

Case Report

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Anesthesia in a Pregnant Patient with Multiple Sclerosis and Spinal Fusion



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Abstract

We report the case of a 36-year-old pregnant female with multiple sclerosis and a lumbar spinal fusion who presented at 36 weeks with fetal distress. We were successfully able to provide general anesthesia for this patient's emergent cesarean section. We discuss and review multiple sclerosis in pregnancy and hope to benefit medical knowledge in providing anesthesia care to this unique patient population.

Keywords: Anesthesia; Pregnancy; Multiple sclerosis; Neuraxial anesthesia; Sugammadex

Abbreviations: ASA: American Society of Anesthesiologists; ASRA: American Society of Regional Anesthesia and Pain Medicine; CNS: Central Nervous System; CT: Computed tomography; FDA: Food and Drug Administration; IVIG: Intravenous Immunoglobulin; MRI: Magnetic Resonance Imaging; MS: Multiple Sclerosis; RSI: Rapid Sequence Induction

Introduction

Multiple sclerosis (MS) is a T-cell mediated autoimmune disease affecting the central nervous system (CNS) characterized by inflammation and demyelination of nerve fibers that can result in a variety of neurological deficits depending on the areas affected [1]. Demyelination sites may be random, but often include the optic nerve leading to visual disturbances such as diplopia, cerebellum leading to ataxia, and spinal cord leading to both weakness and dysesthesias [2]. Most commonly the disease course is one of exacerbations and remissions with the overall progressive worsening of symptoms overtime. Diagnosis is usually clinical with subsequent confirmation by CT/MRI imaging of demyelinating plaques, CSF laboratory findings of elevated immunoglobulin levels, and a radioimmunoassay demonstrating elevated myelin protein. The incidence of multiple sclerosis in women is twice that of men and for reasons unknown, there is a higher incidence of MS in the northern temperate zones and a lower incidence near the equator. Notably the peak age of disease onset is during a woman's childbearing years. As such, obstetric anesthesiologists will likely manage this unique patient population at some point in their career. Moreover anesthesia for patients with multiple sclerosis can be complicated in the setting of obstetrics where neuraxial anesthesia is routinely provided. Consent for publication of this case report was obtained from the patient.

Case History

A 36-year-old female (height, 68 in; weight, 103 kg; and body mass index, 35 kg/m²), Gravida 4 Para 3003, with a history

of multiple sclerosis, chronic back pain with L5-S1 posterior spinal fusion with titanium rods and L4-L5 intervertebral disc space, depression, controlled asthma, and gestational diabetes presented at 36 5/7 weeks after feeling irregular contractions at home. The patient's vital signs were within normal limits. There was nothing remarkable on social history. Her preoperative medications included oral steroids, acetaminophen with codeine, cyclobenzaprine, and gabapentin for back pain, as well as citalopram for depression. Her preoperative labs and her airway exam were overall unremarkable. Importantly, her preoperative neurologic exam was without any obvious limitations or deficits. Regarding her multiple sclerosis, the patient was diagnosed by MRI 5 years prior to pregnancy. Her initial symptoms were loss of hearing and stability/gait and she described her relapses as episodes of heat and pain in her lower extremities. After multiple different treatments, her disease was effectively managed into remission with alemtuzumab (beta interferon), which she started annually in 2016 at the recommendation of her rheumatologist. Prior to her spinal fusion she had undergone 3 spontaneous vaginal deliveries without complications. However, according to her as well as the obstetric team, her orthopedic surgeons advised against vaginal delivery in order to avoid any damage to the instrumentation in her back.

Not long after her presentation to us, she underwent a semi-urgent caesarean section under general anesthesia for fetal distress at 36 weeks gestation. Rapid sequence induction and tracheal intubation was performed with 1mg/kg of rocuronium while electively using a Glidescope for laryngoscopy. After 30 minutes,

she was reversed with 8mg/kg of sugammadex for 0/4 twitches on train of four monitoring. The c-section was complicated by post-partum hemorrhage, however, not requiring transfusions. Moreover, the patient successfully underwent tracheal extubation and had an uneventful and immediate recovery. The obstetric team, in collaboration with the rheumatologist, had planned to treat any acute exacerbations of multiple sclerosis with IV methylprednisolone 500:1000 mg daily for 3-5 days, followed by oral prednisone taper for 2 weeks, if needed. Fortunately the patient did not require this.

Upon our follow up, however, she noted that her multiple sclerosis went into relapse just over 1 month after pregnancy. She stated that she is still pending alemtuzumab treatment, which her rheumatologist intends to resume once her diabetes is under control.

Discussion

As anesthesia providers are becoming more involved with the ASA perioperative surgical home, patient-centered model of care, the preoperative, intraoperative, and postoperative management of pregnant patients with multiple sclerosis is becoming of significance. In addition to treating these patients as anesthesia providers would treat any obstetric population, certain aspects of the disease process should be known. Firstly, although pregnancy is usually protective in MS, with an estimated 70% reduction in relapse risk during pregnancy, there is a significant increased relapse rate postpartum, up to 50% in the first 6 months [3]. The exact reasons for this still need to be elucidated, however, the thought is that it is due to the loss of antenatal immunosuppression post-partum and decreasing hormonal levels, particularly progesterone.

Although most patients with MS may be asymptomatic during their pregnancy, it should be known that the disease may be exacerbated by stress, infection, anesthesia, and changes in core body temperature, particularly hyperthermia. This is why temperature monitoring is especially important for anesthesia providers, in cases of both general and neuraxial anesthesia [2]. In fact, no particular anesthetic agents and inhaled gases have been implicated as contributing to the progression of MS but increased body temperature is more likely to worsen symptoms. Treatments for MS include immunomodulating agents including beta-interferon, intravenous immunoglobulin (IVIG), glatiramer (synthetic myelin basic protein), mitoxantrone, azathioprine, and methotrexate. However, not all of these are FDA-approved and determined clinically safe during pregnancy. The patient described in this case had previously been on glatiramer and two different beta-interferon agents prior to her trial period with alemtuzumab, which turned out to be effective for the patient. Her rheumatologist discontinued this once the patient discovered she was pregnant. As of now, only corticosteroids and intravenous immunoglobulin are considered safe during pregnancy and lactation [4]. The plan for treating any acute exacerbations in the above patient was corticosteroids.

Furthermore, it is well known that obstetric patients receiving general anesthesia are treated as if they are “full stomach.” In these cases, succinylcholine is most often utilized for purposes of rapid sequence induction (RSI). In the setting of MS, however, the potential upregulation of acetylcholine receptors related to prolonged muscle weakness can then lead to exaggerated potassium release after the administration of succinylcholine. Thus with respect to providing muscle relaxants in the setting of multiple sclerosis, particularly in those patients suffering from severe neurologic deficits, succinylcholine administration has been associated with hyperkalemia and should be avoided. The most common muscle relaxant alternative is rocuronium at RSI dosing. Administration of rocuronium, however, requires reversal at the end of a short cesarean section case due to concern for residual neuromuscular blockade, particularly in MS patients whose respiratory muscle strength might already be compromised as a result of their illness, even when not under the effects of general anesthesia. MS patients’ response to non-depolarizing neuromuscular blockers like rocuronium appears to be unpredictable as both sensitivity and resistance have been described, requiring train-of-four monitoring to appropriately re-dose rocuronium as well as reversal with sugammadex [5,6].

Sugammadex is a gamma cyclodextrin that can reverse the effects of rocuronium by encapsulating rocuronium molecules in a 1:1 binding ratio, accounting for its ability to reverse deeper neuromuscular blockade from rocuronium than neostigmine would have been able to [7]. Neostigmine, a cholinesterase inhibitor, works by indirectly increasing acetylcholine concentration in the neuromuscular junction in the hopes of displacing a muscle relaxant from the acetylcholine receptor [7]. As a result, cholinesterase inhibitors require a certain level of recovery of neuromuscular function in order for the reversal to work. In a 2014 case report by Sinikoglu et al, sugammadex was repeatedly used for a total of 6 times in an MS patient within a short time period without any acute complications and no changes in its effectiveness. Similarly, sugammadex was used for reversal in our postpartum patient without any complications.

The issue of neuraxial techniques in MS patients is controversial, with ambiguous guidelines by the American Society of Regional Anesthesia and Pain Medicine (ASRA) 2008 practice advisory neither confirming nor refuting the safety of neuraxial anesthesia in patients with CNS disorders, nor does it definitively address the relative safety of spinal vs epidural anesthesia. It is believed that neuraxial techniques can potentially exacerbate MS1 and that spinal anesthesia or epidurals with higher local anesthetics concentration are more likely to be associated with MS exacerbations [2]. As such, although neuraxial anesthesia is not contraindicated, the lowest effective concentration of local anesthetic and opioid doses are recommended [8].

According to a 2016 systematic review of neuraxial anesthesia in patients with MS by Helmar et al, “current clinical evidence does not support the theory that central neuraxial analgesia negatively affects the course of MS” and that MS symptoms tend

to improve with pregnancy and are then exacerbated postpartum, worsening of symptoms could also be due to the normal course of the disease. Neuraxial anesthesia, nor general anesthesia for that matter, has definitively shown to contribute to the increased relapse rate post-partum. Given this patient's history of surgery in the L4-S1 space where ideally spinal or epidural anesthesia could be administered for a caesarian section, we decided to proceed with general anesthesia. It is possible we could have attempted a neuraxial technique higher in the lumbar spine, for example L2, however given the emergent nature of the surgery and the increased risk of aspiration in pregnant women, a general anesthetic was provided with a rapid sequence induction. As alluded to before, succinylcholine had to be avoided given the theoretical risk of hyperkalemia and so rocuronium was provided with subsequent reversal with sugammadex. This unique case highlights the importance of a multidisciplinary approach and the collaborative effort needed to take of patients in uncommon diseases such as multiple sclerosis.

Conflicting Interest

None.

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