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Surgical Treatment of Sellar Region Tumors with Hydrocephalus

Uygun U. Altibayev, Gayrat M. Kariev, Sardorkhuja A. Sizdikhojaev, Robiya R. Uzakova

Republican Scientific and Practical Medical Center of Neurosurgery, Tashkent, Republic of Uzbekistan
Email: uygun100@mail.ru, admin@neuro.uz, sardorxoja9008@gmail.com, lokilafeysonfromasgard@mail.ru

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Abstract

Despite significant progress in neurosurgery, the treatment of tumors in the sellar region remains one of the most difficult and pressing challenges in modern medicine, requiring a comprehensive approach and high-tech surgical interventions aimed at removing neoplasms located in anatomically difficult-to-reach areas. The situation is complicated by the fact that in some cases, tumors of the sellar region invade the third ventricle cavity, causing the development of occlusive hydrocephalus. This factor aggravates the course of the pathological process and negatively affects the prognosis of the disease. Moreover, it significantly increases the complexity of surgical intervention, the main objectives of which are to resect as much of the tumor as possible, restore the patency of the cerebrospinal fluid pathways, and maintain a satisfactory quality of life for the patient.

Keywords

Sellar Region Tumors, Hydrocephalus, Pituitary Tumors

1. Introduction

According to our research, the frequency of detection of tumors in the sellar region complicated by the development of hydrocephalus is approximately 15% - 20% of the total number of neoplasms in this location. The presence of hydrocephalic syndrome has a significant impact on the prognosis of the disease and determines the characteristics of the postoperative outcome [1] [2].

As a rule, the development of hydrocephalus significantly reduces the quality of life of patients. This condition is accompanied by the progression of intracranial hypertension, manifested by increased general cerebral symptoms and pronounced asthenia. The increase in congestive phenomena in the fundus, especially in childhood, can lead to a significant decrease in visual functions. In this regard,

the prognostic significance of surgical intervention is aggravated not only by the need to remove the tumor, but also by the risk of complications caused by hydrocephalus [3] [4].

The principles of surgical tactics for tumors of the sellar region complicated by hydrocephalus consist of performing the maximum possible resection of the neoplasm with simultaneous restoration of adequate cerebrospinal fluid circulation. The choice of surgical intervention is determined by the morphological features and location of the tumor, as well as the severity of hydrocephalic syndrome. In cases where radical removal of the tumor or elimination of the blockage of the cerebrospinal fluid pathways is impossible, additional shunting operations are required to restore normal cerebrospinal fluid outflow [3]-[5].

In most cases, the results of surgical treatment for this category of patients are satisfactory. Their effectiveness is largely determined by the correct choice of surgical method, the technical quality of the resection, sufficient reduction of the tumor volume to restore physiological cerebrospinal fluid circulation, and adequate postoperative management. The overall somatic condition of the patient and the presence of concomitant pathology have a significant impact on the outcome [6] [7].

2. Objective

Conducting an assessment of outcomes and a comparative analysis of the results of surgical treatment of tumors in the sellar region complicated by the development of hydrocephalus.

3. Materials and Methods

The investigation is based on an analysis of the results of observation of 131 patients with tumors of the sella turcica region complicated by hydrocephalus who underwent inpatient treatment at the Republican Specialized Scientific and Practical Medical Centre for Neurosurgery of the Ministry of Health of the Republic of Uzbekistan between 2016 and 2023. The patients' ages ranged from 7 to 62 years; among them were 59 men (45%) and 72 women (55%). The duration of follow-up ranged from 6 months to 5 years. The average age at the time of the initial surgical intervention was 33.5 years [8] [9].

All patients underwent a full range of diagnostic procedures, including clinical neurological, clinical paraclinical, clinical instrumental, and clinical laboratory examinations. The clinical diagnosis was verified by means of overview and targeted craniography, as well as computerized (CT) or magnetic resonance imaging (MRI) of the brain [10].

Depending on the initial surgical approach used, patients were divided into four groups:

Group I—transcallosal access (**Figure 1** & **Figure 2**). This option was used as the primary one due to the lower frequency of complications and provided

satisfactory visualisation of the ventricular system. A potential limitation of the method was the need for frontal lobe traction, which in some cases could lead to damage to the brain tissue. This approach was used in 47 patients.

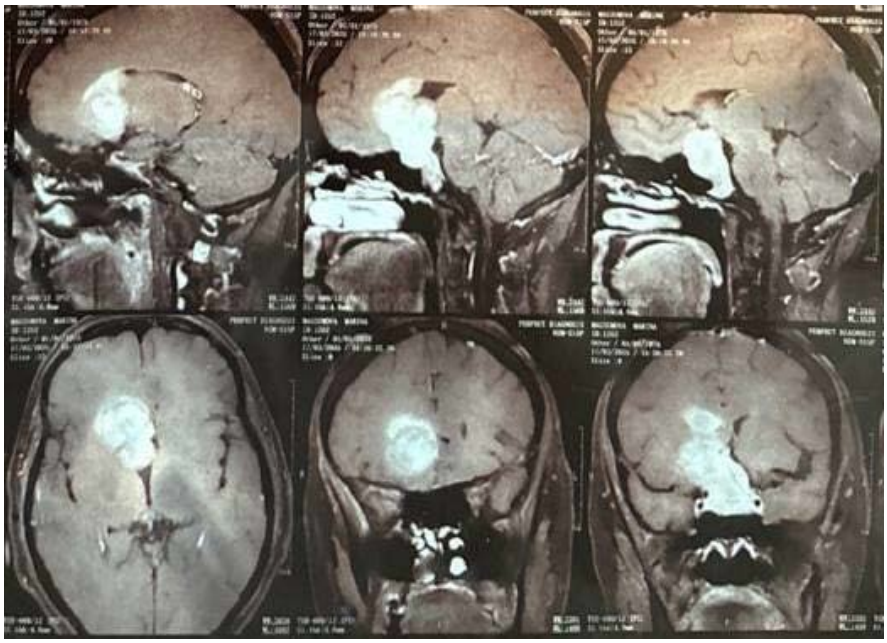

Figure 1. MRI of the brain with intravenous contrast: coronal, sagittal, and axial images. The scans demonstrate a space-occupying lesion in the chiasmal-sellar region with supra-, antero-, and retrosellar extension, as well as signs of obstructive hydrocephalus.

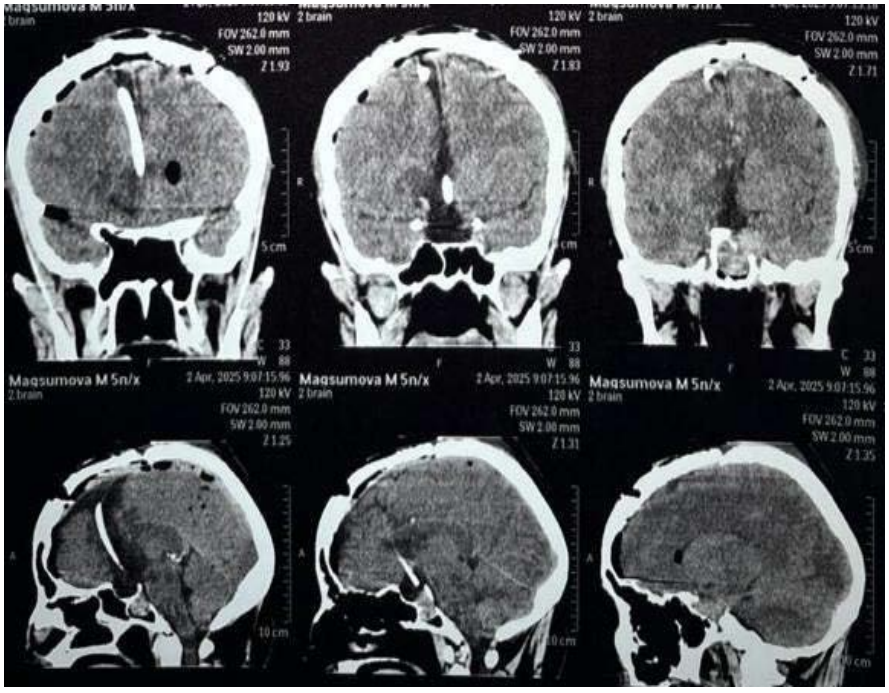

Figure 2. Postoperative MSCT scan performed the day after surgery, showing axial, frontal, and sagittal views. The images demonstrate the postoperative condition following the resection of the chiasmal-sellar region (CSR) tumor.

Group II—transcortical transventricular access (**Figure 3** & **Figure 4**). This option provided optimal visualization of the Monroe foramen due to a more lateral approach, which creates favorable conditions for tumor removal. This method is most preferable for significantly larger neoplasms and severe hydrocephalus. The main disadvantage of this method was an increased risk of seizure activity in the postoperative period. This approach was used in 45 patients.

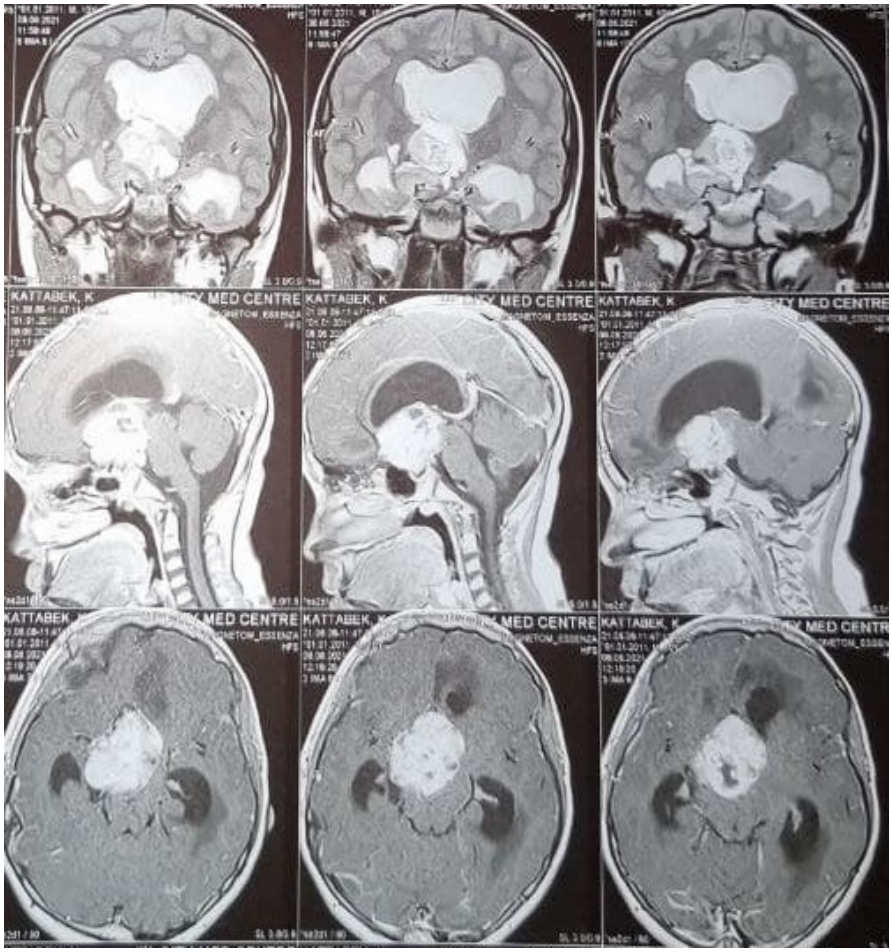

Figure 3. MRI of the brain with intravenous contrast administration: coronal (A)-(C), sagittal (D)-(F), and axial (G)-(I) images. The scans reveal signs of a space-occupying lesion in the chiasmal-sellar region (size: 4.2 × 4.1 × 4.1 cm) with supra-, antero-, and retrosellar extension, as well as signs of obstructive hydrocephalus.

Group III—bifrontal approach. This option was used in cases where the main volume of the tumor was located in the sella turcica region, and a smaller part spread into the third ventricle cavity, accompanied by moderately pronounced hydrocephalic syndrome. This approach was used in 22 patients.

Group IV—ventriculoperitoneal shunting performed to eliminate hydrocephalus. This method was used in patients with initially severe conditions, invasive tumor growth that precluded radical removal, and severe concomitant pathology. A shunting system was installed in 17 patients.

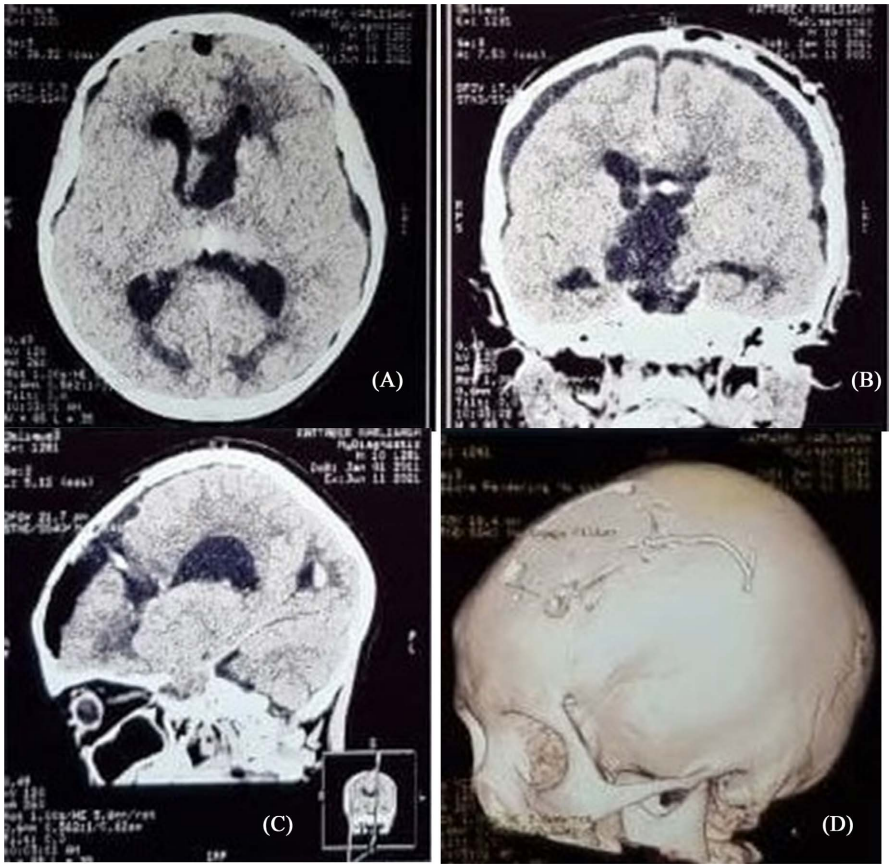

Figure 4. Follow-up MSCT performed the day after surgery: axial (A), frontal (B), sagittal (C) images, and 3D reconstruction of the skull (D). The images demonstrate the postoperative state following resection of the chiasmal-sellar region tumor.

4. Results and Discussion

As part of the study, we assessed the degree of radicality of tumor removal in the sella turcica region complicated by hydrocephalus, depending on the surgical approach used. According to **Table 1**, transcallosal and transcortical approaches were the most commonly used. When these approaches were used, total removal of the neoplasm was achieved in 34 of 92 operated patients, which amounted to 37%.

Table 1. Assessment of the radicality of tumor removal depending on surgical access.

Approaches	Radicality of tumor removal			
	Totally	Subtotally	Partially	Overall
Transcallosal	16 (34%)	24 (51.1%)	7 (14.9%)	47 (100%)
Transcortical	18 (40%)	22 (48.9%)	5 (11.1%)	45 (100%)
Bifrontal	8 (36.4%)	11 (50%)	3 (13.6%)	22 (100%)

It should be emphasized that increasing the radicality of tumor removal is associated with an increased risk of secondary complications. This is due to the close

anatomical connection between the tumor capsule and the structures of the hypothalamic region and its location in close proximity to the main arteries. In the postoperative period, diencephalic disorders are often observed, manifested by hyperthermia, chills, general weakness, and drowsiness. In addition, damage to the pituitary stalk can lead to the development of clinical symptoms of antidiuretic hormone (ADH) deficiency, accompanied by polyuria, polydipsia, and a decrease in the relative density of urine.

Subtotal tumor resection was performed in 46 patients (50%). In a number of cases, removal of the lower parts of the capsule was impossible or associated with excessive risk due to their close anatomical proximity to the basilar artery.

In 12 patients (13%), due to the high density of tumor tissue, pronounced adhesion to surrounding structures, significant intraoperative bleeding and unstable hemodynamic parameters, the scope of the intervention was limited to partial removal of the neoplasm.

As with any surgical intervention, the main goal of the operation was to achieve the maximum possible resection of the pathological focus while minimizing the risk of complications. In most cases, satisfactory results were achieved, contributing to an improvement in the general condition of patients and their quality of life. However, despite all precautions, the incidence of postoperative complications remains relatively high, which necessitates further improvement of surgical techniques and anesthesiological methods.

The complexity of anatomical localization and technical difficulties in removing the tumor in a number of cases led to the development of complications such as antidiuretic hormone deficiency, cerebrospinal fluid leakage, diencephalic disorders, persistent hyperthermia, and pronounced drowsiness in the postoperative period. Patients in this category underwent intensive therapy until a positive clinical effect was achieved. A fatal outcome was recorded in 6 patients. The main causes were the initially severe conditions of the patients, the formations of hematomas in the tumor bed with subsequent ventricular tamponade, as well as severe diencephalic disorder that were refractory to medical treatment.

According to **Table 2**, most patients achieved positive results after surgery, manifested in improved general condition and reduced severity of general brain symptoms. Complications caused by damage to the diencephalic structures required intensive care, during which the patients' condition stabilized, as a rule, on the 5th-7th

Table 2. Outcomes of surgical treatment.

Approaches	General conditions			Complications	Mortality
	Improvement	No changes	Deterioration		
Transcalosal 47 patients	32 (68.1%)	9 (19.1%)	6 (12.8%)	6 (12.8%)	1 (2.1%)
Transcortical 45 patients	28 (62.2%)	8 (17.8%)	9 (20%)	10 (22%)	2 (4.4%)
Bifrontal 22 patients	14 (63.7%)	5 (22.8%)	3 (13.6%)	6 (27%)	1 (4.5%)
Shunting 17 patients	11 (64.7%)	2 (11.8%)	4 (23.5%)	4 (23.5%)	2 (11.8%)

day. In cases of antidiuretic hormone deficiency, replacement therapy with desmopressin was prescribed at a dosage of 1 - 2 drops per day, which continued for a long time after discharge from the hospital. When visual functions deteriorated, patients underwent additional treatment by a neuroophthalmologist, also for a long period of time.

5. Conclusions

In most cases, sellar region tumors are benign, slowly progressing neoplasms. Early detection of this pathology has critical prognostic significance, as it enables the achievement of maximal radical tumor resection while preserving vital functions and minimizing the risk of postoperative complications. With disease progression, tumor invasion into the third ventricle may occur, leading to the development of hydrocephalus, which considerably complicates surgical management and has a substantial impact on both treatment outcomes and the quality of life in the postoperative period.

5.1. Clinical Case 1

An 11-year-old boy was admitted to our neuro-oncology department with complaints of progressive vision loss, recurrent headaches, dizziness, nausea, and vomiting. His medical history revealed that symptoms began three years earlier with headaches and vomiting. Initial MRI revealed a CSR tumor, and he underwent a bifrontal craniotomy in Kazakhstan, where subtotal resection of the lesion was performed. Histopathology confirmed pilocytic astrocytoma. The postoperative period was complicated by bilateral amaurosis and diabetes insipidus.

Upon re-admission to our center, the patient presented with tumor progression, intraventricular extension, and secondary obstructive hydrocephalus. MRI with contrast demonstrated a 4.2 × 4.1 × 4.1 cm lesion with supra-, antero-, and retrosellar growth. Visual evoked potentials (VEP) revealed conduction delays and ischemic changes along the optic pathways. Hormonal assays were within normal limits for his age.

Given the severity of the clinical presentation, a left fronto-parietal craniotomy with transcortical transventricular resection was performed. Histological examination again confirmed pilocytic astrocytoma. Postoperatively, the patient experienced partial visual recovery, with improved light perception and stabilization of systemic symptoms. He was discharged on the 12th postoperative day.

5.2. Clinical Case 2

A 49-year-old woman was hospitalized with progressive bilateral visual impairment, persistent headaches, dizziness, nausea, and vomiting. Her history included treatment for non-keratinizing squamous cell carcinoma of the cervix with hysterectomy and chemoradiotherapy in 2024. MRI revealed a mass in the CSR with supra-, infra-, and intraventricular extension. Ophthalmological evaluation showed marked visual impairment, particularly in the left eye.

She underwent a left frontotemporal craniotomy with transcortical transventricular resection of the lesion. Intraoperative findings demonstrated a partially vascularized, dense tumor extending into the third ventricle. Subtotal resection was achieved, with preservation of critical neurovascular structures. Histopathological analysis confirmed pituitary adenoma.

The postoperative course was uneventful, and visual function stabilized, with partial improvement in the right eye. Systemic symptoms improved significantly, and no endocrine dysfunction developed. She was discharged on the 12th postoperative day in satisfactory condition.

Neoplasm of the chiasmal-sellar region of the brain with supra-, infra-, and intraventricular extension.

Comorbidities: History of cervical cancer, status post-hysterectomy with adnexectomy (June 21, 2024), non-keratinizing squamous cell carcinoma, status post-chemoradiotherapy, and Grade I arterial hypertension (risk category 4).

Given the localization and size of the tumor, the clinical picture with pronounced cerebral symptoms, and progressive visual deterioration, the patient underwent surgical treatment: *"Left frontotemporal craniotomy. Resection of the chiasmal-sellar tumor with supra-, infra-, and intraventricular components via a transcortical transventricular approach."*

The surgery was completed without intraoperative complications. Vital signs were monitored, and intraoperative guidance was performed using visual landmarks. The tumor tissue was partially vascularized, dense in consistency, extending into the suprasellar, infrasellar, and third ventricular regions. A subtotal tumor resection was performed with maximal preservation of vital structures.

Histological diagnosis: *Pituitary adenoma.*

Postoperative Condition:

During the immediate postoperative period, the patient was monitored in the intensive care unit and subsequently transferred to the specialized neurosurgical ward on the following day. Under the ongoing therapeutic regimen, a partial improvement in systemic status was documented, characterized by a reduction in headache intensity, nausea, and vomiting. The patient remained fully conscious, oriented, and demonstrated preserved speech function.

Ophthalmological assessment revealed stabilization of visual performance, with residual vision maintained in the left eye and moderate pallor of the optic disc. No diplopia or ptosis was reported. Endocrinological evaluation demonstrated stable pituitary hormone levels without clinically significant deviations.

Postoperative Imaging Findings:

A control multislice computed tomography (CT) of the brain, performed on the second postoperative day, demonstrated postoperative osseous defects of the cranial vault and moderate perilesional edema along the margins of resection. No radiological evidence of intracranial hematoma was identified. Minimal residual tumor tissue was visualized within the region of the third ventricle.

The patient was discharged on the 12th postoperative day in satisfactory clinical

condition, with noted improvement of neurological and systemic symptoms.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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