Optimized Surgical Approach to Third Ventricular Choroid Plexus Papillomas of Young Children Based on Anatomical Variations

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Key words
- Third ventricle choroid plexus papilloma
- Transcallosal approach
- Transcortical approach

Abbreviations and Acronyms
CPP: Choroid plexus papilloma
CSP: Cavum septum pellucidum
CT: Computed tomography
ICV: Internal cerebral vein
MR: Magnetic resonance

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BACKGROUND: **Choroid plexus papilloma (CPP) in the third ventricle is a rare benign intracranial tumor.**

METHODS: **We report 3 pediatric cases of CPP in the third ventricle. The lesions were totally removed by a different surgical approach in each case.**

RESULTS: **When remarkable hydrocephalus is present, the transcortical approach is easier to perform, but may expose the patient to epilepsy and subdural effusion postoperatively. The transcallosal approach offers direct exposure of the ventricle system with minimal risk of cortical damage. The transcallosal-transforaminal approach with posterior enlargement of the foramen of Monro along the choroidal fissure provides a direct trajectory into the third ventricle through the natural cleft. The transcallosal-interforniceal approach does not depend on the size of the foramen of Monro, but it carries a risk for damage to the both fornices. The midline plane of the septum pellucidum and the forniceal columns in children are sometimes easily identifiable and separable, and in such cases the transcallosal-interforniceal approach appears to be a safe route for tumors extending to the posterior third ventricle. The interforniceal approach should be reserved for lesions that cannot be removed safely via the transforaminal approach.**

CONCLUSIONS: **Young children have a small total blood volume and fragile cardiovascular status. Therefore, it is critical to preserve the venous system and to ligate the feeding artery before extirpation of the tumor. The surgical approach to the third ventricular CPPs should be tailored to individual children based on tumor size, location, and vascularity.**

INTRODUCTION

Choroid plexus papilloma (CPP) is an intraventricular papillary neoplasm derived from the epithelium of the choroid plexus. A CPP in the third ventricle is rare compared to the more common sites of the lateral and fourth ventricles. The total removal of a CPP can be curative, although achieving this goal can be challenging due to the potential for significant blood loss and damage to surrounding structures, particularly the internal cerebral veins (ICVs) or the territories they drain. The anterior interhemispheric transcallosal approach and the transcortical approach are well-recognized routes for resection of lesions located in the third ventricle. From 2001 to 2011, we operated on 3 pediatric cases of CPP within the third ventricle, using a different surgical approach in each case.

CASE REPORTS

Case 1

A 5-month-old boy presented with macrocephaly, irritability, vomiting, and an inability to roll over. He had a large head circumference (97th percentile), a tense fontanel, and exhibited sunset phenomenon. Computed tomography (CT) revealed severe ventriculomegaly with a third ventricular mass. Magnetic resonance (MR) imaging showed a lobular, intensely and homogenously enhanced mass within the third ventricle, extending superiorly into the lateral ventricles through the foramen of Monro (Figure 1).

After an extraventricular drainage from the right frontal horn was placed, the tumor was totally removed via a transcortical approach. We fenestrated the septum pellucidum and approached through the foramen of Monro. The cauliflower-like tumor was entirely contained within the third ventricle and dilated the foramen of Monro. The tumor showed no attachment to the third ventricular wall or the ICVs, which were well visualized after tumor removal. The tumor was fed by the medial posterior choroidal artery, which was clipped at the last stage of the procedure. Postoperatively, the patient needed a ventriculoperitoneal shunt for persistent subdural fluid collection. The postoperative developmental quotient was 80. Postoperative MR images showed no residual tumor, no visible brain damage along the transcortical route, and normalized ventricular size (Figure 2). The patient has been free from epilepsy for 5 years without anticonvulsants.

Case 2

A 9-year-old girl presented with morning headaches. CT showed a third ventricular tumor with moderate ventriculomegaly,

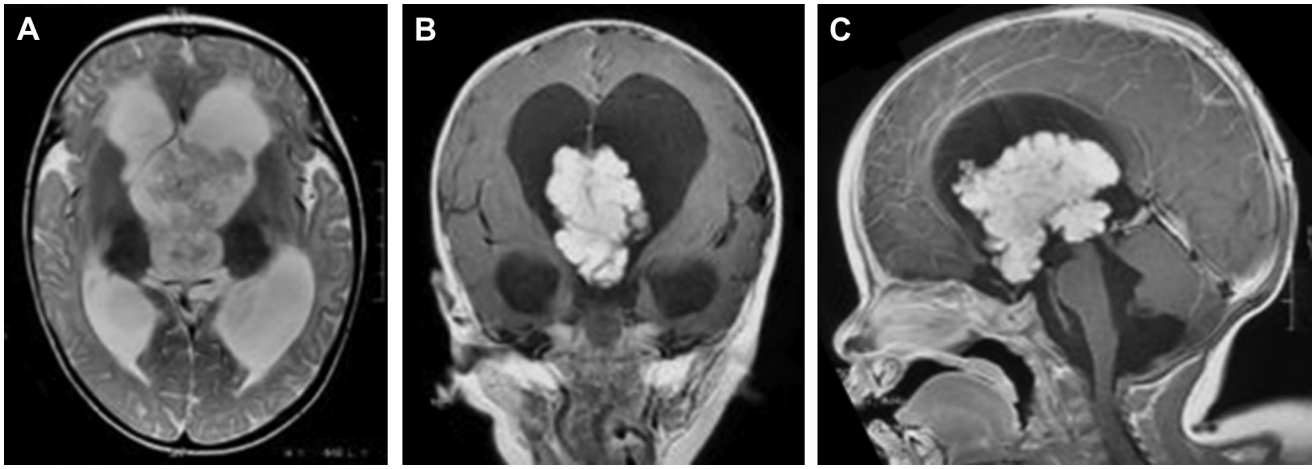

Figure 1. Preoperative magnetic resonance images reveal a large tumor in the third ventricle. (**A**) T2-weighted image. (**B**) Coronal contrast-enhanced image. (**C**) Sagittal contrast-enhanced image.

whereas MR imaging showed a cauliflower-like tumor in the third ventricle and cavum septum pellucidum (CSP) with separated fornix bodies (Figure 3). Contrasted MR imaging was not performed because of a history of asthma. The tumor was totally removed via a transcallosal-interforniceal approach. After a 15-mm incision was made along the body of the corpus callosum, we entered the CSP. The septum pellucidum was incised sectioned to enter both lateral ventricles. The tumor tissue was visible through the foramen of Monro. Because the foramen of Monro were not sufficiently enlarged and both fornices were widely separated by the CSP, we decided to make an interforniceal approach. The tumor was fed by the medial posterior choroidal artery, which was clipped and cut at the last stage of the procedure. The identification and obliteration of the feeding artery at the first stage of the procedure did not prove successful because often the large size of the tumor prevented access to the vascular pedicle, which was deeply situated. The last portion of the tumor was sharply dissected from the ICVs. No blood transfusion was necessary.

The postoperative course was uneventful, and the patient was discharged with no memory deficit. Postoperative MR images showed no residual tumor and a 15-mm callosotomy (Figures 4 and 5). The patient has been free from epilepsy without anticonvulsants and enjoys a normal school life.

Case 3

An 8-month-old boy presented with irritability and poor feeding. He was somnolent on admission. CT revealed a third ventricular mass, 4 cm in diameter, and hydrocephalus. MR imaging showed a lobular, intensely and homogenously enhanced mass within the third ventricle, extending superiorly into the lateral

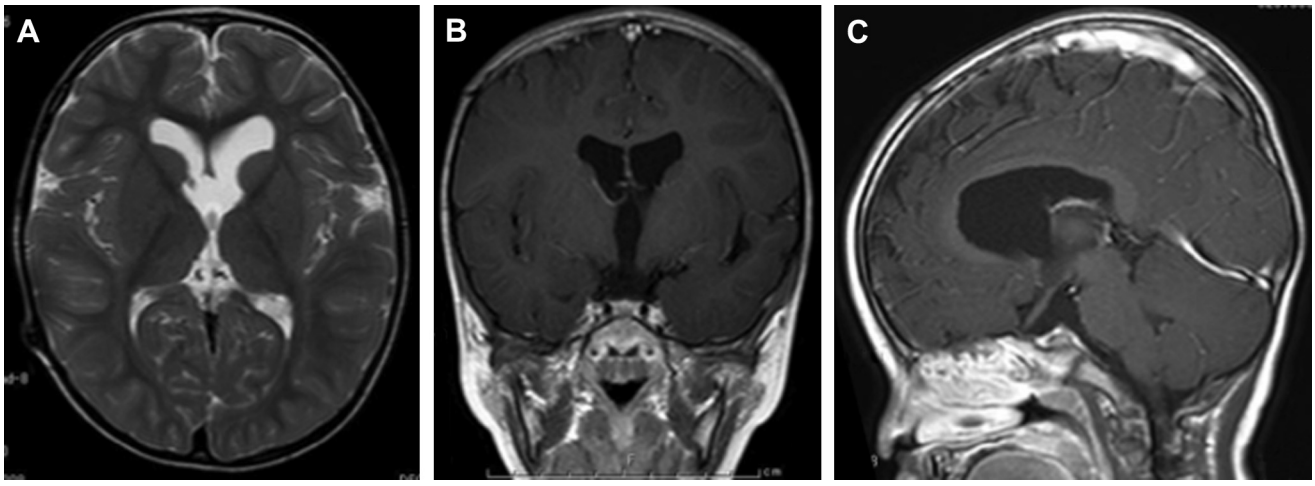

Figure 2. Postoperative magnetic resonance images. (**A**) T2-weighted image. (**B**) Coronal contrast-enhanced image. (**C**) Sagittal contrast-enhanced image.