



# Spinal anesthesia performed for cesarean delivery after external ventricular drain placement in a parturient with symptomatology from an intracranial mass

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## ABSTRACT

We describe a case in which spinal anesthesia was undertaken in a pregnant patient with a space-occupying tumor and significant symptomatology. The collaborative efforts of all medical disciplines involved and the willingness of the neurosurgeon to discuss and help determine the safety of neuraxial anesthesia, culminated in placing an external ventricular drain to help monitor and manage intracranial pressure, so that we could proceed with spinal anesthesia and more easily monitor neurologic status.

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**Keywords:** Spinal anesthesia; Intracranial mass; Meningioma; External ventricular drain

## Case report

A 34-year-old gravida 7, para 6 female at 35 weeks' gestation presented to the hospital with six weeks of intensifying headaches and dizziness. Her symptoms also included two weeks of rapidly deteriorating neurologic status, with symptoms such as ataxia, dysphagia, facial numbness, diplopia, hearing loss, hyperemesis, imbalance and slurred speech. On physical examination she had multiple right-sided cranial neuropathies involving the fifth to tenth cranial nerves; and a left hemiparesis. A non-contrast magnetic resonance image revealed a large (5.4 × 5.1 × 2.9 cm) right petroclival mass in the cerebellar pontine angle, with extension of the tumor into the internal auditory canal and Meckel's cave. There was marked mass-effect and severe compression of the brainstem, with resultant obstructive hydrocephalus and tonsillar herniation (see [Figs. 1 and 2](#)).

She was admitted to the neurologic intensive care unit (ICU) and an interdisciplinary team discussion began between the departments of neurosurgery, obstetrics-gynecology, (ICP) maternal-fetal medicine, neonatology and obstetrical anesthesia. Given the extent of the tumor, its rapid progression and the worsening symptomatology which was concerning for increased intracranial pressure, (ICP) the neurosurgeon recommended surgical intervention within the week. Maternal-fetal medicine and obstetrics-gynecology specialists were consulted for recommendations regarding potential preterm delivery versus the continuation of pregnancy. The recom-

mendation was made to proceed with a preterm delivery before neurosurgical intervention, because it was felt that the demands of neurosurgery and recovery would be greater for the fetus compared to those of a prior but late pre-term delivery. The patient would then be able to undergo more extensive imaging, to allow the surgical team to prepare for the operation.

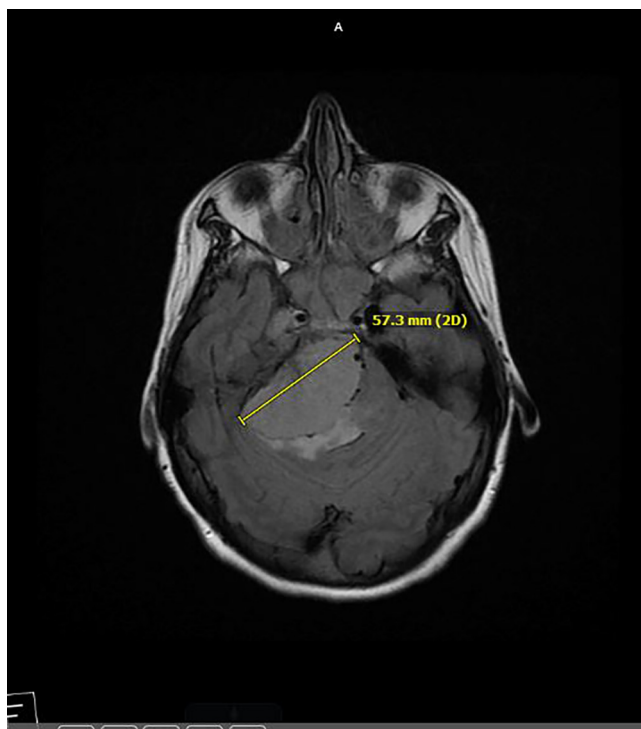
After extensive interdisciplinary discussions considering the risks and benefits of both general and neuraxial anesthesia in a neurologically deteriorating pregnant patient with an obstructing intracranial mass, the decision was made to proceed with placement of an external ventricular drain (EVD) and then to perform immediate delivery under spinal anesthesia. An EVD would allow for both monitoring and treatment of elevated ICP. Additionally, it would mitigate the risk of tonsillar herniation in the event of inadvertent enlargement of a sub-arachnoid breach.

The patient was brought to the obstetrical operating suite where standard monitors were applied and monitored anesthesia care was performed with propofol, along with local anesthetic. The ventriculostomy catheter was placed into the frontal horn of the lateral ventricle. The opening pressure was noted to be 15 mmHg [normal 5–15 mmHg]. Spinal anesthesia with a 27-gauge Whitacre needle was performed and dosed with our institution's regimen of 1.6 mL hyperbaric 0.75% bupivacaine, 15 µg fentanyl and 150 µg morphine. Cesarean delivery was performed without complications during monitoring of both her neurological examination and ICP. A healthy baby was delivered and the patient recovered in the ICU. The baby had an unremarkable neonatal ICU admission for observation. The following

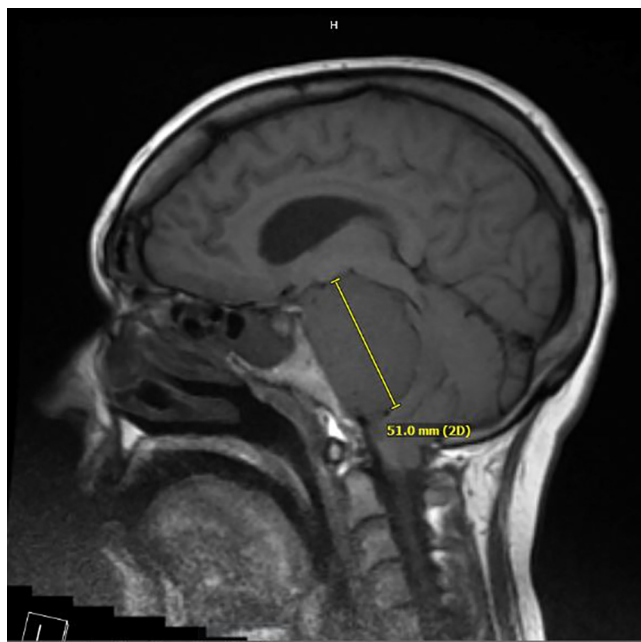
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**Fig. 1** Magnetic resonance imaging brain axial fluid-attenuated inversion. Recovery sequence showing a 5.7 cm right petroclival meningioma, with severe compression of the brainstem and edema within the right middle cerebral peduncle



**Fig. 2** Magnetic resonance imaging sagittal T1-weighted non-contrast sequence showing severe compression of the brainstem and posterior fossa contents by the tumor, with evidence of tonsillar herniation

week the woman underwent a retrosigmoid craniotomy for a near total resection a petroclival meningioma. She tolerated the procedure well and postoperatively her hemiparesis and obstructive hydrocephalus resolved.

## Discussion

This is the first published report of a pregnant patient, with a symptomatic skull-based tumor and tonsillar herniation, who was managed with an EVD and by cesarean delivery under spinal anesthesia. There are few other reports of parturients managed with EVD and other methods of delivery. One such report describes a patient who had a shunt placed at 27 weeks' gestation for a non-communicating hydrocephalus. The shunt was maintained until her delivery, which was done with an opioid analgesic and pudendal nerve block.<sup>1</sup> Another report describes a ventriculoperitoneal shunt, placed under general anesthesia, that allowed the team to delay delivery until 37 weeks' gestation, at which time a cesarean delivery was performed under general anesthesia.<sup>2</sup> Gliomas and meningiomas are the most common brain tumors.<sup>3</sup> Meningiomas, which are otherwise slow-growing, are particularly challenging as they are hormone responsive and may increase in size during pregnancy, which explained our patients sudden worsening of symptoms.<sup>4</sup>

The decision to perform general versus neuraxial anesthesia is complex and must take into consideration the need to balance the requirements of both the mother and baby.<sup>5</sup> Neuraxial anesthesia is typically the preferred method of anesthesia during cesarean delivery as it allows the patient and partner to experience the birthing process, avoids the risks of general anesthesia, limits fetal exposure to general anesthetics, and allows for postoperative neuraxial pain control. General anesthesia is typically avoided as the physiologic, anatomical, hormonal and pathological changes make it more challenging: parturients are at increased risk of difficult and failed intubations, regurgitation and aspiration, and hypoxia due to a decrease in functional residual capacity.<sup>6</sup> Additionally, volatile anesthetics result in uterine relaxation, which can lead to increased blood loss.

In patients with increased ICP the method of delivery and anesthesia becomes even more complicated. In laboring patients, ICP can increase significantly with uterine contractions, as much as 33 cmH<sub>2</sub>O during the first stage of labor and 70 cmH<sub>2</sub>O during the second stage, with pushing.<sup>7</sup> While an assisted second stage vaginal delivery under neuraxial anesthesia is another option, we opted for a cesarean delivery to avoid uterine contractions. Neuraxial anesthesia in a patient with increased ICP is usually considered to be a contraindication because of the risk of brain herniation.<sup>8</sup> Some of our primary concerns revolved around controlling and monitoring the patient's ICP, especially in association

with rapid sequence induction, intubation and emergence. Succinylcholine has a theoretical risk of increasing ICP, likely due to muscle fasciculations, so we would have used rocuronium. Intubation is the period in which the ICP may increase significantly, as a result of laryngoscopy. Large doses of opioid drugs can block the sympathetic response, but may result in respiratory depression in the baby.<sup>6</sup> Laryngotracheal topical anesthesia could blunt some of this effect without affecting the baby. Emergence is another challenge as deep extubation is not a consideration and high-dose opioids may lead to hypoventilation and hypercarbia, which can also then lead to increases in ICP. With all these potential increases in ICP, we considered it was important to be able to monitor for neurologic deterioration.

Based on their size and location, intracranial masses can cause direct compression of brain tissue, secondary compression related to cerebral edema, and/or obstruction of outflow and subsequent accumulation of CSF. This can lead to significant pressure gradients both between, and within, intracranial compartments, resulting in cerebral herniation and death. There have been reports of successful neuraxial anesthesia performed in patients with intracranial pathology,<sup>9,10</sup> but they were not performed in patients with space-occupying lesions or symptoms. Several complicated cases detail how epidural anesthesia played a role in brain herniation and death.<sup>11,12</sup> Space-occupying lesions that narrow the ordinarily large opening of the foramen magnum, or are situated in the posterior fossa and cause a bottleneck to CSF flow, specifically place the patient at significant risk of herniation. Leffert et al. published a detailed review article that provides a more comprehensive review of our abridged discussion.<sup>5</sup>

External ventricular drains are silastic catheters that allow ICP monitoring and CSF removal. They are commonly placed in patients in ICUs, however it is not known if one has been utilized in this particular situation. With the ability to normalize the pressures across the supratentorium and infratentorium, the risk of herniation was diminished. For lesions in the posterior fossa, care has to be taken to avoid over-drainage and upward herniation.

We chose to perform a single shot spinal anesthetic, as opposed to our institution's standard practice, which is a combined spinal-epidural anesthetic. Inadvertent dural puncture can occur in the hands of even the most experienced providers and if it occurred with the larger, cutting Tuohy needle, it would have created significant loss of CSF, resulting in a greater pressure gradient. Even the use of a spinal needle caused initial concern for our neurosurgical colleagues. An uncontrolled leak could lead to protracted headaches that could obscure the symptoms of increased ICP and too much pressure from above could potentially cause the smaller spinal needle puncture to become larger, leading to herniation.

It has been demonstrated that punctures with smaller gauge needles and pencil-point needles result in less CSF leak.<sup>13,14</sup> Additionally, epidural injections have been shown to increase ICP.<sup>15</sup> The large volume needed to provide surgical analgesia displaces CSF cephalad as a result of the compression on the dural sac.<sup>15</sup>

Many of our concerns were alleviated after placement of the EVD and we were able to continually assess the patient's neurologic status, as she remained awake during the delivery. A neurological ICU nurse was present to help manage the EVD and drain CSF as needed, and the neurosurgeon was available throughout the delivery. We also had mannitol and emergency induction medications prepared. This was a challenging case that presented a complex discussion involving the timing and sequence of procedures and the modality of anesthesia. The willingness of all parties to communicate and evaluate what was considered best for the patient and her child was tantamount to the success of the case. We believe the placement of an EVD immediately prior to neuraxial anesthesia is a low risk alternative to previously described approaches in this unique patient population that is bridging to neurosurgery. We suggest practitioners consider it as an option going forward.

## Conflict of interest

None.

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## Anaesthetic implications of a patient with cold-induced anaphylaxis presenting to the labour ward



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### ABSTRACT

Cold contact urticaria is a well described condition, with reactions ranging from localised wheals to systemic and anaphylactic reactions. Case reports involving anaesthetic care are rare. This report describes a patient with cold-induced urticaria with systemic reactions who had been advised to carry an adrenaline autoinjector. She presented to the labour ward out-of-hours and in established labour requesting epidural analgesia. She subsequently had an uneventful instrumental delivery following an epidural ‘top-up’. This report focuses on the anaesthetic implications of her condition.

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**Keywords:** Cold induced urticaria; Anaphylaxis; Labour; Epidural

### Introduction

Cold contact-induced urticaria is a well described physical urticaria that occurs following contact with cold objects.<sup>1</sup> The pathophysiology remains unclear, but there is IgE-mediated mast cell and basophil degranulation.<sup>2</sup> Release of histamine and other inflammatory mediators results in reactions ranging from mild localised wheals to systemic reactions such as bronchospasm, hypotension and anaphylaxis. The incidence is about 0.05%, with 50% of patients experiencing systemic reactions and one-third anaphylaxis.<sup>3–5</sup> Primary acquired cold-induced urticaria is the most common subtype, and reactions typically occur within minutes of exposure. Rarer forms exist: in delayed cold-induced urticaria symptoms may occur hours after exposure to cold.<sup>5</sup> Case reports have described particularly severe reactions following exposure to cold

water.<sup>6,7</sup> Cases described in the anaesthetic literature are rare, but include one case of hypotension and facial oedema following administration of refrigerated atracurium.<sup>4,8</sup>

This case report describes a patient with a diagnosis of cold-induced anaphylaxis who presented to the labour ward. The anaesthetic implications of epidural insertion and bolusing for a trial of instrumental delivery are described.

### Case report

A 39-year-old primigravida with an uneventful pregnancy attended antenatal visits. She had no other medical co-morbidities or allergies and no relevant family history. She gave a clear history of cold-induced urticaria, including whole limb urticaria and oedema following administration of an intramuscular (IM) vaccination that had been refrigerated, and oropharyngeal swelling after consumption of a cold drink. Anaphylaxis had not occurred, but the presence of respiratory involvement meant she was advised by an immunologist

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