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Multiple sclerosis an chronic demyelinating disease and anesthesia management

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Abstract

Multiple sclerosis (MS) is an immune-mediated disease of the central nervous system (CNS) and the most common chronic demyelinating disease affecting approximately 2.8 million people worldwide. Its high prevalence worldwide makes it probable for an anesthesia professional to take care of a patient diagnosed with MS at some point during their career. MS is an immune-mediated disease characterized by inflammation, demyelination, and axonal damage in the central nervous system. The course of MS is characterized by exacerbations and remissions at unpredictable intervals over a period of several years. Progression of disability due to MS is highly variable among patients. General, epidural, and spinal anesthesia are generally deemed safe when used in patients with the disease. General anesthesia is the most common anesthetic technique used. There is more controversy surrounding spinal anesthesia, but it seems spinal anesthesia can be administered safely without any additional increased risk of disease relapse. The purpose of the preoperative assessment is to ensure the patient undergoes a safe and adequate anaesthetic experience by selecting the most suitable type of anaesthesia. This assessment must include the full documentation of the neurological deficits detailed by the neurologist in charge of the patient. The use of an established score such as the "Expanded Disability Status Scale" score or "EDSS" score should also be used in order to evaluate the degree of disability. Besides neurological data, the preoperative assessment conducted by the anaesthesiologist should also document any respiratory, cardiac, renal, hepatic, autonomic or any other medical comorbidities. There is a lack of published guidelines on the management of patients with multiple sclerosis (MS) undergoing procedures that require anaesthesia. The anaesthetic management covers preoperative assessment, choice of anaesthetic techniques and agents, side-effects of drugs used during anaesthesia and their potential impact on the disease evolution and drug interactions. The choice of the anaesthetic technique used should be made after careful assessment of the risks and benefits for each specific patient and his preference must also be considered. The association of general anaesthesia and epidural with low concentrations of local anaesthetic are considered safe. Post-operative MS relapses are not affected by the choice of the anaesthetic technique, and that all techniques, including general anaesthesia, may be safely used.

Keywords: Multiple Sclerosis; MS Relapses; Disability; Neurological Condition; Anesthesia

1. Introduction

Inflammation, demyelination, and axonal damage are the major pathologic mechanisms that cause clinical manifestations. The characteristic neuropathology of MS is the presence of focal demyelinated plaques within the central nervous system with variable inflammation and scarring (gliosis) that can be seen on magnetic resonance imaging (MRI). The varying location of plaque formation dictates the clinical manifestations that patients may have. Brainstem and cranial nerve involvement can lead to optic neuritis, diplopia, and trigeminal neuralgia. Cerebellar involvement can cause vertigo and gait disturbances. Cerebrum and spinal cord involvement causes cognitive dysfunction, limb paresthesia, motor weakness, and bladder dysfunction. Symptoms of MS can eventually persist and lead to severe disability from visual loss, ataxia, skeletal muscle weakness, incontinence, and paralysis. Multiple sclerosis is a demyelinating disease of the CNS that has implications for anaesthesia. Triggers of MS relapses include

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infections and fever of other causes, while surgical procedures and emotional stress are still controversial. The interdisciplinary management of MS should optimise medical follow-up and allow him/her to be fully informed. Treatment goals include decreasing relapses and magnetic resonance imaging activity while minimizing permanent disability [1-6].

2. Relapsing multiple sclerosis

MS is an acquired demyelinating neurological condition characterized by neurological remission of the symptoms, followed by neurological deficit and progressive disability as time passes. Relapsing Multiple Sclerosis (RMS) is characterised by acute episodes of neurological dysfunction, that are not triggered by infections or raised temperature or other metabolic change, with partial or complete remission. Secondary Progressive Multiple Sclerosis, which is characterised by chronic deterioration of neurological function without remission. Primary Progressive Multiple Sclerosis, evolution from onset. In addition, the Clinically Isolated Syndrome while radiologically isolated syndrome can be considered as a MS pre-stage syndrome. The symptoms people with MS describe are numerous and varied, depending on the regions of the CNS affected. There is no unique clinical phenotype. Frequently observed problems include impaired eyesight, impaired balance and coordination, motor and sensory abnormalities, fatigue, urinary and faecal incontinence and cognitive impairment. Genetic and environmental factors is thought to be involved in people developing MS. Multiple sclerosis is a type of demyelinating encephalomyelitis of the central nervous system with symptoms affecting sensory and/or motor nerves that typically undergo a relapsing/remitting course. Neurological dysfunction characterizes the common symptoms of MS, which include paralysis, sensory disturbances, autonomic disturbances, lack of coordination, and visual impairment. Patients with multiple sclerosis (MS) are at an increased risk for exacerbation of their signs and symptoms in the postoperative period. A thorough preoperative neurological assessment is critical to assess for worsening of signs and symptoms in the postoperative period. The neurological assessment must cover the clinical presentation of the disease, the most recent MRI results, the duration of the disease, the presence/absence and timing of the last acute exacerbation or MS relapse, as well as a complete clinical examination evaluating the degree of neurologic impairment. Risk factors that trigger multiple sclerosis relapses include infection, fever and trauma, while surgery itself and emotional stress are more controversial. Certain medications used by patients with multiple sclerosis, such as baclofen or clonazepam may trigger OSA by causing excessive relaxation of the pharyngeal muscles. Prolonged steroid therapy, eventually used for other comorbidities, needs to be avoided since it may lead to muscle wasting and osteoporosis and hence increase the risk of injury. The main treatment goal for an acute exacerbation of MS is to reduce the recovery time. Corticosteroids are used for acute relapses for their immunomodulatory and anti-inflammatory properties to improve axonal nerve conduction, decrease edema, and restore the blood-brain barrier. Adrenocorticotropic hormone (ACTH) is an alternative for patients who do not respond to or tolerate corticosteroids. ACTH stimulates endogenous corticotropin production to regulate anti-inflammatory and immunomodulatory functions. Plasmapheresis is considered second-line therapy for MS and aims to remove pathogenic antibodies and proinflammatory mediators from the circulatory system. Patients with relapsing-remitting MS should begin disease-modifying therapy (DMT) to decrease relapse rate and slow the accumulation of CNS lesions. High efficacy DMTs include monoclonal antibodies such as natalizumab, ocrelizumab, and ofatumumab. The main disadvantage of these therapies is the risk of severe adverse events including serious infections and breakthrough disease with cessation of therapy. Low risk DMTs include interferon beta and glatiramer. The advantage of initiating therapy with these DMTs is the long-term evidence of safety and rarity of serious adverse events [7-24].

3. Anesthesia considerations

Preoperative Assessment: A thorough history and physical examination is necessary to determine an appropriate anesthetic plan and safe postoperative management. A comprehensive preoperative evaluation should assess the patient's baseline neurological signs and symptoms, triggers, progression of disease, and medications. Regarding baseline impairment, MS can cause respiratory dysfunction, autonomic nervous system dysfunction, and conduction abnormalities. The broad spectrum of medications that patients with MS can be treated which can create many potential anesthetic drug interactions perioperatively. If patients were treated with oral or intravenous corticosteroids recently for an exacerbation, the anesthesiologist should consider stress-dose steroids. Muscle relaxants, specifically baclofen, can cause muscle weakness and increased sensitivity to nondepolarizing muscle relaxants. Preoperative testing is usually dictated by patient comorbidities. General anaesthesia has been considered as controversial considering its potential to induce a relapse. Neuraxial blockade are also controversial in MS, as local anaesthetics used in the presence of a damaged blood-brain barrier and demyelinated axons are theoretically more likely to generate neurotoxicity. However, neuraxial blockade has never been associated with any complications. Multiple sclerosis relapses after epidural anaesthesia were related to higher concentrations of local anesthetic administered for longer periods of time. Epidural and subarachnoid anaesthesia are not contraindicated, provided the doses of local anaesthetics used are kept

to a minimum. Historically, the use of regional anesthesia techniques for this population of patients has been contraindicated for fear of further deteriorating the neurological evolution (patients with a history of neurological involvement may be more susceptible to injury when exposed to a secondary insult such as mechanical trauma, toxicity of the local anesthetic agent, neuronal ischemia). Preoxygenation is important during induction of anaesthesia, as multiple sclerosis lesions may affect the respiratory centres in the medulla oblongata or the cervical or thoracic spinal cord causing diaphragmatic weakness or paralysis and therefore altering respiratory function. There is no preference as regards to the induction agents used (inhalational versus IV). Sevoflurane and desflurane are reported to be safe. Nevertheless, we recommend avoiding the use of nitrous oxide due to its potential to inhibit vitamin B12 metabolites, which play a role in myelin formation and maintenance. There is no relationship between inhaled anaesthetic agents and the development or the aggravation of MS symptoms. Moreover, inhalational anaesthetics do not appear to have adverse effects on nerve conduction. The use of depolarizing neuromuscular blocking agents should be avoided. With nondepolarizing neuromuscular blockers, patients with MS may exhibit a prolonged response if they have skeletal muscle weakness. Pain management with opioids doesn't seem to provoke any modification in the course of the disease. Peri and post-operative spasticity can be easily managed with an association of preoperative oral medications such as baclofen or tizanidine, regional or neuraxial anaesthetic techniques, and intravenous muscle relaxants. A dexmedetomidine infusion, which is a selective α-2 agonist, for postoperative anxiolysis and possible antispasticity effect could also be beneficial. Finally, IV dantrolene, a ryanodine receptor-1 antagonist, was used to control postoperative exacerbated spasticity if needed. Close perioperative monitoring of hemodynamic, respiratory function, neuromuscular and temperature is mandatory. MS may present with respiratory impairment secondary to brainstem or cerebellar dysfunction, resulting in the lack of coordination of the respiratory muscle function. MS may present with respiratory impairment secondary to brainstem or cerebellar dysfunction, resulting in the lack of coordination of the respiratory muscle function. Breathing disorders that need to be identified in MS are obstructive sleep apnea syndrome (OSA), and more rarely central sleep apnea, insomnia or narcolepsy. Baseline autonomic assessment in patients with more advanced disease and those on a large number of medications known to affect the autonomic nervous system. Anesthetic goals include maintaining normothermia, fluid homeostasis, and normal hemodynamics during the perioperative period. In patients with motor weakness or paralysis, succinylcholine should be avoided as it can result in profound hyperkalemia. Spinal anesthesia has been associated with an exacerbation of the disease. General anesthesia, regional nerve blocks, and epidural anesthesia have not been directly associated with exacerbations. Specific attention is required for post-operative complications, infection, delayed wound healing and venous thrombosis [25-37].

4. Discussion

Irrespective of the type of anesthetic performed and medications used, patients are at an increased risk of release in the postoperative period. Complications such as fever and infection have been shown to exacerbate the signs and symptoms of MS. Patients with respiratory involvement at baseline are more susceptible to pulmonary issues such as atelectasis, hypoventilation, and airway obstruction. Blood pressure fluctuations can occur in the postoperative period in patients with autonomic nervous system involvement. Residual motor blockade may be more common in patients with MS. Vigilance is key for safe postoperative management of a patient with MS. There are two main patterns of disease with MS: relapsing-remitting and progressive disease. The relapsing-remitting phenotype of MS accounts for approximately 85% of cases and is defined by MS attacks (flares, relapses, exacerbations) followed by full or incomplete recovery of symptoms. The progressive type is much less common and is characterized by continued deterioration over time. It can be further delineated into the primary progressive and secondary progressive type of MS. Primary progressive MS is the accumulation of disease with occasional plateaus or temporary minor improvements. Secondary progressive MS describes patients with relapsing-remitting disease that eventually develop worsening disease with or without additional flares. There are several case reports associating spinal anesthesia to MS symptom exacerbation, but there have also been studies that show no link between spinal anesthesia and relapses. MS is not a contraindication to spinal anesthesia, but the anesthesiologist should consider the possibility of inciting an MS flare. Epidural anesthesia is considered a safe technique in patients with MS, and several studies in the obstetric population have shown no difference in relapse rate using epidural anesthesia. Peripheral nerve blocks are regarded to be safe in MS, a disease of the CNS, though studies are limited. Regardless of the type of anesthetic and medications used, patients may experience exacerbation of their disease postoperatively. There is no association between the post pregnancy relapse rate and anaesthesia procedures or drugs used.

5. Conclusion

Multiple sclerosis (MS) is a demyelinating disease of the central nervous system characterized by varying initial symptoms such as visual impairment, bowel/bladder dysfunction, trigeminal neuralgia, cognitive problems, gait

disorder, and motor paralysis. The stress of surgery and anesthesia may worsen symptoms and incite an MS flare, but this correlation remains unpredictable. An elevated body temperature has been shown to be a trigger for an exacerbation by causing conduction block in demyelinated nerves, and an increase in body temperature as little as 1 degree Celsius can cause an MS flare. The anesthesiologist should meticulously monitor the patient's temperature and maintain normothermia. Regarding general anesthesia, there is no evidence to suggest superiority between inhaled anesthetics and intravenous anesthetics. No complications have been reported with the use of sevoflurane, desflurane, nitrous oxide, propofol, midazolam, dexmedetomidine, ketamine, and opioids. The use of premedication may be advantageous in patients with MS as stress is a reported trigger for disease exacerbation. Since patients with MS have an upregulation of nicotinic acetylcholine receptors characteristic of upper motor neuron lesions, succinylcholine should be avoided as it can cause a profound hyperkalemic response. With nondepolarizing neuromuscular blockers, patients with MS may exhibit a prolonged response if they have skeletal muscle weakness. The concern with neuraxial anesthesia is the possibility of exposing demyelinated areas of the spinal cord with local anesthetics and their potential neurotoxic effects.

Compliance with ethical standards

Disclosure of conflict of interest

The author has no conflicts of interest to declare.

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