

Multiple Sclerosis

Risk

- Affects more than a half million people in USA, with almost 10,000 new cases every year.

Perioperative Risks

- Worsening of symptoms due to stress or infection
- Aspiration related to bulbar involvement
- Postop mechanical ventilation

Worry About

- Hyperkalemia related to succinylcholine.
- Fever that could exacerbate the disease.
- Pt may come to surgery medically unoptimized.

Overview

- A chronic progressive inflammatory T-cell-mediated demyelinating disease that affects the CNS, with periods of remission and exacerbation.
- Commonly affects more women than men (ratio of >2:1) and peaks between ages 20–40; however, it can also affect children (<0.5%) and the elderly.

Etiology

- Pathogenesis is not fully clear; immunologic, viral (EBV, HHV-6), and environmental factors are involved. The disease is more common in areas away from the equator. Sun exposure and vitamin D may play a role. MS is more common in white than black Americans. HLA associations are present (e.g., A3, B7).

Usual Treatment

- Disease-modifying agents: Interferon beta, glatiramer acetate, natalizumab, fingolimod hydrochloride, dimethylfumarate, and teriflunomide. Flu-like symptoms, elevated liver enzymes, neutropenia, and cardiac arrhythmias (fingolimod) are common side effects.
- Immunosuppressive agents: Mitoxantrone can be cardiotoxic. Other agents include cyclophosphamide, corticosteroids, and IV immunoglobulins.
- Symptomatic treatment: For spasticity, depression, neuropathic pain. This includes baclofen, SSRIs, and gabapentin. Continue all these medications.

Assessment Points

System	Effect	Assessment by Hx	PE	Test
HEENT	Lhermitte sign	Visual disturbances due to optic neuritis	Neck flexion induces electrical sensation	
CNS	Neurologic sequelae	Neurologic symptoms	Uhthoff sign (worsening symptoms by increased body temperature, e.g., with exercise)	MRI CSF analysis
PSYCH	Depression			

Key References: Makris A, Peperopoulos A, Karmanioliou I: Multiple sclerosis: basic knowledge and new insights in perioperative management, *J Anesth* 28(2):267–278, 2014; Dorotta IR, Schubert A: Multiple sclerosis and anesthetic implications, *Curr Opin Anaesthesiol* 15(3):365–370, 2002.

Perioperative Implications

Preoperative Preparation

- Ask pt if symptoms are stable and when he or she last visited the neurologist. Pay special attention to any bulbar symptoms and respiratory system. Inform pt of possible postop mechanical ventilation if significant respiratory compromise is evident.
- Carefully review list of medications and their possible side effects and drug interactions.
- Avoid stressors that exacerbate the disease. This includes pain, anxiety, infection, and hyperthermia.
- Premedicate with midazolam, as it decreases stress. It is believed also to decrease core body temperature through inhibition of tonic thermoregulatory vasoconstriction.
- For unknown reasons, MS is stable during pregnancy but worsens postpartum.
- Consider aspiration prophylaxis.

Monitoring

- Depends on other comorbidities and the risk of surgery. Pay special attention to temperature.

Airway

- Consider RSI to avoid aspiration or awake fiberoptic intubation for difficult airway.

Preinduction/Induction

- Titrate medications slowly on induction, as there could be an element of autonomic dysfunction.
- If RSI is needed, it is advisable to avoid succinylcholine for possible myopathy-induced hyperkalemia. For ECT, sugammadex can reverse rocuronium very rapidly.
- Spinal anesthesia may exacerbate the disease; better to avoid it. Epidural is safe; however, it is prudent to avoid higher concentrations of local anesthetics. Avoid epinephrine-containing local anesthetics for peripheral nerve blocks to avoid potential vasoconstriction-induced neuropathy.
- IV lidocaine can worsen MS, especially eye symptoms.
- Use multimodal analgesia, especially for pts with pain issues. There is increased risk of OSA and less commonly central apnea (“Ondine’s curse”).
- Consider stress dose of steroids if pt chronically uses high doses.

Maintenance

- Stress on normothermia.
- Inhalational anesthetics and NO are safe to use.
- Careful padding of extremities to avoid exacerbation of peripheral neuropathies.
- Response to muscle relaxant is variable. Titrate to TOF.

Extubation

- Fully awake extubation is preferred, with careful attention to clearing secretions.

Adjuvants

- Duration of most NMBs is shortened by phenytoin and carbamazepine.

Postoperative Period

- Adequate pain control; avoid emotional stressors; avoid overheating the pt; consider incentive spirometry for pts with respiratory dysfunction.

Anticipated Problems/Concerns

- Postop mechanical ventilation
- Aspiration

Multisystem Organ Failure, Lung Dysfunction in

Muhammad Azam

Risk

- 200,000 new cases of ARDS occur annually in USA.
- 0.2% of general surgical pts develop ARDS postop.

Perioperative Risks

- Hypoxemia, hypercarbia, hemodynamic instability.
- ARDS hypoxemia requires ventilator management using high PEEP to achieve adequate oxygenation.
- High PEEP may impede right atrial/right ventricular preload.
- Lower RV preload can reduce stroke volume and cardiac output. This can lead to alveolar hypoperfusion, thus inhibiting carbon dioxide elimination and further worsening hypercarbia and respiratory acidosis.

- Mechanical ventilation modes, such as inverse ratio and pressure control, target oxygenation rather than carbon dioxide elimination, resulting in permissive hypercarbia.
- Mechanical ventilation may cause breath stacking, which can also cause hemodynamic instability.
- Acidosis and dysrhythmias worsen hemodynamic instability.

Worry About

- Mortality: 40% among ARDS alone; >90% for MODS, involving three or more organ failures.
- Poor prognostic factors: Advanced age, impaired immunity, poor prior functional status, resistant organisms, MODS despite adequate therapy.

- Severity of ARDS by Berlin criteria as graded by oxygenation ratio (PaO₂/FiO₂): Mild ≤300 mm Hg; moderate ≤200 mm Hg; severe ≤100 mm Hg.

Overview

- Lung dysfunction in MODS is either ARDS or ALI.
- ARDS is more severe than ALI.
- MODS exists when altered organ function in the acutely ill requires medical intervention for homeostasis.

Etiology

- Pulm conditions (pneumonia, lung contusion)
- Nonpulmonary (sepsis, trauma, transfusions, pancreatitis, DIC)