Intrapartum Seizure in a Patient Undergoing Cesarean Delivery: Differential Diagnosis and Causative Factors

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This case describes the unusual occurrence of grand mal seizures in a 28-year-old patient undergoing a repeat cesarean delivery during spinal anesthesia. The patient had an absence of preeclampsia. Medical history included a closed head injury with seizures at the time of injury and for a brief time thereafter, with no further seizures in the subsequent 9 years. The patient was treated with fosphenytoin and benzodiazepines. She underwent a postoperative neurologic workup, which included computed tomography, bloodwork, and electroencephalography, and all results were normal. It was determined that the seizure was the result of brain scarring from the previous head injury. A review of the current literature regarding seizures in the parturient and causative factors for this patient are discussed.

Keywords: Cesarean delivery, closed head injury, seizures, traumatic brain injury.

Expect the unexpected! As anesthesia providers, this could be our mantra. A scheduled repeat cesarean delivery in a healthy patient is usually a joyous occasion. As anesthesia providers, we prepare a patient to undergo an operation that results in the birth of a new life, and the atmosphere is generally celebratory. Most often, surgery proceeds in a predictable manner and after the baby is delivered, we breathe a sigh of relief. We chat with the parents, complement them on their beautiful child, and sometimes even serve as an amateur photographer. However, what happens when the “healthy” patient has an unexpected complication? A routine repeat cesarean section can become anything but “routine.”

Case Summary
A 28-year-old, 80-kg, 150-cm-tall white woman (gravida 3, para 1) presented for an elective second cesarean delivery at 38 weeks’ gestation. Preoperative assessment was performed the morning of surgery by the attending anesthesiologist, with a review before surgery by the Certified Registered Nurse Anesthetist (CRNA) and student registered nurse anesthetist administering the anesthetic. The patient had reported allergies to sulfonamides, penicillin, cephalaxin, and magnesium. Her current medications included prenatal vitamins and ranitidine. Surgical history included a splenectomy, pelvic fracture pinning, lithotripsy, dilatation and curettage, and a cesarean delivery performed under spinal anesthesia 3 years previously. There were no reported complications with previous anesthetics. A review of systems revealed that she smoked a half pack of cigarettes a day, had mitral valve prolapse, and experienced nausea and heartburn with pregnancy. She had a history of renal lithiasis.

Ten years earlier the patient was involved in a motor vehicle accident, sustaining a closed head injury with a depressed skull fracture, pelvic fracture, and splenic rupture requiring surgical care. She has residual hearing loss in the right ear and a subsequent history of depression. The patient experienced generalized tonic-clonic (grand mal) seizures at the time of injury, requiring treatment with phenytoin for a “couple of months.” She stated that her last seizure was 9 years ago. When questioned about the magnesium allergy, the patient said she had received the medication following her head injury, and she experienced “paralysis” on 1 side of her body. Preoperatively, the patient was anxious and complained of a mild headache. She stated that she had a history of migraines but denied any medications for management.

The patient had received prenatal care throughout the pregnancy, commencing at 8 weeks’ gestation. There were no problems reported throughout the pregnancy, with normal results for glucose tolerance, urinalysis, blood pressure (BP), and other laboratory values according to her prenatal record. Preoperative physical assessment revealed clear bilateral breath sounds, regular heart rate and rhythm, cuff BP of 130/76 mm Hg, heart rate of 96/min, respiratory rate of 18/min, and arterial oxygen saturation (SaO2) of 99%. Preoperative hemoglobin and hematocrit were 9.3 g/dL and 29.1%, white blood cell count was 13.3, and platelet count was 630. Airway assessment revealed a Mallampati class 2.

The patient consented to a spinal anesthetic with intrathecal narcotic for postoperative pain management. Preanesthetic medications consisted of sodium bicarbonate (30 mL orally), metoclopramide (10 mg intravenously), clindamycin (600 mg), and gentamicin (100 mg intravenously) according to pharmacy infusion protocol. Lactated
Ringer’s solution was infusing intravenously, with 1,400 mL given before placement of the spinal anesthetic.

In the operating room, standard monitors were applied. The spinal was performed with the patient in a sitting position. After preparation of the back with povidone-iodine (Betadine) and sterile draping, skin and subcutaneous tissue were injected with 1% lidocaine and a 25-gauge Whitacre spinal needle was introduced at the L3-4 interspace. The cerebrospinal fluid (CSF) was clear, and no paresthesias or blood was noted. A total of 9 mg of bupivacaine in dextrose with 250 μg of preservative-free morphine was injected into the subarachnoid space, and the patient was placed in a supine position with left-sided uterine displacement. Oxygen was administered at 2 L/min by nasal cannula. A Foley catheter was placed by the circulating nurse, the abdomen was prepared and draped, and a spinal block at the T4 sensory level was confirmed before incision.

The patient was anxious throughout the procedure and delivery, requiring constant reassurance by the anesthesia providers. A male infant was delivered 5 minutes after incision with a 1-minute Apgar score of 8. Oxytocin (20 U) was added to the fourth liter of lactated Ringer’s solution and was infused at a rate of 300 mL/h. Immediately after delivery, the patient complained of feeling discomfort and pressure in her abdomen. The surgeon placed the uterus back into the abdomen to improve the patient’s comfort, and her heart rate dropped precipitously, with a ventricular rate of 20 to 30/min.

The anesthetist looked at the patient and observed her pupils spontaneously dilate, and she had an onset of a grand mal seizure. Administration of 100% oxygen via face mask was initiated, and with application of cricoid pressure, the patient promptly received propofol (60 mg) and succinylcholine (100 mg) intravenously, and the trachea was intubated with a 7-mm endotracheal tube on the first attempt. After the onset of the seizure, the patient’s heart rate increased to approximately 110/min, with a BP of 130/72 mm Hg, and 100% SaO2. Immediately after delivery, the patient complained of feeling discomfort and pressure in her abdomen. The surgeon placed the uterus back into the abdomen to improve the patient’s comfort, and her heart rate dropped precipitously, with a ventricular rate of 20 to 30/min.

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The patient experienced a second grand mal seizure approximately 10 minutes later while under general anesthesia. The patient's end-tidal carbon dioxide level was 35 mm Hg and SaO2 was 100% before the seizure. Diazepam, 10 mg, was administered intravenously to help prevent further seizure activity. The neurologist ordered a loading dose of 1 g of fosphenytoin and 2 mg of lorazepam intravenously.

The operation was completed approximately 10 minutes after the second seizure, and the patient was transported to the intensive care unit (ICU), intubated, and ventilated. Vital signs remained stable throughout the transport and recovery period. Brain computed tomography (CT) with and without contrast, electroencephalography (EEG), and comprehensive laboratory tests were performed postoperatively. The results of the CT scan showed no abnormalities, the EEG results showed a normal drowsy examination, and results of all laboratory work were within the normal range with the exception of a mild anemia (hemoglobin level, 8.8 g/dL).

The patient was extubated but slightly drowsy within 3 hours of surgery. She had no recall of the experience. The patient’s mother was present in the ICU during the initial postanesthesia visit. She described the patient’s previous head injury in greater detail than had been given preoperatively by the patient herself. The mother stated that her daughter had suffered a 30-minute seizure at the time of her head injury, had been comatose for several days, and had seized several times during the course of a 2-week period. She was prescribed phenytoin for approximately 6 months, before she discontinued the medication because of adverse “side effects.” The mother also described “staring” episodes that her daughter has had since the initial head injury. In addition, she stated that her daughter had been on a migraine medication, topiramate, until she learned of her pregnancy at about 5 weeks’ gestation.

The patient’s neurologist determined the grand mal seizures to be secondary to intracranial brain scarring. It was also thought that the patient had suffered a vasovagal response, resulting in cerebral hypoperfusion, which led to the seizure. The patient was discharged 3 days postoperatively, on a regimen of topiramate, 50 mg twice daily, increasing to 75 mg twice daily after 1 week.

Seizure Disorders

It has been estimated that seizure disorders affect nearly 1.1 million women of childbearing age in the United States. Approximately 1% of pregnant women will suffer a seizure, and the initial seizure can present in the antepartum, intrapartum, or postpartum period. Seizures are a relatively rare occurrence in pregnant patients undergoing an anesthetic. The most common cause of seizures during pregnancy is preexisting epilepsy, followed by eclampsia as the second most common cause. Epilepsy has been defined as recurrent seizures resulting from congenital or acquired factors, affecting approximately 0.6% of the population. There are other, less common causes of seizures in pregnancy as well. The differential diagnosis of the seizure cause must be performed in order to provide optimum treatment.

Seizures occurring in a pregnant patient are generally assumed to be caused by eclampsia until other causes can be ruled out. Patients with a history of previous seizures may have a higher risk of suffering a seizure during pregnancy because of the physiologic changes of pregnancy or because of elective cessation of anticonvulsant
medications. It is essential that the anesthesia provider be able to make a rapid determination of the likely cause of a seizure when it occurs, in order to optimize treatment to reduce the risk of morbidity to the patient. A detailed history of previous seizures should be obtained, and appropriate seizure precautions should be considered.

**Review of the Literature**

A National Library of Medicine MEDLINE search was performed using the following keywords: pregnancy, intrapartum, postpartum, seizures, anesthesia, obstetrics, cesarean delivery, and convulsions. In addition, a literature review was performed for the terms seizure disorders, risk factors, post-traumatic seizures, closed head injuries, shearing injuries, and epilepsy in order to specifically address this case study.

Very few cases have been reported in the literature describing intrapartum seizures occurring in patients during cesarean delivery. One report from 1962 described a convulsive seizure during a cesarean delivery of a woman who had undergone a spinal anesthetic. The exact cause of her seizure was not determined, although it was thought to be cerebral anemia and a possible effect of the local anesthetic on the brain itself. The patient had no signs of eclampsia and had never suffered a prior seizure.

In another case, a patient receiving a subarachnoid block for a spontaneous vaginal delivery suffered a grand mal seizure approximately 5 hours after delivery. The patient had received 10 U of oxytocin and 0.2 mg of methylergonovine maleate in a single intravenous dose, followed by an infusion of 5% dextrose in water (D5W) with 10 U of oxytocin added. The patient experienced a severe headache after delivery; treatment with diazepam and morphine as well as phenobarbital did not relieve the symptoms. She seized and was treated with further administration of phenobarbital. The patient had a workup that showed no eclampsia and normal BP readings. The cause of the seizure was determined to be the oxytocin and the ergot injection.

A patient receiving general anesthesia with sevoflurane for an emergency cesarean delivery because of umbilical cord prolapse suffered a generalized tonic-clonic seizure during emergence. The postoperative neurologic findings were normal, and it was determined that the patient was not eclamptic. Sevoflurane, which has been reported to have epileptogenic potential, was determined to be the trigger for the seizure. It was believed that the high levels of progesterone seen in pregnant patients make the central nervous system more sensitive to epileptogenic medications.

Two cases of seizures in patients receiving epidural anesthetics were reported. The first case involved seizure activity in a patient who received 20 mL of 0.5% bupivacaine for epidural anesthesia followed by meperidine, 10 mg/h, with an initial 10-mg bolus. Nine hours postoperatively, the patient suffered a generalized tonic-clonic seizure, which was treated with diazepam. The patient had a workup that showed no eclampsia or neurologic abnormalities, and had no history of seizure activity. Buildup in the CSF of normeperidine, an active metabolite of meperidine, was believed to be the cause of the seizure.

The second case described a 29-year-old woman with a twin pregnancy who received an epidural anesthetic for management of labor pain during delivery of the second twin by cesarean delivery. There were no complications reported with placement of the epidural anesthetic, and the patient had no history of preeclampsia. A constant headache developed on the third day postpartum, which did not fit the criteria of a postdural puncture headache. On day 7 after delivery, she had a sudden worsening of her headache, with visual involvement and fever. She suffered 2 tonic-clonic seizures, which were treated with diazepam. Results of all neurologic, blood, urine, CSF, and radiologic tests were normal. The cause of this patient’s headache was never completely determined, but it was suspected that the patient may have had a late eclamptic seizure.

Other cases of late onset of postpartum eclampsia have been reported. Veltkamp et al described 2 different cases of eclampsia occurring in patients 9 days postpartum. Both patients experienced severe headache with visual disturbances and hypertension, followed by generalized tonic-clonic seizures. Neither patient had symptoms of preeclampsia during pregnancy. The magnetic resonance imaging (MRI) findings for these patients did not reveal “characteristic” findings seen in eclampsia until days after the onset. The authors suggest that late-onset postpartum eclampsia may not present with the classic symptoms of preeclampsia.

Another case of late postpartum seizures occurred in a 40-year-old woman who presented 4 days after delivery with a complaint of headache and fever and was treated for a possible pelvic infection with antibiotic therapy. She continued to have the headache, which worsened until postpartum day 14, when she experienced multiple seizures. Physical findings and workup showed protein-uria and bilateral hyperreflexia with clonus, and an MRI of the brain demonstrated bilateral, symmetrical, multifocal cortical and subcortical abnormalities. The patient was treated with magnesium sulfate infusion and antibiotics until further tests were completed, all of which had normal results, including lumbar puncture. She recovered fully, and her MRI 8 weeks later was normal. The cause of her seizures was determined to be encephalitis. Despite the lack of positive verification by diagnostic tests, it was believed that the resolution of the symptoms was the result of antibiotic therapy.

Vercauteren et al described a case of seizures developing 3 days postpartum in a 32-year-old patient who had been administered an epidural anesthetic for management...
of labor pain. The patient started to complain of a severe headache 2 days after delivery, which was followed by a seizure. A diagnostic lumbar puncture showed slightly hemorrhagic CSF. She had neck pain, nausea, visual disturbances, and increasing discomfort in the erect position. A CT scan of the brain, cerebral arteriogram, and all laboratory results were normal. The patient had increasing discomfort that appeared to be a posidural puncture headache. She received an epidural blood patch 48 hours after the onset of symptoms, with complete resolution of the headache and all symptoms within 10 hours. It was suggested that this patient had postlumbar puncture cephalgia, with possible small amounts of cortical bleeding, resulting in headache and seizure.11

Seizures have been described in a parturient who was otherwise healthy and in the 28th week of pregnancy.12 This patient experienced a headache with nausea, followed by a generalized tonic-clonic seizure. She was initially treated with intravenous magnesium sulfate and had repeated seizures, although she had no history of pre-eclampsia. The patient required an emergency cesarean delivery performed under general anesthesia. Postoperative diagnostic studies revealed abnormalities on the brain CT scan that were indicative of posterior reversible encephalopathy syndrome. This syndrome is a relatively new disorder that can be identified by neuroradiography. It is characterized by an acute headache; nausea and vomiting; visual disturbances; behavioral changes such as restlessness, agitation, and confusion; seizure; stupor; neurologic deficits; and coma. It is common for patients to experience multiple seizures. This condition has been reported in parturients, with preeclampsia and eclampsia being a frequent causative comorbidity.12

Discussion
Seizures can be defined as “abnormal electrical activity associated with certain behavioral and neurologic effects.”4 The cause of a seizure can be idiopathic or acquired, with multiple factors contributing to seizure activity. A seizure occurring in an obstetric patient is assumed to be caused by eclampsia unless the patient has other known seizure disease. Seizures are the most common neurologic complication seen in pregnant women.2

During pregnancy, women with a history of seizures can be at a higher risk of seizure activity.2,13,14 There are many theories as to why this increase in seizures can occur. Physiologic changes, such as chemical, behavioral, and hormonal factors, can contribute to increased seizure activity. Emotional reactions resulting in increased heart rate and respiration can cause a release of neurotransmitters that affect brain homeostasis.14 Sleep deprivation, anxiety, and physical stress have also been linked to increased seizure frequency.13,15

Because of changes in pharmacodynamics during pregnancy, anticonvulsant medications can be less effective. Blood levels of anticonvulsants can be affected by nausea and vomiting, altered protein binding, delayed gastric emptying, folic acid supplementation, increases in plasma volume and distribution, and increased renal clearance.2,13 Pregnant patients require careful titration of their medications to ensure therapeutic blood levels.

Patient noncompliance with anticonvulsant medications can increase during pregnancy because of fear of fetal malformations. Many anticonvulsant medications have been linked to birth defects. Newer medications appear to be safer, particularly if pregnant patients are limited to treatment with a single anticonvulsant medication.2,16 Because of the risk of fetal anomalies, this patient stopped her topiramate treatment shortly after she became pregnant because she was taking it solely to prevent migraine headaches. Interestingly, migraine headaches can be compared physiologically to seizures and are often treated with anticonvulsant medications.15

Patients with a previous history of traumatic brain injury (TBI) can be at an increased risk for seizures, depending on the severity of the initial injury. Nearly 20% of seizures are the result of TBI.17 Patients with a history of severe TBI can have an increased risk of seizures for 20 years or longer after injury.18,19 Late seizures are more likely to occur in patients with TBI who experience immediate seizures at the time of injury; skull fractures; diffuse axonal injuries (shearing); penetrating injuries; amnesia longer than 24 hours; Glasgow Coma Scale score less than or equal to 10; intracerebral, epidural, or subdural hematoma; and cortical contusions.18,20 The patient in this case study had several of these risk factors, and it was later discovered that she had been experiencing absence seizures, although she had not suffered a generalized tonic-clonic seizure in many years.

Seizures occurring in the peripartum period are frequently attributed to eclampsia until proved otherwise. Eclampsia is the development of seizures in a preeclamptic patient. The incidence of eclampsia in the United States is 0.1% to 0.4% of pregnancies, although preeclampsia occurs in 6% to 8% of pregnant women.15 Preeclampsia is recognized as a classic triad of proteinuria, hypertension, and edema. Patients can lack any of these symptoms and still have preeclampsia.2,13 Eclampsia usually develops in the third trimester of pregnancy; however, it can occur in the postpartum period. Cerebral imaging with CT or MRI will show cerebral edema. Treatment of eclampsia is delivery of the fetus as soon as possible and administration of magnesium sulfate.2

In addition to epilepsy and eclampsia, there are other possible causes of seizures in the parturient. Any condition that affects the physical environment of the brain can contribute to seizures.15 Intracranial neoplasms or hemorrhage, cerebral vein thrombosis, local anesthetic toxicity, encephalitis, and amniotic fluid embolus can all cause seizures in the obstetric patient.16,21 The different-
tial diagnosis requires obtaining bloodwork and cerebral imaging in addition to patient history.²

This case study presented an unusual development of a seizure in a peripartum patient. The patient exhibited no history of preeclampsia during her prenatal period. She had a remote history of seizures following a closed head injury nearly a decade previously. The preoperative anesthetic evaluation revealed little to suggest that this patient was at high risk of seizures. History obtained postoperatively from the patient’s mother revealed factors that placed the patient at a high risk of seizures, to include the severity of the previous TBI, discontinued anticonvulsant therapy, and the history of absence seizures.

Treatment of the seizure in the operating room was also a dilemma. Stabilization of the patient and securing the airway was the immediate concern. Administration of benzodiazepines was initiated to decrease the risk of recurrence of seizures. Magnesium sulfate was not considered an option as the patient had experienced an adverse reaction to the medication in the past, although it is likely that it was a complication of overdose. Consultation with a neurologist resulted in further treatment with benzodiazepines and initiation of fosphenytoin. The preliminary diagnosis was that the seizure was a result of a decreased seizure threshold and the previous TBI. Therefore, treatment was based on this, pending the results of testing.

Seizures rarely occur in patients undergoing anesthesia. Many of the medications that we anesthesiology providers administer during an anesthetic decrease the likelihood of a seizure occurring, even in patients with active seizure disorders. This case highlights the importance of having a complete understanding of the possible effects of a previous TBI. Patients may not always understand the need to divulge all of their medical history during a preanesthetic assessment, and we sometimes fail to probe deeply enough. However, even with the additional information that was provided by the patient’s mother postoperatively, a seizure may not have been prevented in this patient. Treatment of this patient’s anxiety with a benzodiazepine after delivery may have helped to prevent a seizure, although the elevated risk of seizure was unknown. Routine administration of a benzodiazepine during cesarean delivery is usually avoided because of the amnesia that generally occurs, and most patients wish to remember their birth experience. However, an anxious patient with an elevated seizure risk may benefit from benzodiazepines after delivery.

The choice of sevoflurane anesthesia may have contributed to the second seizure, although the concentration used in this patient (0.5% to 0.9%) was much below values described as being epileptogenic (>1.5 minimal alveolar concentration, or MAC).³⁴ Use of either desflurane or isoflurane would have been a better choice in this patient.

In summary, peripartum seizures in a parturient are a rare occurrence. Seizures in the pregnant patient are assumed to be eclampsia unless other causes are known. Patients with a history of seizures can experience an increase in seizure activity during pregnancy. A thorough preanesthetic assessment can reveal risk factors for seizures that can assist in making an accurate differential diagnosis of the cause of a peripartum seizure.

REFERENCES


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