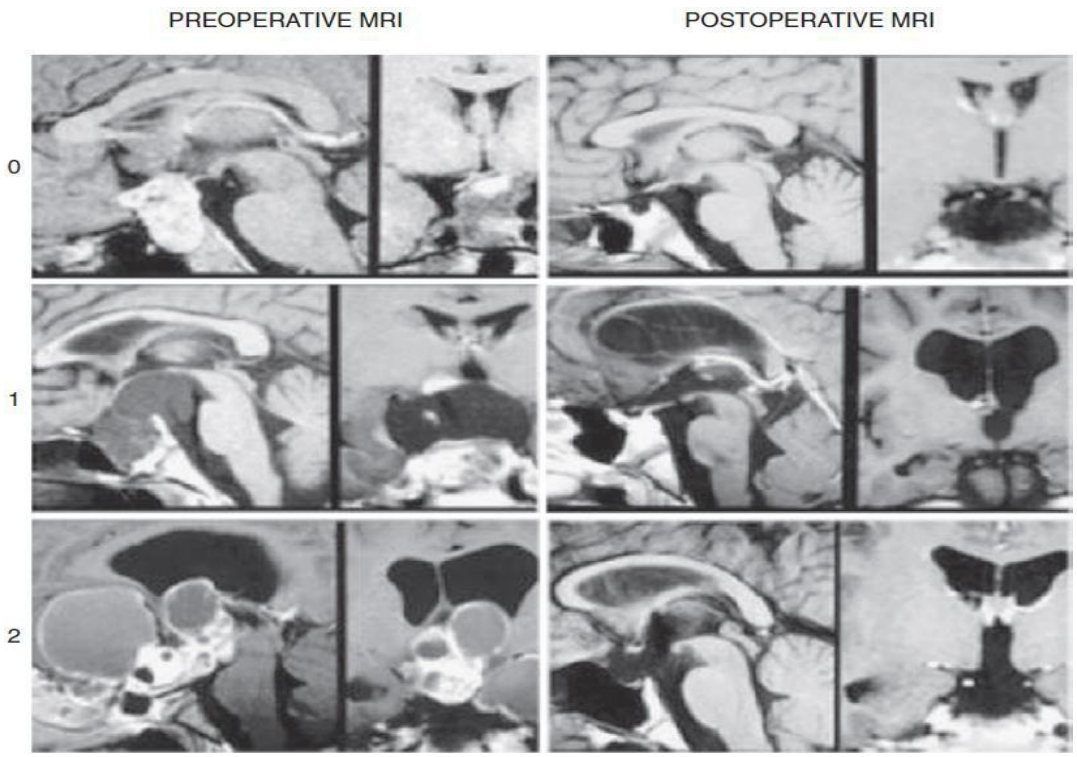

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Fig. 2. MRI Classification of Craniopharyngiomas in Children.

- **Rightcolumn – Preoperativeassessment:**
  - **0 points** – Hypothalamus is not affected.
  - **1 point** – Hypothalamus is displaced by the tumor.
  - **2 points** – Hypothalamus is damaged.
- **Leftcolumn – Postoperativeassessment:**
  - **0 points** – Hypothalamus is not affected.
  - **1 point** – Hypothalamus is minimally damaged.
  - **2 points** – Hypothalamus is significantly damaged.

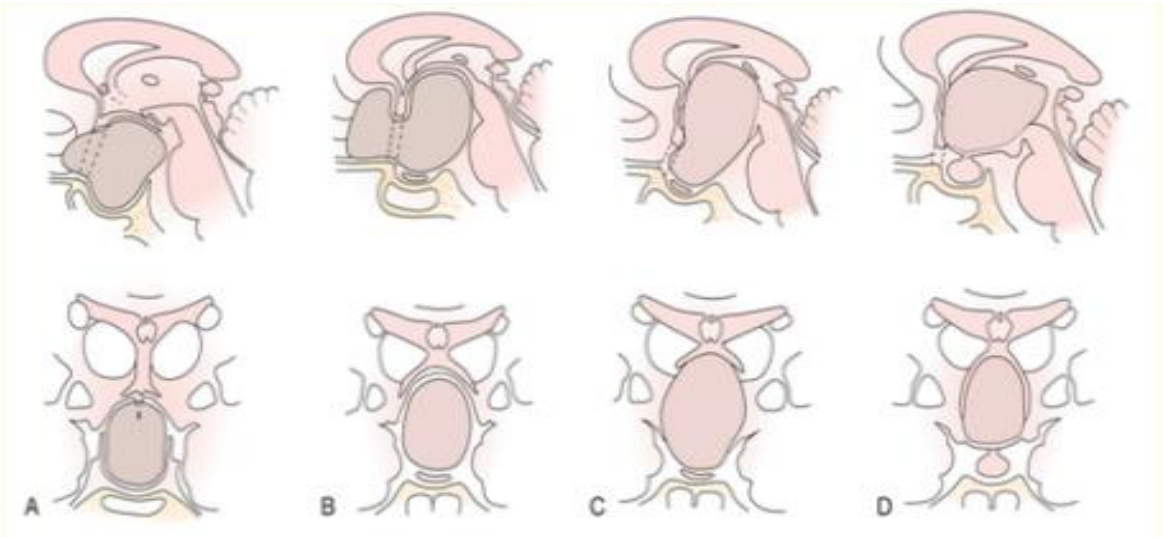

Fig. 3. Classification of Craniopharyngiomas Based on Their Location Relative to the Infundibulum:

- **1A** – Preinfundibular (Type I)
- **1B** – Transinfundibular (Type II)
- **1C** – Retroinfundibular (Type IIIa)
- **1D** – Retroinfundibular (Type IIIb)

Adamantinomatous Craniopharyngiomas (ACPs) are most commonly found in children. These tumors contain a cystic cavity and appear as a spongy mass filled with a cloudy, greenish fluid resembling motor oil. In ACPs, the central columnar epithelium is surrounded by diffuse epithelium, resembling an adamantinoma (an odontogenic tumor). They often

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contain calcifications and keratin.The **papillary type** is more common in adults (40–55 years old) and consists of monolayered solid tumors with less pronounced calcifications or cystic components.The **clinical presentation** of craniopharyngiomas includes a combination of **ophthalmologic, endocrine, neurological, and radiological symptoms**. These symptoms depend on the patient's age, tumor location and direction, structure, and growth rate. The primary signs of craniopharyngiomas include **pituitary dysfunction, hypothalamic involvement, visual impairment, and hydrocephalus**.

In **children**, the leading symptom is **hypertensive-hydrocephalic syndrome**.

In adults, the main symptoms are reduced visual acuity and visual field defects.

Ophthalmoneurological Symptoms in Craniopharyngiomas. One of the most common symptoms is vision impairment, observed in 92% of cases (A.A. Arendt).

Clinical Manifestations of Craniopharyngioma:

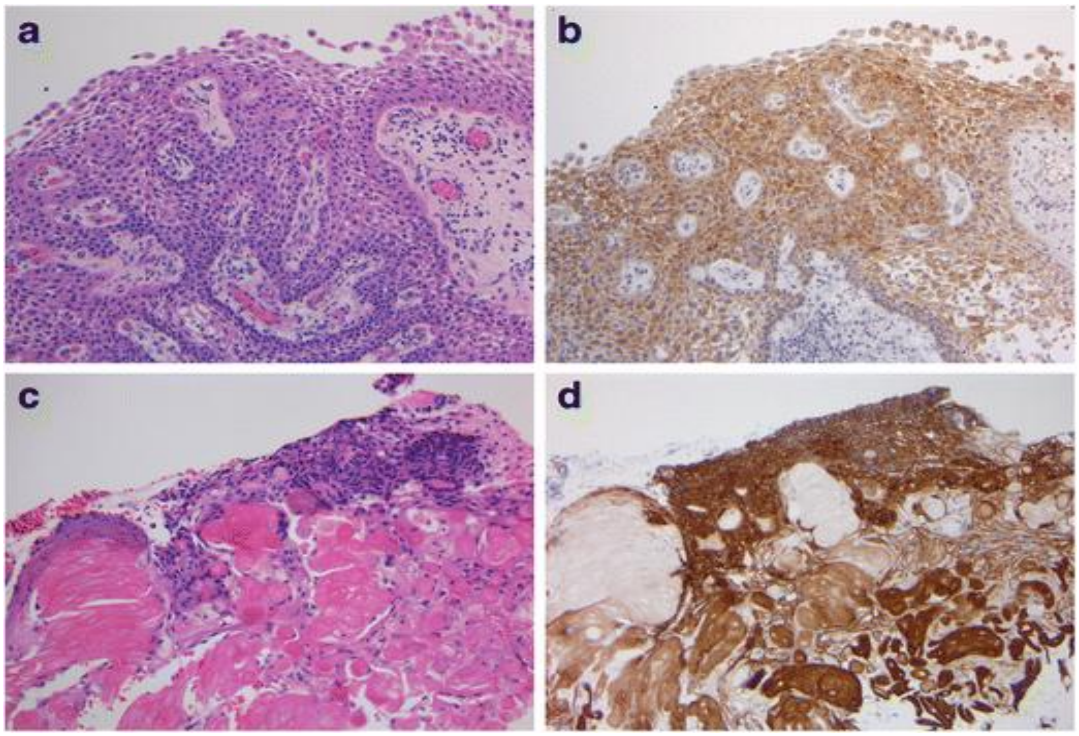

Fig. 4. Immunohistochemical Structure of Craniopharyngioma. Papillary craniopharyngioma consists of squamous epithelium (a) stained with BE1 antibody (b), indicating the presence of the BRAF V600E mutation. In contrast, adamantinomatous

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craniopharyngioma (c) exhibits nuclear translocation of β-catenin in morphological structures (d), which are present in significant quantities within keratin.

Types of Optic Nerve Dysfunction in Craniopharyngioma:

1. **Primary optic nerve atrophy** – Results from the direct impact of the tumor on the visual pathway and is accompanied by hemianopic visual field narrowing, which is often asymmetric.
2. **Optic nerve swelling (blurred optic disc)** – In this case, visual field changes may be absent or present as concentric or hemianopic narrowing.

Visual Field Changes and Their Diagnostic Significance. Visual field defects can aid in the diagnosis of craniopharyngioma. Depending on the tumor's location, various chiasmal syndromes may develop:**With retrosellar extension**, homonymous hemianopsia occurs.

Symptoms of Oculomotor Nerve Involvement. Signs of oculomotor nerve dysfunction indicate tumor progression:

- Abducens nerve palsy and trigeminal nerve dysfunction may suggest parasellar tumor spread.
- Compression of sympathetic fibers of the internal carotid artery can cause exophthalmos.

Parinaud's Syndrome (Dorsal Midbrain Syndrome): Upward gaze palsy, Light-near dissociation of the pupils, Impaired convergence. These symptoms suggest tumor invasion into the midbrain and suprasellar region.

Impact of Tumor Structure on Ophthalmologic Symptoms: Ophthalmologic manifestations, like other clinical signs, depend on the cystic structure of the tumor.

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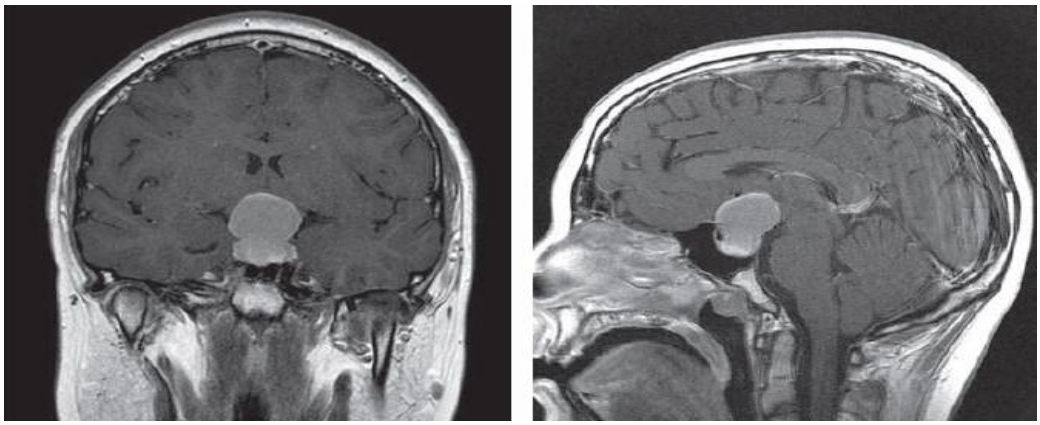

Fig. 5. 14-Year-Old Girl with Bitemporal Hemianopsia and Obesity. After an MRI examination, a suprasellar craniopharyngioma growing within the sella turcica was diagnosed.

Visual impairments include defects in the visual field (bitemporal hemianopsia) and decreased visual acuity. In adults, visual impairments are more common, whereas in children, signs of increased intracranial pressure and hydrocephalus predominate, including headache, nausea, and vomiting. Other common symptoms include short stature, obesity, diabetes insipidus (DI), sexual dysfunction, cold intolerance, and hemiparesis.

Patients with craniopharyngioma present with signs of anterior pituitary dysfunction (35–100%) and posterior pituitary dysfunction (diabetes insipidus) (6–38%) at the time of diagnosis.

Signs of increased intracranial pressure, manifesting as headache, nausea, and vomiting, may be associated with the direct "mass effect" of the tumor or secondary hydrocephalus resulting from occlusion of the Monro foramina or the Sylvian aqueduct.

Hypothalamic dysfunction in craniopharyngiomas includes thermoregulation disorders and neurocognitive impairments, as well as hormonal and metabolic disorders (particularly diabetes insipidus). Various changes in behavior, cognition, and psychosocial aspects are observed in 57% of patients with craniopharyngioma. Hypothalamic obesity is one of the complications of craniopharyngiomas, occurring in 61% of patients. It increases the risk of diabetes mellitus, hypertension, and dyslipidemia, which in turn raises the likelihood of cardiovascular diseases and worsens quality of life, also leading to neurocognitive impairments.

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Diagnosis of Craniopharyngiomas Using Neuroimaging Techniques

Computed tomography (CT) and magnetic resonance imaging (MRI) are used for the diagnosis of craniopharyngiomas. Both methods allow for the determination of the tumor's consistency, size, and location. CT provides more accurate detection of calcifications, which are found in approximately 90% of cases, and offers a detailed view of the anatomy of the sella turcica. This method provides information not only about bone anatomy but also about cystic and solid tumor components, local invasion, and compression of surrounding structures.

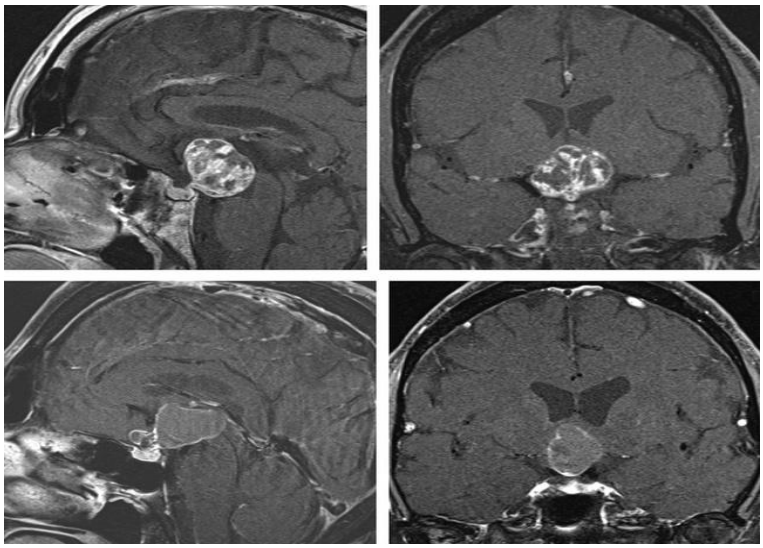

Fig. 6. MRI Images of Craniopharyngioma with Solid (Upper) and Partially Cystic (Lower) Components

Non-contrast and contrast-enhanced MRI techniques are used to assess the topographic location and structure of the tumor. Solid tumors appear isointense or hypointense compared to the brain on T1-weighted images, with characteristic enhancement after gadolinium administration, and hyperintense on T2-weighted images [14,23,39].

Differential Diagnosis of Craniopharyngioma

Includes Rathke's cleft cyst, pituitary adenoma, dermoid/epidermoid cysts, and other rare tumors [6,22,29].

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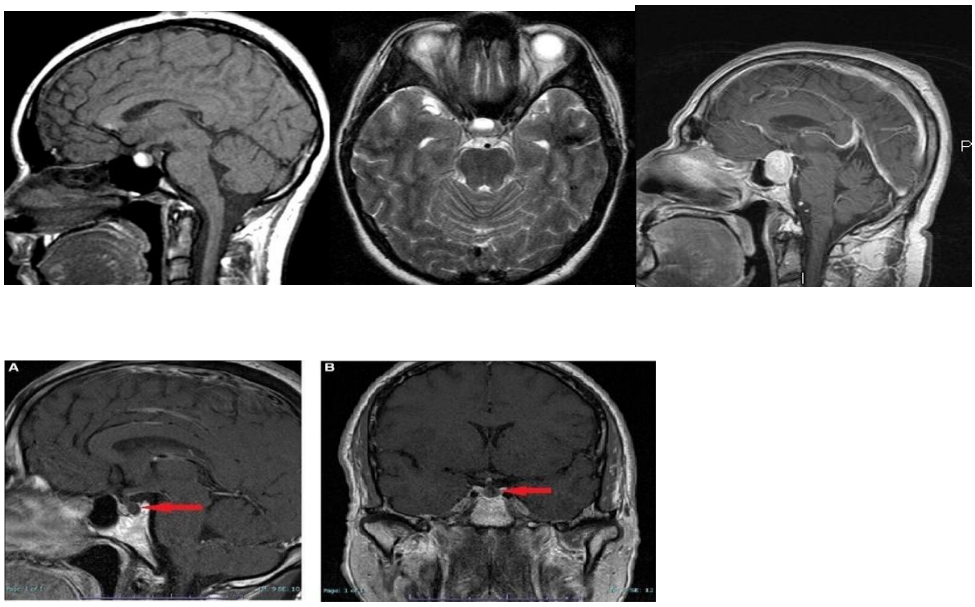

Fig. 7. Rathke's cyst (top left), pituitary adenoma (top right), dermoid/epidermoid cysts (bottom).

Surgical Methods for Treating Craniopharyngiomas

Despite advances in modern neurosurgical technologies, the size of craniopharyngiomas and their location near vital structures limit the possibility of total resection, making the surgery complex. Modern microsurgical and endoscopic techniques, along with advancements in neuroimaging and hormone replacement therapy, currently allow for total or near-total resection. The rate of total resection ranges from 72.7% to 90%.

When the tumor is located close to critical structures such as the optic nerve/chiasm, hypothalamus, or perforating arteries, the goal of surgery is to ensure the safest possible or near-total resection (>95%) while preserving neurological functions.

There are several approaches for accessing craniopharyngiomas (Fig. 8). The choice of approach depends on the tumor's location and direction of growth. Currently, two main approaches are used for the surgical treatment of craniopharyngiomas:

1. **Transcranial approaches.**
2. **Endoscopic transnasal transsphenoidal approaches** (standard transsphenoidal and **EETA – Extended Endoscopic Transnasal Transsphenoidal Approach**).

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The choice between transcranial or endoscopic access should be based on the anatomical location of the tumor. For optimal surgical approach selection, preoperative assessment of tumor size, its relationship with neurovascular structures, and consistency is necessary. Endoscopic resection of large calcified craniopharyngiomas can be risky due to their proximity to the basilar artery and its branches, increasing the risk of vascular damage when using the transnasal approach. **Transcranial approaches** are more effective for large calcified tumors. For tumors located on the midline and retrochiasmatic region, endonasal approaches are used, whereas for parts located **laterally to the bifurcation of the internal carotid artery**, standard transcranial approaches are preferred.

Transcranial approaches usually require brain retraction, but the EETA "transplanumtranstuberculum" approach provides direct access to intrasellar/subdiaphragmatic, supradiaphragmatic, and retrochiasmatic craniopharyngiomas, allowing for safer resection.

Several studies have compared the outcomes of microsurgical transcranial and endoscopic transsphenoidal resection of craniopharyngiomas.

Retrochiasmatic craniopharyngiomas, due to their deep location and proximity to vital neurovascular structures, make tumor removal a complex task. Complete removal of craniopharyngiomas provides the best surgical outcome and reduces the risk of recurrence. The Extended Endoscopic Transnasal Transsphenoidal Approach (EETA) allows direct access to the retrochiasmatic region, improved visualization of the optic chiasm and the lower hypothalamic surface, facilitating bimanual extracapsular tumor dissection and enabling total resection of complex tumors.

Retrochiasmatic craniopharyngiomas are challenging for surgical removal due to their anatomical location and proximity to essential neurovascular structures. Approximately 11%–46% of all craniopharyngiomas are retrochiasmatic, posing a high risk of disability and mortality even after highly skilled surgery, as well as a higher likelihood of recurrence in cases of incomplete tumor removal.

For this location, various transcranial surgical approaches include:Transbasalsubfrontal approach, Frontobasal interhemispheric approach, Pterional approach, Orbitopterional

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approach, Orbitozygomatic approach, Transpetrosal approach.Many retrochiasmatic craniopharyngiomas often require lamina terminalis opening for removal via subfrontal, interhemispheric, or transsylvian approaches.

At the same time, the Extended Endoscopic Transnasal Transsphenoidal Approach (EETA) can be used, offering superior visualization of the lower surface of the optic chiasm and the interpeduncular cistern, as well as direct access to the retrochiasmatic space and the third ventricle. The advantage of this approach is that it eliminates the need for brain retraction and reduces the risk of brain edema, which can occur with transcranial approaches. This method provides excellent visualization of the retrochiasmatic region and allows bimanual microsurgical extracapsular tumor dissection from the lower surface of the optic chiasm and hypothalamus.

Transcranial Access Methods

Transcranial approaches for craniopharyngioma removal include several options:

1. **Subfrontal approach via the lamina terminalis** – targets the anterior brain and is used for craniopharyngiomas located near the optic chiasm.
2. **Bifrontal basal interhemispheric approach** – a bilateral approach allowing access to centrally located tumors.
3. **Pterional approach** – used for suprasellar or upper brain tumors.
4. **Orbitozygomatic approach** – provides access through the orbit and zygomatic **area**, usually for tumors associated with the upper skull base.
5. **Interhemispheric-transcallosal approach** – involves an upper brain approach for tumors located between the hemispheres.
6. **Transcortical-transventricular approach** – used for accessing centrally located brain tumors.

Indications for Transcranial Approaches:

1. Intrasuprasellarregion
2. Suprasellarregion
3. Intraventricular (thirdventricle)

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4. Interpeduncular/prepontineregion
5. Lateral/lobarlocation

For cystic craniopharyngiomas, Ommaya reservoir implantation may be performed simultaneously with tumor removal via a transcranial approach, occurring in 4.5% of cases.

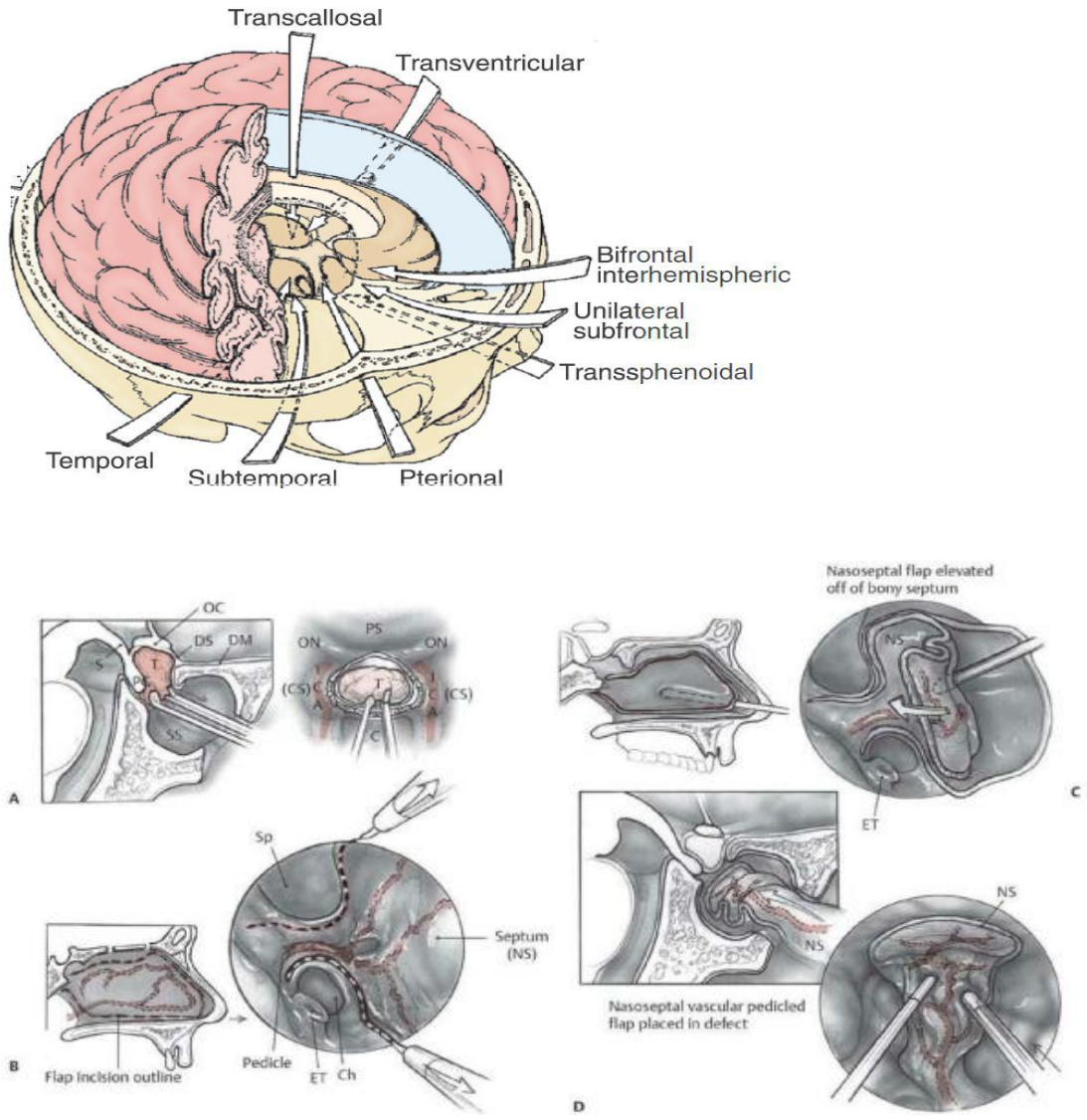

Fig. 8. Surgical approaches to craniopharyngiomas. The choice of method depends on the location and characteristics of the tumor.

Subfrontal approach via the lamina terminalis. This method is used for craniopharyngiomas located along the midline, growing in the prechiasmatic space, anterior cranial fossa, suprasellar cistern, or third ventricle. The advantage of this method is that a midline approach provides access to the optic nerves, internal carotid arteries, third ventricle, and

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lamina terminalis.

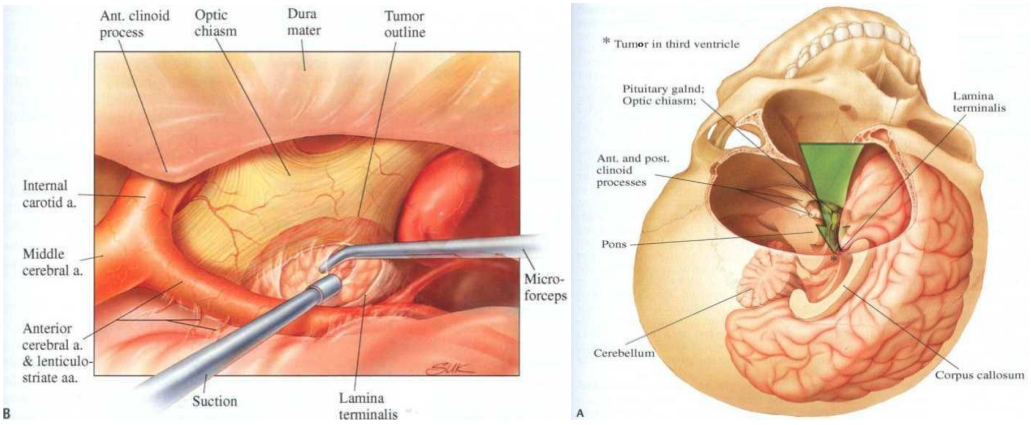

Fig. 9. Tumor exposure using the subfrontal approach via the lamina terminalis.

1. **Bifrontal approach with retraction of both frontal lobes** leads to anosmia after surgery. If the frontal sinus is opened during the craniotomy, it must be cranialized (the inner epithelial mucosa should be removed). This prevents postoperative infectious complications. Tumor removal from within the sella turcica may be challenging but can be easily performed using angled endoscopy.

2. **Bifrontal basal interhemispheric approach.** This approach is suitable for large retrochiasmatic tumors. Despite its technical complexity, it allows effective visualization of the anterior optic pathways and the Willis circle. A unilateral approach may result in areas that cannot be visualized, creating potential "blind spots." One advantage of the bifrontal interhemispheric approach is the absence of such "blind spots." To improve access to the retrochiasmatic region, ligation of the anterior communicating artery is sometimes necessary.

3. **Pterional approach.** The pterional approach is one of the most widely used methods in neurosurgery for craniopharyngiomas, particularly for relatively small tumors located in the suprasellar region. This approach allows for tumor removal in both prechiasmatic and retrochiasmatic areas. If the tumor is large, the pterional approach can be combined with the interhemispheric transcallosal or transcortical-transventricular approach.

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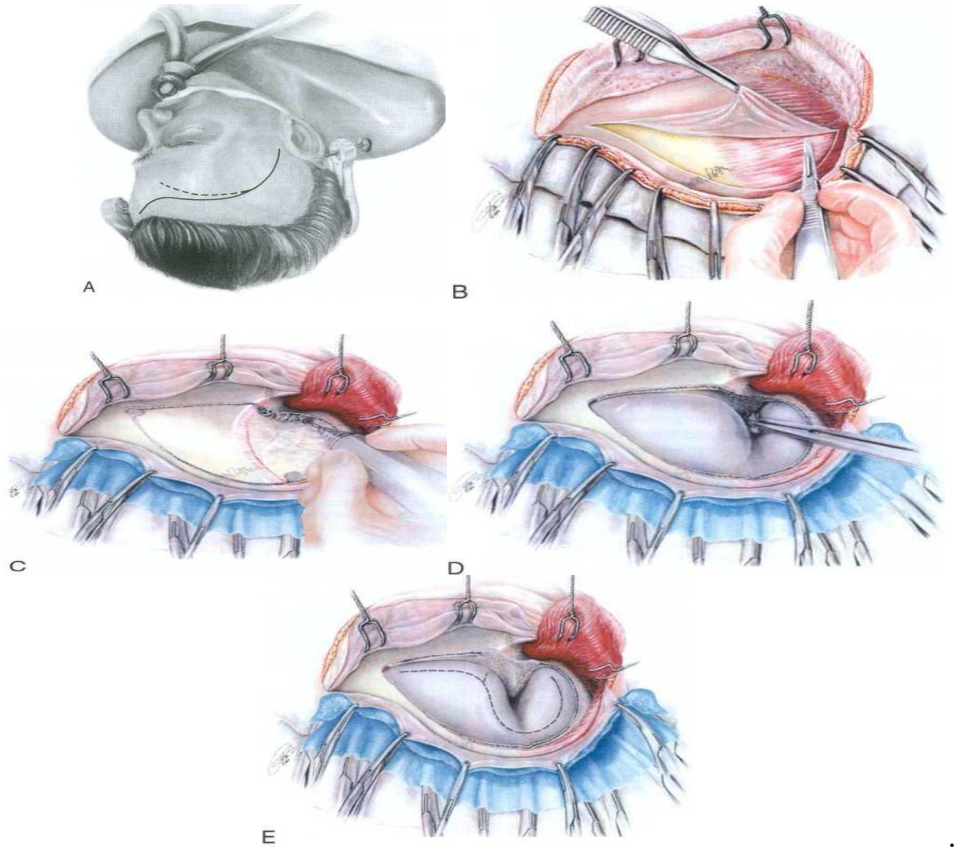

Fig. 10. Stages of pterional craniotomy.

4. **Orbitozygomatic approach.** The orbitozygomatic approach can be considered an extended pterional craniotomy technique, in which the superior orbital wall and zygomatic bone are removed after a frontotemporal craniotomy. This approach allows for the removal of craniopharyngiomas growing in the suprasellar region [8,10,18,27,28].

5. **Interhemispheric-transcallosal approach.** This method is used in combination with basal approaches for large suprasellar craniopharyngiomas, as well as for tumors of the third ventricle and lateral ventricles. It is very rarely used alone for third ventricle tumors.The interhemispheric-transcallosal approach is typically combined with subfrontal and pterional methods. During surgery, there is a risk of damaging the medial surface of the cerebral hemispheres, pericallosal arteries, veins, and the fornix.

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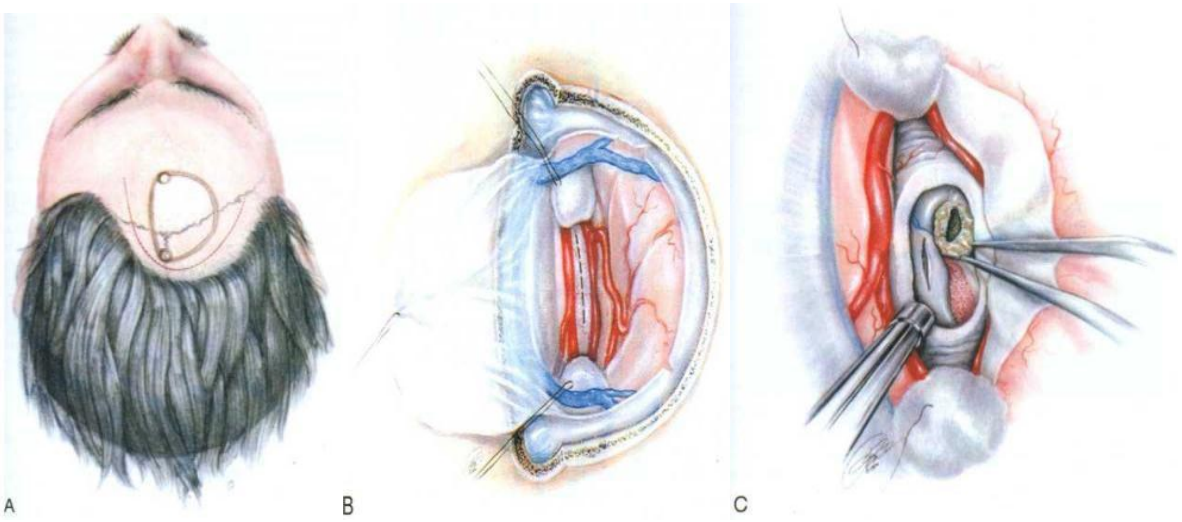

Fig. 11. Interhemispheric-transcallosal approach.

6. **Transcortical-transventricular approach.** The transcortical-transventricular approach is rarely used for craniopharyngioma resection. In patients with tumors invading the third ventricle and accompanied by hydrocephalus, this approach may be used in combination with basal methods if the tumor extends through the foramen of Monro [16].

The transcortical-transventricular approach involves cortical damage, and postoperative epileptic seizures may occur [16].

Transsphenoidal and Extended Endoscopic Transnasal-Transsphenoidal Approaches

Craniopharyngiomas located along the midline in the sella turcica with an infradiaphragmatic suprasellar component can be removed using these methods. The transsphenoidal approach is most suitable when there is sella expansion. If the craniopharyngioma significantly extends in the suprasellar direction, transsphenoidal removal becomes impossible. However, if the cystic component extends upward, this approach may still be used.

The main advantage of the transsphenoidal approach over open surgery is the absence of brain retraction and the low risk of postoperative visual disturbances [15,17,19,40].

Resection of retroinfundibular craniopharyngiomas using the extended endoscopic endonasal transsphenoidal approach with posterior clinoidectomy.

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Surgical treatment of large retroinfundibular craniopharyngiomas is challenging due to their location and proximity to vital neurovascular structures. Various transcranial microsurgical methods have been reported. However, for tumors in the retroinfundibular or petroclival region, endoscopic endonasal access is difficult due to anatomical constraints and the presence of vital structures. The dorsum sellae and posterior clinoid processes (PCPs) form natural anatomical barriers limiting access to this area [33,35].

An extended endoscopic endonasal transsphenoidal approach with posterior clinoidectomy can serve as an alternative to the transcranial approach for tumor removal in these regions. This method provides direct access without brain retraction, a wider surgical corridor, and improved visualization.

Indications for dorsum sellaeresection:

- Tumors located above the clivus;
- Tumors located behind the dorsum sellae;
- Tumors involving the interpeduncular or prepontine cistern [14,20,33,35].

Combined one-stage "Keyhole" transcranial and transsphenoidal approach for resection of craniopharyngiomas extending into the parasellar region.

The endoscopic transsphenoidal approach may be challenging for the complete removal of craniopharyngiomas tightly attached to the internal carotid artery or vital neurovascular structures, even when using a transcranial approach. Aggressive tumor resection can lead to damage to critical neurovascular structures and severe complications. A one-stage endoscopic transsphenoidal and (or exoscopic/microscopic) supraorbital transcranial "Keyhole" approach allows for effective and safe removal of complex tumors located in the parasellar region and is one of its advantages.

The surgery is performed by two teams: transcranial and endonasal [15,25].

In the **classic endoscopic transsphenoidal approach (CETTA)**, careful total dissection of the capsule, major vessels and perforators, as well as the third ventricular walls (hypothalamus), is possible with direct visualization, which may be more effective in preserving hypothalamic function compared to transcranial approaches. Direct

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decompression of the optic nerves while preserving the superior hypophyseal artery (SHA) is also possible, which may lead to significant improvement in visual outcomes postoperatively [6,7,11].

For a long time, the presence of a large tumor extending upward and backward from the prefixed chiasm was considered a relative contraindication for total resection using CETTA. A common postoperative complication of CETTA is **nasal liquorrhea** [7]. It is important to adequately reconstruct the skull base after endoscopic transsphenoidal surgery to prevent postoperative complications such as nasal liquorrheaand associated life-threatening conditions.

Extended endoscopic transnasal transsphenoidal approach for suprasellar craniopharyngioma resection.

Main indications for CETTA:

- Resection of suprasellar craniopharyngiomas;
- Resection of retroinfundibular craniopharyngiomas;
- Resection of craniopharyngiomas within the third ventricle.

This approach is used for craniopharyngiomas located along the midline with a laterally non-extended supraclinoid portion of the internal carotid artery, not extending towards the foramen of Monro [15,17,40].

Primary cyst aspiration in cystic craniopharyngiomas followed by transsphenoidal resection.

Primary aspiration of large cysts and/or obstructive hydrocephalus in patients is advisable. In patients with large cysts and/or obstructive hydrocephalus, primary cyst aspiration is reasonable. If a patient has a large cyst with obstructive hydrocephalus and a severe general condition, a palliative surgical procedure may be performed—primary cyst aspiration (placement of an Ommaya reservoir into the cyst cavity) or a combined two-stage endoscopic cyst fenestration and tumor resection via the transsphenoidal method [8,15,23].

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Cyst decompression allows gradual separation of the tumor capsule from the hypothalamus and lowering of its dome, reducing the risk of hypothalamic damage [5,8,26]. Craniopharyngiomas often form cysts and can be large. In some cases, a large tumor or associated obstructive hydrocephalus can cause life-threatening symptoms. Patients with sudden vision deterioration and/or increased intracranial pressure require urgent surgical intervention.For cystic craniopharyngiomas extending into the foramen of Monro or upward and laterally, complete removal through a transsphenoidal procedure may be impossible. In such cases, a two-stage surgical procedure is performed:

1. Endoscopic cyst fenestration via a ventricular approach.
2. Transsphenoidal tumor resection.

Cyst fenestration in cystic craniopharyngioma is usually performed using a flexible endoscope through the foramen of Monro. The cyst wall is fenestrated using monopolar coagulation, and to restore cerebrospinal fluid pathways, it is separated from the third ventricle wall. Additionally, to prevent the closure of the cyst wall, it is cut as widely as possible [3,12,21].

Several studies have compared the results of microsurgical transcranial and endoscopic transsphenoidal resection of craniopharyngiomas. Jeswani et al. described similar resection volumes in both groups (86% in CETTA vs. 91% in transcranial approaches, p=0.77), along with data on overall survival and recurrence rates. Despite nasal liquorrhea being more common with the endoscopic endonasal approach, cranial nerve injuries were more frequent with the transcranial approach [20].

Conclusion

The treatment of craniopharyngiomas remains a serious challenge, as high rates of disability and recurrence persist after surgery. There is no single "gold standard" surgical approach applicable to all cases, and each case must be considered individually.The choice of method depends on multiple factors, including tumor location, its extension, consistency, and relationship with the chiasm and pituitary stalk. When selecting a surgical approach, the endoscopic transsphenoidal approach stands out as an optimal option, serving as an alternative to transcranial methods for both primary and recurrent craniopharyngiomas. The

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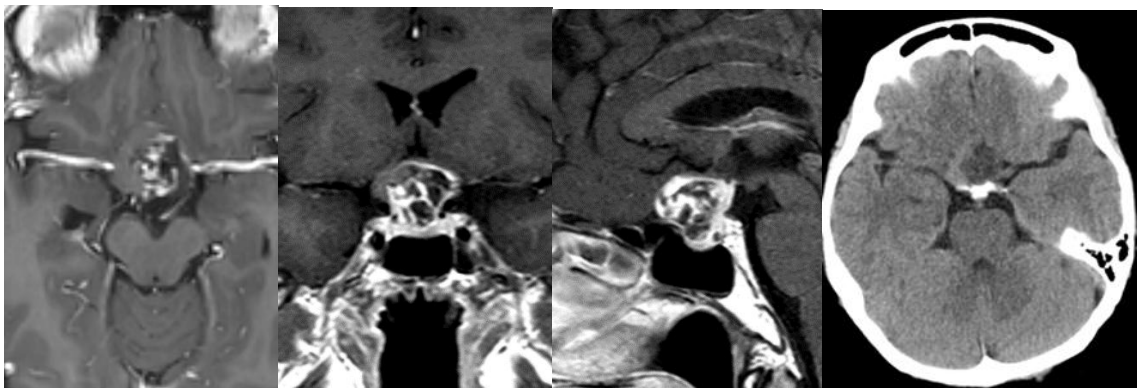
choice of the optimal surgical approach helps minimize complication risks, maximize resection volume, and improve surgical outcomes.

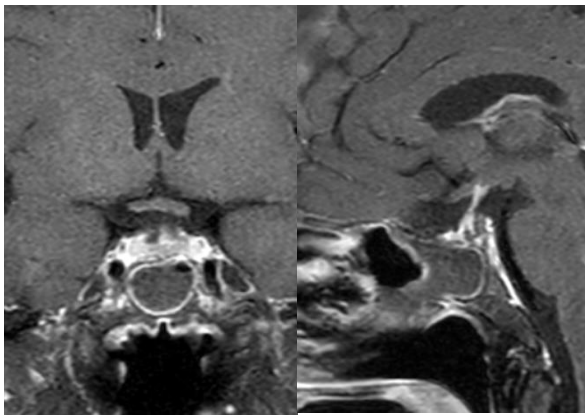
Clinical Case No.1

Patient N, 37 years old. Treated at Nagoya Clinic, Japan, with the complaints listed below. The patient underwent surgery.The patient had been experiencing illness for several years. The disease began with visual acuity impairment. No endocrinological changes were observed.



Preoperative MRI examination
Preoperative MSCT examination

On November 17, 2017**,** an "extended transsphenoidal approach" was performed for the total removal of the tumor**.** After the surgery, the patient's visual acuity improved**,** but hypopituitarism developed.



Postoperative MRI examination

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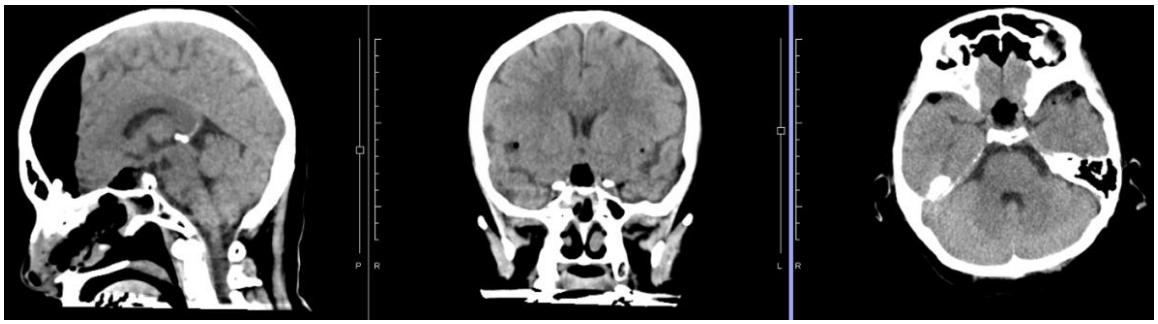


Postoperative MSCT examination

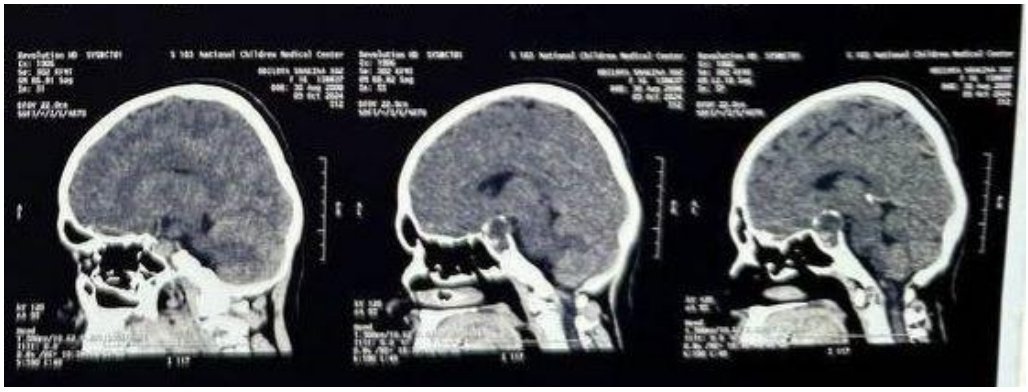
Histology: adamantinomatous craniopharyngioma

Clinical Case No. 2

Patient:Sh., 16 years old. Complaints**:** Menstrual cycle irregularities, growth and developmental delay.

The patient is a 10th-grade student at a local school. Due to menstrual irregularities and growth retardation compared to her peers, she consulted a pediatrician and an endocrinologist. Following medical recommendations, an MRI scan was performed, revealing a mass in the sellar region.

Endocrinological status: The patient exhibits menstrual cycle disturbances, pituitary hypoplasia, and delayed sexual development.



Preoperative MSCT examination

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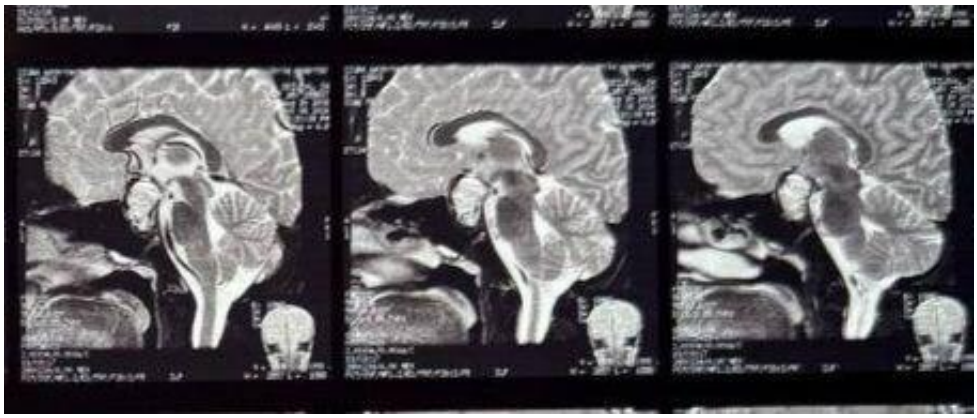
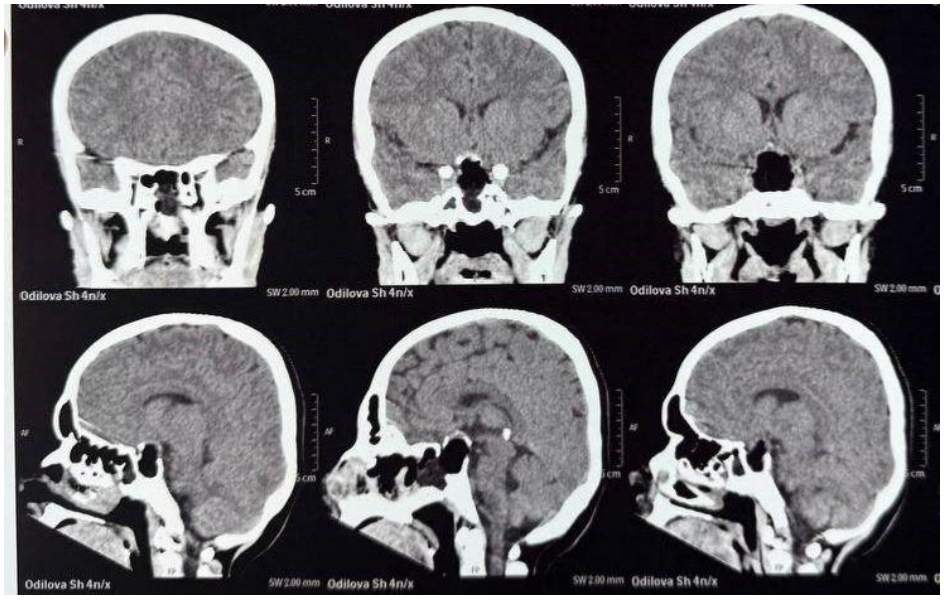


Preoperative MRI examination

Surgery:"Extended Endoscopic Endonasal Transsphenoidal Tumor Removal of the Chiasmal-Sellar Region."



Postoperative MSCT Examination

Clinical Case No. 3

Patient: B., born in 2004. Complaints: Headache, dizziness, loss of appetite, persistent thirst, frequent urination, vision impairment, unsteadiness while walking, and general weakness. Neurological Status: Cranial nerve II: Reduced vision, Visus 0.07/0.08. Cranial nerves III, IV, VI: Pupils equal in size (D=S), reactive to light, no oculomotor disturbances. Coordination: Stable in the Romberg position.

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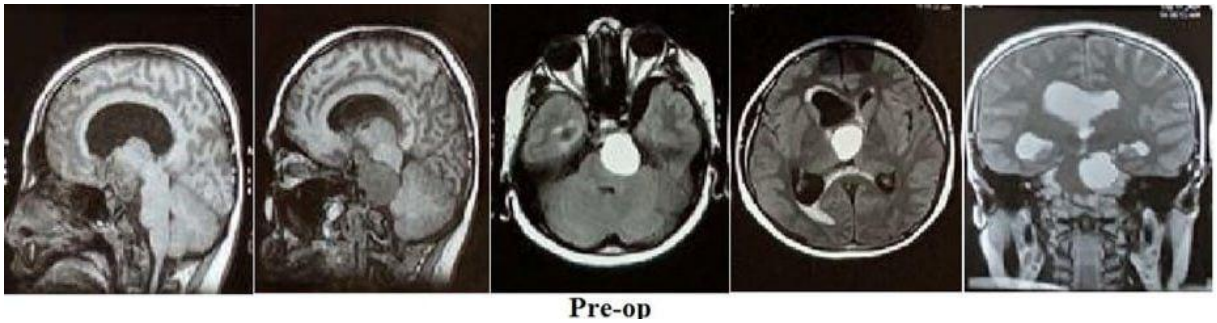
Hormonal Indicators: Cortisol: 0.80 µg/dL [Normal: 6.4–22.8] hCG: 6.38 mIU/mL [Normal: <0.5–2.2 for males] AFP: 1.98 ng/mL [Normal: 7.2 for males, 7.4 for females] ACTH: 1.87 pg/mL [Normal: 7.0–65.0]

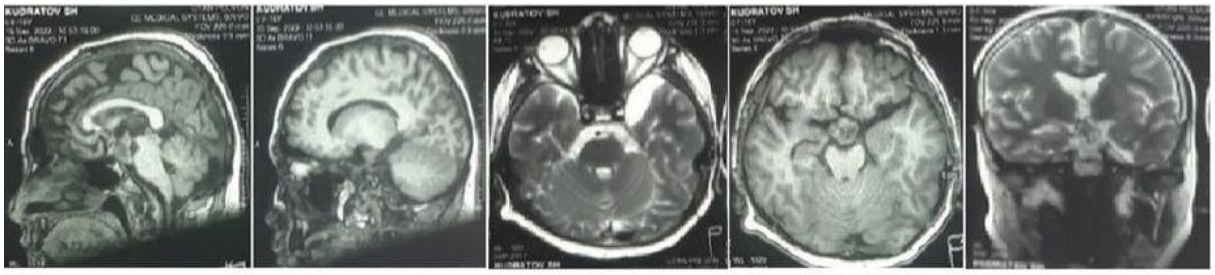


Pre-op

Preoperative MRI Examination

The patient underwent the first stage of surgical intervention on September 16, 2020: "Frontoparietal craniotomy on the right side using a transcortical-transventricular approach, resection of the neoplasm in the chiasmatic-sellar region."

The second stage of surgical intervention was performed on October 30, 2020: "Right retrosigmoid craniectomy, resection of the petroclival part of the neoplasm in the chiasmatic-sellar region."



Post-op

Postoperative MRI Examination

Histology: Craniopharyngioma.**Postoperative Neurological Status:** Pupils are of equal size (D=S), photoreaction is active. Vision acuity remained stable with improvement – Visus 0.9/0.8.

Clinical Case No. 4

Patient: Baymanov I., born in 1969. Complaints: The patient reports headaches, dizziness, nausea with vomiting, bilateral vision loss, and general weakness. **Neurological Status:**

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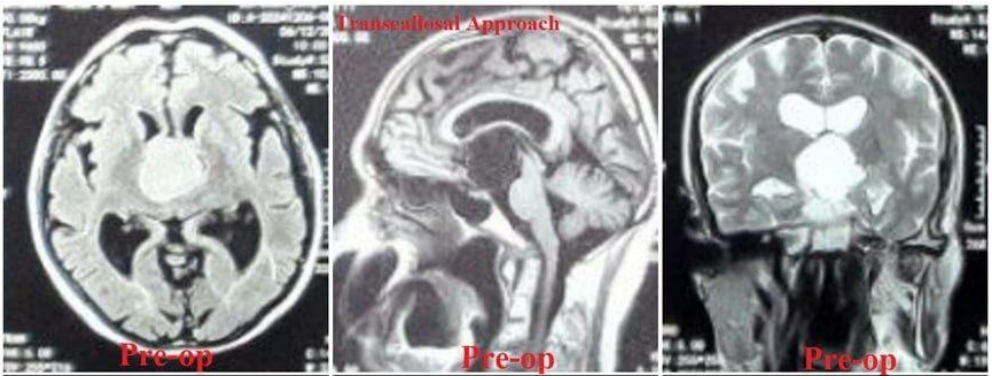
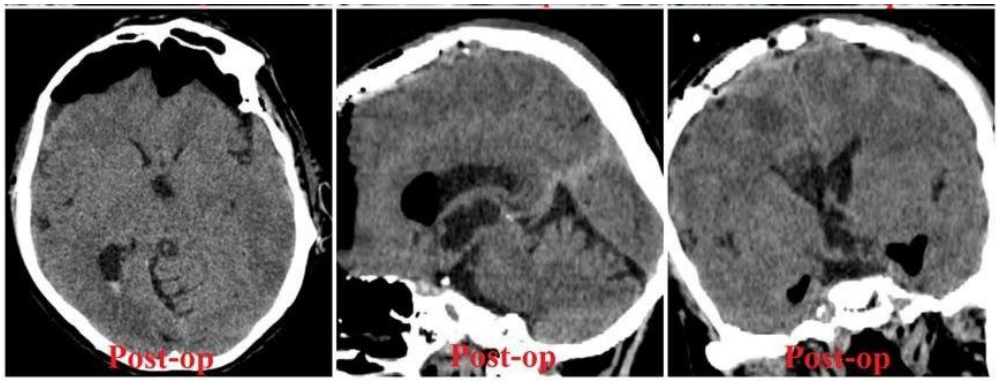
Pupils are of equal size (D=S), photoreaction is active. Bilateral vision loss is present. **Bitemporal hemianopia** is detected.

Hormonal Indicators: GH – 0.55 mIU/L [Normal: 0-20] Cortisol ↓ – 1.24 µg/dL [Normal: 6.4-22.8] TSH – 3.768 mIU/mL [Normal: 0.35-5.1] Prolactin – 13.23 µg/L [Normal for men: up to 16.5] ACTH ↓ – 6.55 pg/mL [Normal: 7.0-65.0]



Postoperative MRI Examination

Surgery Date: 13.12.2024. **Procedure:** "Parasagittal craniotomy of the frontoparietal region with a transcallosal approach, removal of a chiasmatic-sellar region tumor extending into the third ventricle cavity."



Postoperative MSCT Examination

Histology: Craniopharyngioma. **Postoperative Neurological Status:** Pupils of equal size (D=S), reactive to light. Vision is preserved, but bitemporal hemianopsia persists.

Clinical Case No. 5

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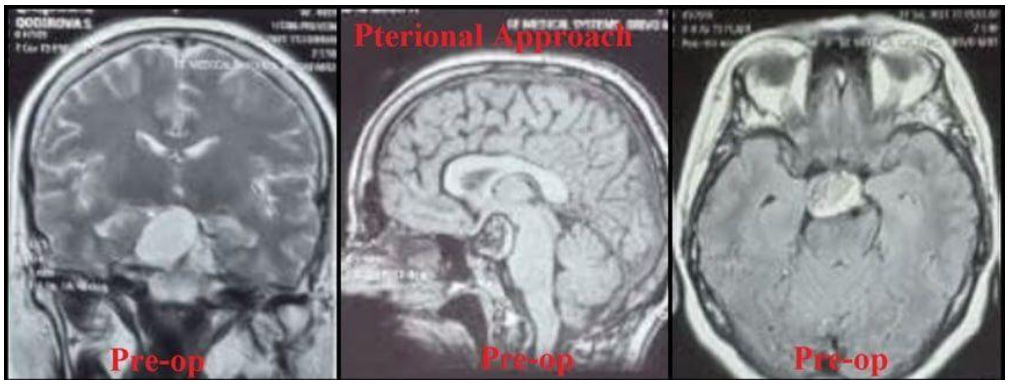
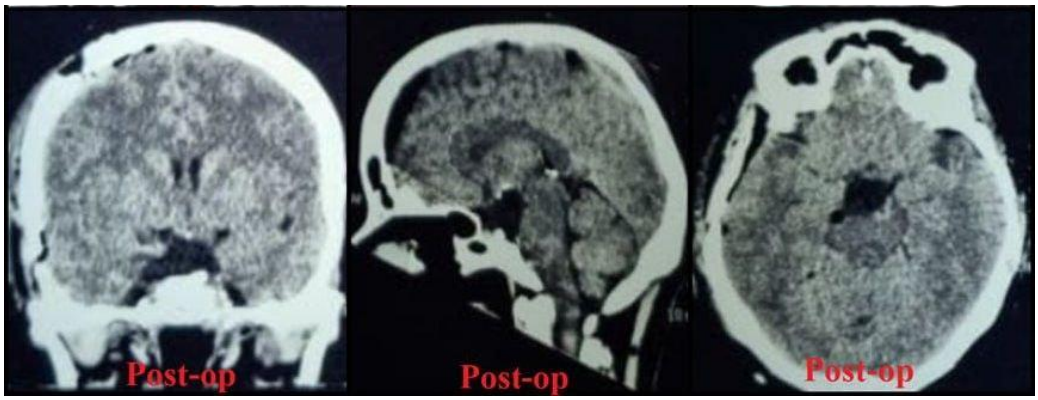
Patient: Qodirova S., born in 1970. Complaints: Headache, dizziness, vision impairment, menstrual cycle disturbances, and general weakness. **Preoperative Neurological Status:** Cranial Nerve II: Decreased vision (Visus = 0.5/0.5). Cranial Nerves III, IV, VI: Pupils of equal size.



Preoperative MRI Examination

Treatment: On August 13, 2021, the patient underwent a planned surgery: "Right-sided pterional craniotomy with tumor removal from the chiasmatic-sellar region of the brain".**Hormonal Indicators:** TSH: 1.455 µIU/mL [normal: 0.35-5.1] Cortisol: 0.80 µg/dL [normal: 6.4-22.8] Prolactin: 6.20 ng/mL [normal for women: up to 50 years – 3.8-30.7 ng/mL, after 50 – 2.9 ng/mL] ACTH: 3.73pg/mL [normal: 7.0-65.0]



Postoperative MSCT Examination

Histology: Craniopharyngioma.

Postoperative Neurological Status: Vision is preserved. Pupils are equal in size (D=S).

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