

# Combined Occipital, Transtentorial, Supracerebellar, Transsinus Approach for Pineal Region Teratoma

## ABSTRACT

An 11-year-old boy with a large pineal region mass was admitted to our clinic. The preliminary diagnosis was teratoma. Tumor resection was carried out via combined occipital, transtentorial, supracerebellar, transsinus approach. The tumor tissue was completely resected, and no operative complication other than transient Parinaud syndrome was noted. The histological diagnosis was teratoma, grade 2. After three courses of chemotherapy, the patient underwent external irradiation. He remained asymptomatic with no signs of recurrence 15 months after the surgery. The combination of occipital, transtentorial, supracerebellar, transsinus approach provides excellent views and workspace above and below the tentorial notch. Transverse sinus section is not mandatory for this approach, but sectioning of the unilateral transverse sinus and the tentorium along the rectal sinus allows retraction of the falx and the underlying brain to the opposite side. Thus, a much wider horizontal and vertical projection is obtained. This approach enables more extensive tumor removal for large pineal region tumors.

**KEY WORDS:** Combined approach, pineal region teratoma, transsinus, transtentorium approach.

## INTRODUCTION

Removal of pineal region tumors is associated with high mortality and morbidity. Pineal region tumors can be resected through the infratentorial supracerebellar approach or the occipital transtentorial approach, with reasonably low morbidity and mortality (1, 16, 14). However, these approaches have limitations when dealing with large tumors. These two approaches can be combined by sectioning the transverse sinus and the tentorium to achieve safer and more extensive tumor removal (16, 15, 10, 19, 20). We report a successful removal of a large pineal region tumor by splitting the transverse sinus-tentorium complex.

## CASE REPORT

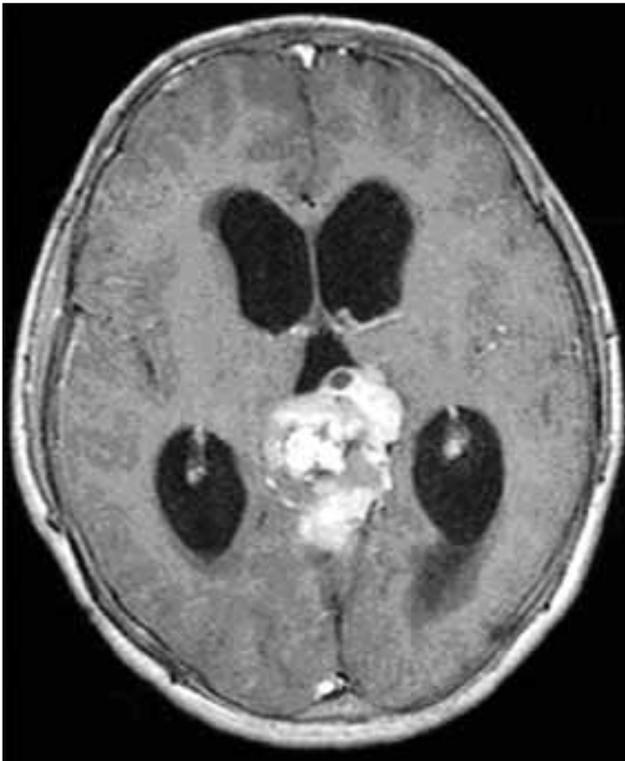
An 11-year-old boy was admitted to our clinic because of persistent headache, nausea and vomiting followed by generalized convulsions. Magnetic resonance (MR) imaging showed a pineal region mass of 6 x 3x3 cm and hydrocephalus (Figure 1, 2). Elevation of serum alpha-fetoprotein (AFP) (582,3 ng/ml) and beta hCG (113, 72 mIU/ml) levels suggested the presence of a germinal component of the tumor. The patient underwent ventriculoperitoneal shunt operation due to hydrocephalus and the postoperative cerebrospinal (CSF) fluid analysis was negative for alpha-fetoprotein (AFP).

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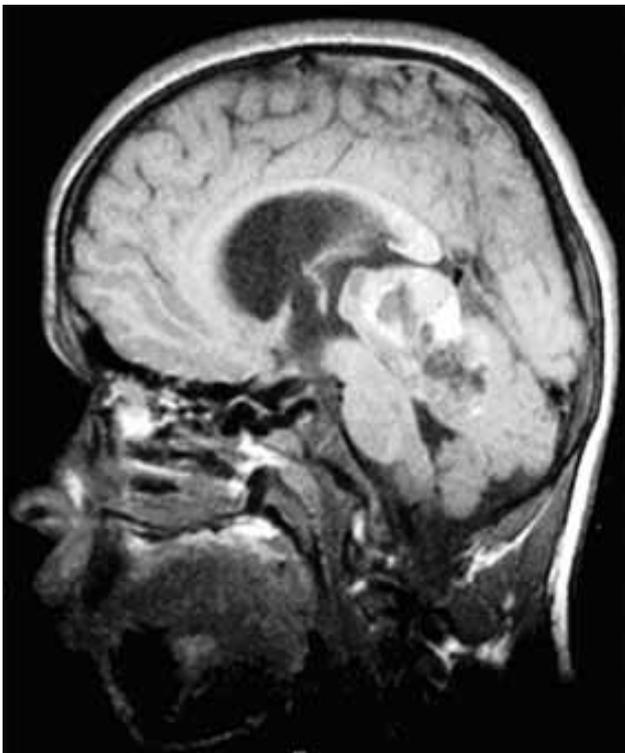
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**Figure 1:** Axial T1-weighted magnetic resonance image shows irregular, hyperintense, solid pineal region mass measuring 6 x 3x 3 cm diameters with lateral ventricular dilation (hydrocephalus).



**Figure 2:** Sagittal T1-weighted magnetic resonance (MR) image of the pineal region mass.

Cerebral venous angiography showed asymmetrical transverse sinuses. The left transverse sinus between the torcular herophili and the junction with the vein of Labbé was very hypoplastic. The supratentorial cortical veins, the superior sagittal sinus, and the galenic systems were well visualized, and the majority of contrast medium drained into the well-developed right transverse sinus through the torcular herophili (Figure 3).

The patient was placed in the Concorde position under general anesthesia. This prone position lifts the patient's head higher than the level of the heart with the head tilted to the right, away from the surgeon. Left side combined occipital and suboccipital craniotomies around the torcular herophili were performed.

The suboccipital duramater was opened in a triangular shape with the transverse sinus as the base. The occipital sinus was divided after ligation. The occipital duramater was then opened just superior to the transverse sinus. A 20-gauge Teflon cannula attached to a water-filled tube was inserted



**Figure 3:** Cerebral venous angiography shows asymmetrical transverse sinuses. The hypoplastic left transverse sinus between the torcular herophili and the junction with the vein of Labbé, the supratentorial cortical veins, the superior sagittal sinus, and the galenic systems are also well visualized.

into the transverse sinus just lateral to the torcular herophili. Test occlusion of the sinus lateral to the needle was continued for 5 minutes. The venous pressure was 5 cmH<sub>2</sub>O before the occlusion. No rise of venous pressure or brain swelling was noted. The transverse sinus was ligated and sectioned 1,5 cm lateral to the torcular herophili, and the tentorium was then cut along the line parallel to the straight sinus toward the tentorial notch area.

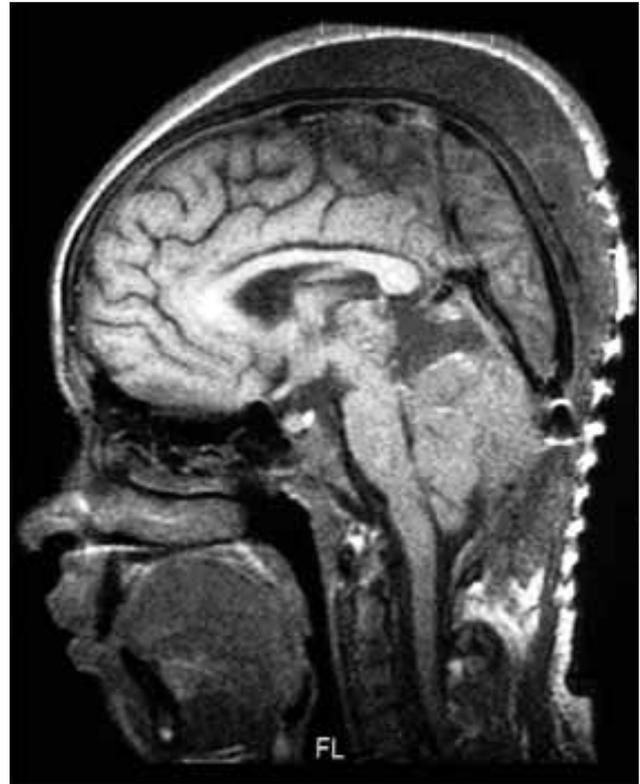
After splitting the left transverse sinus-tentorium complex, the left occipital lobe was gently retracted laterally. The right occipital lobe was retracted to the opposite side with the overlying falx, and the cerebellum was retracted caudally. Consequently, the quadrigeminal region was widely exposed, and the tumor together with the displaced galenic venous system came into the operative field. The tumor tissue extending into the third ventricle was also well visualized. Superior and inferior colliculars were identified and the tumor was gently disconnected from the superior part of 4th cranial nerve. After tumor removal, the duramater was resutured in a watertight manner and the tentorium was approximated with duramater but the transverse sinus was not resutured because of the gap between the cut ends. The histological diagnosis was teratoma, grade 2 (Figure 5).

After surgery, the patient had the triad of Parinaud's syndrome with failure of upward gaze, convergence nystagmus, and pupils that react better to accommodation.

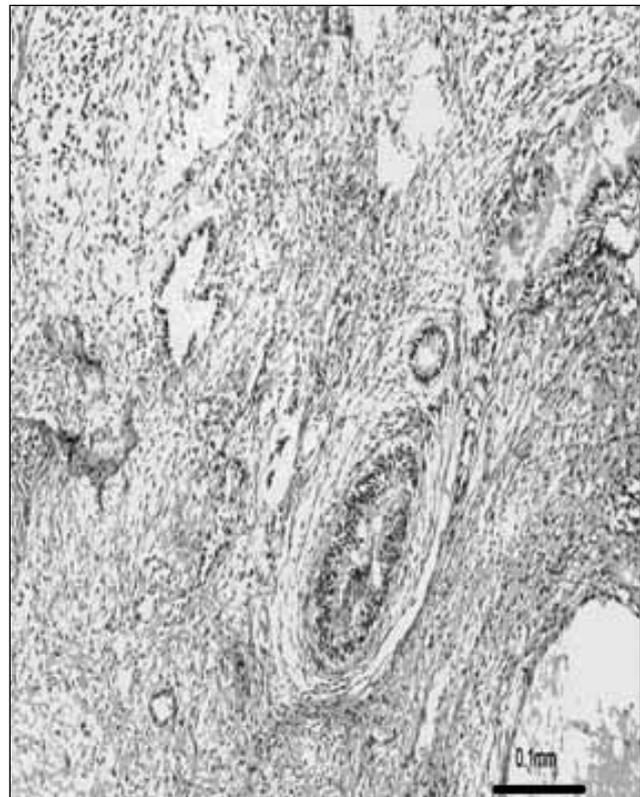
Postoperative sagittal T1-weighted contrast enhanced MR imaging showed no residual tumor after 15 months of the surgery (Figure 4). After three courses of chemotherapy consisting of ifosfamide, cisplatinum, and etoposide, the patient underwent whole brain external irradiation of 30 Gy with local boost of 20 Gy. He remained asymptomatic 15 months after the surgery. Follow-up MR imaging at 15 months found no signs of local tumor recurrence.

#### DISCUSSION

Pineal region lesions can be approached in three ways; the subtentorial supracerebellar approach of Krause and Stein, the occipital transtentorial approach of Proppen, or Sekhar's combined occipital, transtentorial, supracerebellar, transsinus approach. Dandy's parietal transcallosal approach is rarely used because of the adverse effects of dividing the posterior corpus callosum (16). The choice



**Figure 4:** Postoperative sagittal T1-weighted magnetic resonance image shows no residual tumor after 15 months.



**Figure 5:** The histopathological image of the mass (teratoma, grade 2).

among approaches depends on the size and the location of the lesion in the pineal area and its relation to the ventricular system, the median line and the splenium. Angiographic sequences in magnetic resonance with study of the deep veins are helpful in this respect (4). As compared with different approaches to the pineal region described in the literature, the combined occipital, transtentorial, supracerebellar, transsinus approach is ideal for large tumors of the pineal quadrigeminal area. This approach provides a very wide view of the pineal quadrigeminal region, and an excellent view of all the venous anatomy (16, 8). Every effort should be made to remove the tumor extensively or completely, especially when dealing with germ cell tumors, which often have multiple components. On the other hand, damage to normal brain tissue should be minimized. The infratentorial supracerebellar approach cannot easily reach large pineal region tumors extending anteriorly into the third ventricle and above the deep venous complex (13). This approach is suitable for huge tumors because the higher projection in the sagittal plane, obtained by splitting the transverse sinus and the tentorium is an additional attractive feature of this approach (11). The pitfall of this approach is potential injury to the deep veins and they should therefore not be cauterized, if possible, and repaired with 8-0 nylon or 7-0 prolene sutures (16, 11). Retraction of the contralateral occipital lobe with the overlying falx provides much greater exposure of the quadrigeminal region. The falx acts as a natural barrier protecting the underlying brain during the retraction. The tumor can be reached along the midline or along the line angled to the opposite side. The wide, unhindered exposure minimizes retraction of the ipsilateral occipital lobe.

The tumor in our patient could have been totally removed with the combined occipital, transtentorial, supracerebellar, transsinus approach but our main aim was to prevent brain injury during the prolonged retraction. Preoperative venous cerebral angiography showed that the left transverse sinus was hypoplastic and encouraged us to split the transverse sinus-tentorium complex from the beginning of the operation. Our operative technique resembles those used previously (16, 14, 15). A small difference is that our craniotomy was located more to the left, on the side of the hypoplastic transverse sinus.

Sectioning the hypoplastic transverse sinus after uneventful test occlusion seems to be a safe procedure. The patient position and the type of anesthesia influence the venous pressure, but the change rather than the absolute value during the test occlusion is critical. The absence of brain swelling increases the safety of the procedure (16, 15). We believe that reconstruction of the sectioned sinus, which is technically difficult and time consuming, is not necessary. Permanent obliteration of the transverse sinus should have no harmful effects on the brain as it can tolerate temporary interruption during the operation of several hours duration. No significant complications were reported in association with the permanent obliteration of the unilateral transverse sinus in a larger series (14, 15, 9). On the other hand, reconstruction of the cerebellar tentorium with a duramater substitute is advisable. Transverse sinus section is a useful option for selected patients with large pineal region tumors, and enables safer and more extensive tumor removal. Detailed analysis of the preoperative cerebral angiography and intra-operative test occlusion is required.

Precise histopathological assessment of pineal tumors is essential to guide optimal modern therapy modalities in order to assure local tumor control (9, 17, 7). Management of pineal gland tumors requires aggressive multimodality approaches with surgery, radiotherapy, and chemotherapy to improve outcome (12). In this paper we reported on the best convenient surgical approach for a large pineal gland lesion, histologically verified teratoma, grade 2. Additional radio-/chemotherapy was also used in this patient because immature teratomas carry a potential risk of malignant transformation (9, 17). The total removal of the tumor was facilitated by the effect of adjuvant therapy. Among pineal gland tumors, germinomas are the most common, accounting for 41-65% of cases (3). Intracranial teratomas are fairly uncommon and are associated with a poorer therapeutic response (3). Cases presenting with hydrocephalus necessitate ventriculo-peritoneal shunt procedures (3). Parinaud's syndrome (5) is common in pineal region tumors as also seen in our patient. We thought this symptom occurred due to attachment of the tumor to the 4th cranial nerve. Alpha-fetoprotein (AFP), human chorionic gonadotrophins (HCG), and carcinoembryonic antigen (CEA) were also analyzed

in the cerebrospinal fluid to identify the neoplastic cells (5). If the marker studies are positive or malignant neoplastic cells are identified at cytology, it is recommended that radiotherapy be used and direct surgical attack of the tumor should be avoided. On the other hand, if the marker studies and cytology are negative as seen in our patient, a direct surgical attack is recommended after the ventriculoperitoneal shunt process, aiming to decrease the high intracranial pressure (2).

In our case, the elevation of serum alpha-fetoprotein AFP and beta hCG levels suggested the presence of a germinal component of the tumor. In pineal gland teratomas, the extent of tumor removal is the singlemost important prognostic factor, since these tumors are fairly resistant to radiotherapy or chemotherapy (2), and a combination of these two approaches provides excellent management.

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