

## Case Report

# Magnetic resonance imaging is essential prior to spinal subarachnoid blockade for parturients with a history of brain tumor resection undergoing cesarean section

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## Abstract

**Background:** Primary brain tumors are usually treated by surgical removal with the goal of complete resection within the constraints of preservation of neurological function. However, gross total resection may not mean complete tumor removal, and ongoing compression from a mass effect can lead to serious sequelae. Spinal subarachnoid blockade is contraindicated in patients with brain tumors or space occupying lesions.

**Case Description:** A 32-year-old full term parturient presented to Labor and Delivery for semi-urgent repeat cesarean section. Three months ago, she underwent resection of a benign brain tumor and recovered with no new neurological deficits. The neurosurgeon was consulted by the anesthesia team and stated that the tumor was completely extirpated. Since there was no postoperative magnetic resonance imaging (MRI) and the patient still had some neurological deficits, the anesthesia team decided to proceed with a general anesthetic using a rapid sequence induction and intubation. Mild hyperventilation to maintain an end-tidal CO<sub>2</sub> of 30 mmHg was selected and conservative fluid management was maintained. Postcesarean MRI revealed residual tumor compressing the brain stem and a loculated cyst. If a spinal subarachnoid blockade technique had been selected, the risk of uncal herniation, based on the postoperative MRI findings, may have been realized.

**Conclusions:** The present case demonstrates the necessity of a comprehensive and thorough review prior to selecting the anesthetic approach to manage the patients with a history of brain tumor resection. Postoperative MR imaging should be performed to evaluate the extent of tumor resection and possible existence of residual tumor.

**Key Words:** Choroid plexus tumor, pregnancy, postoperative magnetic resonance imaging, Spinal subarachnoid blockade

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## INTRODUCTION

The incidence of primary brain tumors in pregnancy is extremely uncommon, and there is no difference in the relative types encountered during pregnancy.<sup>[21]</sup> Normal physiological changes during the pregnancy, such as increased levels of gonadotropins and augmented fluid volume status may accelerate the growth of some types of brain tumors.<sup>[18]</sup> The treatment of brain tumors during pregnancy varies according to the type of tumor, size, localization, clinical presentation, and stage of pregnancy.

Surgical removal is recommended with the goal of either total removal or removal as much as possible to achieve the best survival. Although the perioperative neurosurgeon may perceive that the entire tumor has been removed, the gross total resection may not conform to 100% tumor removal. There are reports of residual tumor identified using postoperative MRIs, when the neurosurgeon believed that the tumor had been totally resected.<sup>[1,6,7]</sup> Postoperative and intraoperative MRI is the gold standard to determine the extent of tumor resection.

The anesthetic concerns in patients with brain tumors are related to the increase of intracerebral pressure and cerebrospinal fluid pressure. If the choice of anesthetic technique is made based upon the perception of the neurosurgeon that a tumor has been completely removed, serious sequelae from an unrecognized ongoing mass effect may occur. Spinal subarachnoid blockade is contraindicated in any patients who has a brain tumor or space occupying lesion which might cause brain tonsillar herniation.<sup>[7]</sup>

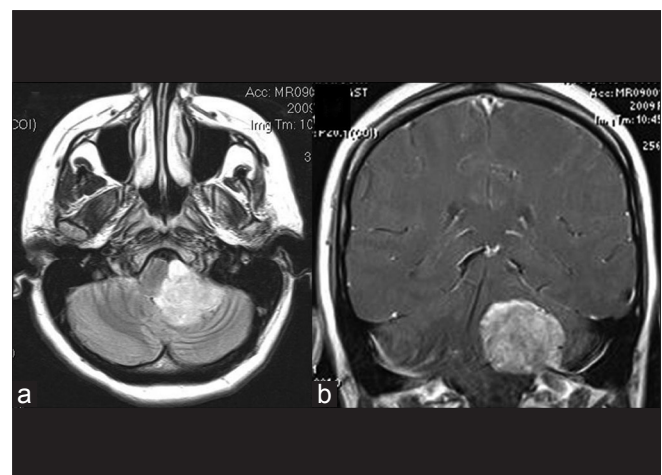
We present a case of a parturient at full-term who had the assurance from her neurosurgeon that there had been complete brain tumor removal, who presented for repeat cesarean section (C/S). We describe the management of this case and provide the recommendation for patients with a history of brain tumor removal to proceed to a general anesthetic. A week following the C/S, MRI revealed that 40% of residual tumor volume remained with ongoing brainstem compression.

## CASE REPORT

A 32-year-old full term pregnant woman presented for semi-urgent repeat Cesarean Section due to a previous low transverse incision and chorioamnionitis. The patient had a history of having had a benign brain tumor resection three months previously. She had had symptoms of increasing headaches, inability to fully control and coordinate her left leg and left arm motor function; ataxic gait; blurred vision; loss of hearing in the left ear; facial numbness; and left ophthalmoplegia. An MRI of the brain prior to surgery revealed a left heterogeneous enhancing mass on the left cerebello-pontine angle (CPA)

region with significant mass effect on the brainstem [Figure 1]. The patient underwent a left suboccipital craniotomy and resection of a 4cm CPA tumor at 26 weeks of gestation age with an uneventful perioperative course. The pathohistology showed a choroid plexus papilloma originating from the fourth ventricle. A CT scan of the head with and without contrast was taken on post operative day 1, revealing postsurgical changes in the left CPA. The operative report indicated “complete removal of a CPA tumor”. No further post-operative MRI was ordered. The “impression” of a successful total resection of the brain tumor was described and no further intervention was suggested.

However, when presenting in active labor, the patient continued to suffer from residual and multiple neurological deficits with no resolution since the brain surgery. The operative neurosurgeon was contacted by the anesthesia team and he stated that the tumor had been totally removed and that the patient had no further mass effect. There was no time to perform an MRI prior to cesarean section. After case discussion with the obstetric surgeon and a neuroanesthesiologist, general anesthesia was chosen. The patient was in a left lateral uterine displacement position, and standard ASA monitors were applied. A rapid sequence induction with cricoid pressure was performed using 200 mg of propofol IV, 100 mcg of fentanyl IV, and 80 mg of succinylcholine IV after 40 mg of lidocaine IV. The trachea was easily intubated, and anesthesia was maintained using 1 MAC of sevoflurane with a propofol infusion at 50 mcg/kg/min, fentanyl 3 mcg/kg and O<sub>2</sub>. Mild hyperventilation to produce an end tidal CO<sub>2</sub> of 30 mmHg and crystalloids were used to prevent a possible sudden increase in intracranial pressure. A healthy infant was delivered with Apgar scores at 1 and 5 minutes of 9/9. The operative course was unremarkable and the patient remained stable throughout



**Figure 1: Preoperative MRI images. Axial T2 (a) and coronal T1 (b) MRI images with contrast demonstrate a large mass (choroid plexus papilloma) in the left CPA region with significant mass effect on the lower brain stem with obstruction of the fourth ventricle**

the procedure. The trachea was extubated and the patient had an unchanged neurological status similar to her preinduction examination without development of any new neurological deficits or any increase in headache intensity following operative delivery.

One week postoperatively, the MRI with and without contrast revealed a residual mass (measuring  $2.5 \times 1.6 \times 2.2 \text{ cm}^3$ ) at the level of the very thin left middle cerebellar peduncle. An associated extra axial cyst located anterior to the mass and on the left aspect of the pons and medulla measured  $1.5 \times 1.7 \text{ cm}^2$ . Mass effects on the left aspect of the pons, medulla and the cisternal segments of cranial nerves VII and VIII were also identified [Figures 2 and 3].

## DISCUSSION

Choroid plexus tumors (CPT) are rare epithelial brain tumors which account for 0.4%-0.6% of all intracranial tumors.<sup>[20]</sup> Most occur as benign, slowly growing papillomas located in the lateral (50%) or fourth ventricles (40%), with a minor percentage arising from the third ventricles (5%) and the cerebellopontine angle (CPA).<sup>[11]</sup> Patients commonly develop hydrocephalus and symptoms related to increased intracranial pressure due to an increased production of CSF by the tumor or by mechanical obstruction of the CSF outflow. Headache is the most common symptom in both adults and children, and an unsteady gait is the main clinical sign in children (71.4%) while adults present most commonly with papilledema (63.1%).<sup>[11]</sup> The present patient reported having headaches, ataxic gait, inability to coordinate and control the upper and lower left limbs, blurred vision along with loss of hearing in the left ear and facial numbness which are common presentations of choroid

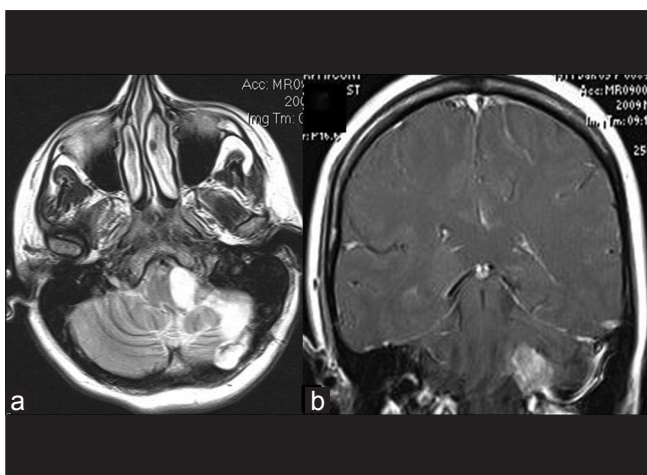
plexus papillomas involving the CPA.<sup>[14]</sup> There are various types of treatment available for CPT, but complete surgical removal is the most important primary goal.<sup>[26]</sup>

Management of brain tumors during pregnancy presents a dilemma and depends basically on the patient's condition. If the diagnosis is made by identifying symptoms provoked by intracranial hypertension or observing neurological deficits, tumor removal should be performed immediately as in the present case. However, complete removal may be difficult because of physiological changes during pregnancy such as increasing progesterone and estrogen receptors which are able to accelerate the tumor growth.<sup>[19]</sup> In most cases, near-total resection can be achieved, but complete resection is generally limited by the inability to remove the tumor from the surrounding clear margins and to remove the scattered tumor cells which have infiltrated beyond normal brain tissue.<sup>[23]</sup> In this case, it appears that the tumor cells adherent to the brainstem made it difficult to completely resect the tumor without causing damage to the brainstem parenchyma.

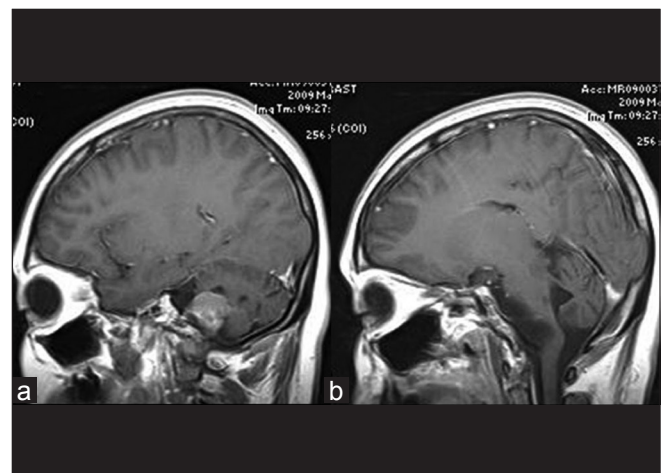
Intraoperative and postoperative MRI are the essential gold standard techniques to accurately estimate residual mass and confirm the extent of tumor resection, even though some patients who received intraoperative MRI have had unsuspected results of residual tumor.<sup>[1,6,12]</sup>

Studies have supported the finding that intraoperative MRI is more helpful to localize, determine tumor margins, achieve the proportion of complete removal and help monitor probable intraoperative complications, when compare with intraoperative ultrasound or postoperative CT scan.<sup>[1,5,6,13,22]</sup>

However, there is no current standardized guideline for frequency of follow up using postoperative MRI in



**Figure 2: Postoperative MRI images. Axial T2 (a) and coronal T1 (b) MRI images with contrast demonstrate residual tumor with cystic changes and brain stem compression in addition to postoperative changes**



**Figure 3: Postoperative sagittal T1 MRI images with contrast demonstrate large residual tumor with a mass effect in posterior fossa including cerebellum (a) and brain stem, pons and medulla (b)**

CPT. There is the suggestion that using MRI T2/FLAIR signal and pre- and post-gadolinium infusions appears to enhance detection of abnormally enhancing brain tumor,<sup>[8,16]</sup> especially if done within 48-72 hours of the surgery, before postoperative changes affect the operative field.<sup>[1,25]</sup> However, Belhawi *et al.*<sup>[4]</sup> suggested that late month MRI should be routinely selected because an MRI within 48 hours of resection might not be clear enough to determine volume of non-enhancing residual tumor when compared with the later performed MRI. In this patient, CT scanning on postoperative day 1 showed post surgical changes in the left CPA. The surgical report indicated “complete removal of CPA tumor” and asserted that no further post-operative MRI was required.

Regional anesthesia for C-section surgery is universally preferred with some advantages over general anesthesia such as reduced risks of aspiration and hemorrhage,<sup>[2]</sup> but there are contraindications for lumbar puncture or neuraxial subarachnoid spinal anesthesia in patients with elevated intracranial pressure, or with space-occupying lesions. Removal of CSF may cause an immediate drop in the spinal CSF pressure and produce an increase in the pressure gradient between supratentorial and infratentorial compartments, resulting in rapid transtentorial or transforaminal brain herniation.<sup>[7,24]</sup> However, there exist case reports of excellent analgesia resulting from use of epidural anesthesia during labor in patients with brain lesions.<sup>[15,17]</sup> Although theoretically an epidural technique may not precipitate brain herniation, some studies have reported that a large volume of local anesthetics may lead to increases in CSF pressure, especially in cases of coexisting elevated ICP or space-occupying lesions.<sup>[9,10]</sup> The anesthetic management for patients with brain tumors or space occupying lesions is reserved for use of general anesthesia, while avoiding elevations of CSF and intracranial pressures. In pregnancy, uterine contractions and inadequate analgesia can increase BP, central venous pressure and CSF pressure.<sup>[3]</sup> Narcotic analgesics are not recommended as they can produce respiratory distress, increasing pCO<sub>2</sub> and possibly raise CSF and intracranial pressure.<sup>[10]</sup>

The anesthetic choice in this case was selected after the anesthesiologist reviewed all the available data including indication for the Cesarean Section, urgency of surgery, the patient’s general medical status and all available imaging. General anesthesia was chosen for C/S based primarily on the patient’s clinical exam revealing ongoing neurological deficits, and the fact that there was no postoperative MRI done in the three month interval between the brain surgery and C/S. Post C/S MRI confirmed the residual tumor adherent to the brainstem and an entrapped cyst exerting significant brainstem compression. In this case, the foramen magnum was not removed during the previous brain surgery and the craniocervical junction was rather narrow. If acceptance of

the language in the dictated operative report of “complete tumor resection” had been made and if a subarachnoid neuraxial blockade had been performed, serious sequelae including possible tonsillar herniation through the tight foramen magnum would likely have taken place.

We suggest that every patient who undergoes brain tumor resection should have serial follow-up postoperative MRIs or at least one controlled MRI following surgery. If the pathohistology reports confirm that the patient had a benign brain tumor, the patient fully recovers from neurological deficit, and post-operative MRI shows no residual tumor left behind, then further MRI follow up may not be necessary. However, if the pathohistology reports identifies a malignant brain tumor, or if the patient has ongoing neurological deficits, immediate postoperative MRI is not sufficient to confirm the totality of tumor resection. Serial and contemporaneous MRIs should be performed to evaluate the possible residual tumor, and the timing of follow up depends on the type of tumor. Operative estimation of the extent of brain tumor by an operating neurosurgeon may not be accurate and the selection of anesthesia should not be made on the perception or estimation of the neurosurgeon alone that the tumor has been completely removed. In any cases where there is doubt about possible residual tumor possibly exerting a mass effect, precesarean section MRI prior to spinal subarachnoid blockade should be performed and reviewed by the anesthesiologist. Even though some authors report excellent results of using epidural analgesia in patients with brain tumors, we need to be cognizant that higher volumes of local anesthetics injected and the possibility for unintentional dural puncture may cause serious complications. We suggest that general anesthesia and avoidance of spinal subarachnoid blockade should be the technique of choice for patients with brain tumors to prevent serious sequelae including possible brain herniation and the associated severe morbidity or mortality.

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