



## Peripheral nerve block in patients with preexisting neurologic disease

ALAIN BORGÉAT

Balgrist University Hospital Anaesthesiology  
Forchstrasse 340, CH-8008 Zürich,  
Switzerland  
E-mail: alain.borgeat@balgrist.ch

Patients with preexisting neurologic disease present a unique challenge to the anaesthesiologist. Knowledge of the pathophysiology of the disease and the effect of anaesthetic drug therapy on the disease process is essential for the safe management of anaesthesia for these patients. Both active and dormant neurologic diseases may worsen in the perioperative period, independent of the chosen anaesthetic method. However, when regional techniques are used, the cause of postoperative neurologic deficits may be difficult to evaluate as neural injury can be related to a wide variety of reasons, ie, surgical trauma, tourniquet pressure, improper positioning, or anaesthetic technique (1). The possibility of needle-induced trauma, local anaesthetic toxicity, or neural tissue ischemia or damage during regional anaesthesia has led many anaesthesiologists to avoid regional techniques in patients with underlying neurologic diseases.

Many of these patients can benefit from regional techniques. Greater autonomic stability, the ability to provide selective anaesthesia and analgesia, greater hemodynamic stability (especially with peripheral nerve block anaesthesia in patients with concurrent cardiomyopathy), and the avoidance of side effects related to general anaesthetics and opioids are a few of the advantages (2, 3). Careful preoperative neurologic evaluation, evaluation of the risk/benefit ratio, and a comprehensive discussion with the patient about the anaesthetic plan and the possibility of worsening neurologic signs and symptoms unrelated to the anaesthetic technique is important for successful implementation of regional techniques in this patient population.

### INCIDENCE OF NEUROLOGIC COMPLICATIONS RELATED TO REGIONAL ANAESTHESIA

Although perioperative nerve injuries have been well recognized as a complication of spinal and epidural anaesthesia, severe or disabling neurologic complications occur relatively rarely. In 1999, Cheney and colleagues examined the American Society of Anaesthesiologists Closed Claims database to determine what percentage of the claims were related to nerve damage in malpractice cases (4). Of the 4183 claims reviewed, 670 (16%) were anaesthesia-related nerve injuries. Ulnar neuropathies were the most frequently reported, followed by other injuries to the brachial plexus, lumbosacral nerve roots, and spinal cord. The injuries were bilateral in 14% of the ulnar injuries and in 12% of the brachial plexus injuries. The important factor in this analysis is that the incidence of ulnar and brachial plexus injuries was greater with general anaesthesia than with regional anaesthesia (5, 6). Horlocker and co-

workers examined the cause of perioperative nerve injury in a review of 607 patients undergoing 1614 axillary blocks for upper extremity surgery. Various surgical variables (direct trauma, stretch, hematoma, vascular compromise, case of tourniquet ischemia) were thought to be the cause of neurologic complications in the majority of the cases 89 (7).

In the closed Claims Analysis 189 (4%) involved either the lumbosacral root or the spinal cord. Injuries to these areas were more frequently associated with regional anaesthesia. The lumbosacral root injuries were thought to be related to paresthesia during needle or catheter placement or pain on injection of local anaesthetic. The spinal cord injuries were related to blocks for chronic pain or neuraxial blocks on patients receiving systemic anticoagulation. These injuries were not related to the presence of preexisting neurologic disease. In another review of over 50'000 spinal and epidural anaesthetics, the incidence of persistent peripheral neuropathy, including paresthesia and sensory or motor dysfunction ranged from 0% to 0.16% for spinal anaesthetics and to 0.06% for epidural anaesthetics, still appreciably lower than the incidence of nerve injuries reported with general anaesthetic case (8-11).

## PARKINSON'S DISEASE

Parkinson's disease is a disabling neurologic disease affecting 3% of the population older than age 65 years. The peak onset is in the sixth decade, but the disease can begin to manifest from age 20 to age 80 with the male to female ratio 3:2. Parkinson's disease is caused by loss of dopamine-containing nerve cells in the substantia nigra (12). The presence of Lewy bodies, eosinophilic cytoplasmic inclusions in pigmented neurons, are a characteristic feature. The cause of the disease is unknown although multiple theories have been proposed, including a defect in the gene for  $\alpha$ -synuclein, mitochondrial dysfunction, excitotoxicity secondary to persistent activation of *N*-methyl-D-aspartate (NMDA) receptors, and oxidative stress secondary to catabolism of dopamine (12, 13).

### Anaesthetic considerations

Patients with Parkinson disease most commonly present for urologic, ophthalmologic, or orthopedic procedures. In addition to the routine history, physical examination, and preoperative testing, assessment of systems specifically affected by Parkinson disease should be evaluated.

### Regional anaesthesia in Parkinson's disease

Autonomic dysfunction is exacerbated by inhalational anaesthetics, resulting in more hemodynamic instability<sup>14</sup>. Halothane, also less commonly used today, sensitizes the heart to catecholamines and should be avoided in patients on levodopa (14). Isoflurane and sevoflurane are less arrhythmogenic; however, hypotension from catecholamine depletion, autonomic dysfunction, and the co-

administration of other medications remains a concern (14).

Regional anaesthesia may have advantages over general anaesthesia as the effects of inhalation anaesthetics, muscle relaxants, high-dose opioids, and anaesthetic medications that may exacerbate the symptoms of Parkinson's disease are eliminated. By utilizing peripheral nerve block anaesthesia or appropriate segmental epidural anaesthesia with limited sedation, the autonomic instability can be controlled; the incidence of nausea and vomiting limited, and muscle rigidity resulting from doses of narcotics used for general anaesthesia can be avoided. Careful titration of sedation with limited use of opioids is suggested in this patient population.

## ALZHEIMER'S DISEASE

Alzheimer's disease is the major cause of dementia in the United States (15). It affects 10% of the people older than age 65 with the female to male ration of 2:1. Risk factors include female sex, advanced age, family history, Down syndrome, and African American or Hispanic descent. Patients with a history of brain trauma may have an increased risk of developing the disease (15).

### Anaesthetic considerations

The choice of anaesthetic technique for patients with Alzheimer's disease should be guided by the patient's general physiologic condition, the degree of neurologic deterioration, and the potential for drug interactions between the anaesthetics and the patient's treatment. Detection of early symptoms may be difficult. Administration of sedatives or anticholinergics could precipitate delirium. Inhalation agents must be administered with care as the elderly patient is more sensitive to the depressant cerebral and cardiovascular effects of these agent (16). Anaesthetics with short durations of action and rapid recovery are advantageous.

### Regional Anaesthesia in Alzheimer disease

Regional anaesthesia can be a challenge because these patients are often uncooperative preoperatively. The advantage of regional techniques is the ability to selectively anaesthetize the area of interest without subjecting the patient to systemic effects of general anaesthetic agents. For block placement, a short-acting sedative/hypnotic, such as propofol or midazolam, at a low dose is effective. Depending on the type of block, a short-acting narcotic (eg, alfentanil) may be administered just before the block placement. Avoiding postoperative confusion and delirium caused by inhalation agents, narcotics, muscle relaxants, and reversal agents may be beneficial to this patient population (16). Postoperative pain control without narcotics may be an even greater benefit of peripheral nerve blocks.

## AMYOTROPHIC LATERAL SCLEROSIS (LOU GEHRIG DISEASE)

Amyotrophic lateral sclerosis (ALS) is a progressive degenerative disease of motor cells throughout the central nervous system (CNS). It involves destruction of cortical, brainstem, and spinal motor neurons. Progression of the disease is relentless. Death occurs within 3 to 5 years of the diagnosis, most commonly precipitated by aspiration. The onset is usually after the age of 50 with a male to female ratio 2:1. The cause is unknown, but theories include glutamate excitotoxicity, oxidative stress, mitochondrial dysfunction, paraneoplastic tumors, autoimmune disease, and viral infection (17). The prevalence of the disease is 6:100 000, making it a rare but profound disease.

### Anaesthetic considerations

Patients with ALS present a challenge to the anaesthesiologist. Neuromuscular transmission is markedly abnormal leading to the up-regulation of nicotinic acetylcholine receptors (nAChRs) (18). The up-regulation makes these patients vulnerable to hyperkalemia in response to succinylcholine (19). They have presynaptic impairment of neuromuscular transmission, making them hypersensitive to nondepolarizing muscle relaxants (20).

### Regional anaesthesia in ALS

Regional Anaesthesia has been used in patients with ALS. There have been several case reports of successful epidural anaesthesia for abdominal surgeries, ie, hysterectomy, bowel obstruction, and orthopedic procedures (21-23). Case studies and reports of the use of peripheral nerve blocks in patients with ALS are not available, probably because the condition is so rare. Given the importance of preserving the laryngeal reflexes and respiratory failure due to the weakness of the respiratory muscles, the judicious use of selective peripheral nerve blocks may be beneficial for these patients. In patients with advanced weakness of the respiratory muscles, interscalene nerve block should be used with caution due to the resultant diaphragmatic paralysis.

## Demyelinating central nervous diseases

### Multiple Sclerosis

Multiple sclerosis (MS) is the most common demyelinating disease of the CNS, affecting over a million people worldwide (24). Of the people affected, 75% are women in young adulthood (ages 20–40). It is characterized by random, multiple sites of demyelination in the brain and spinal cord. The peripheral nervous system is not involved. The cause of disease is unknown, but is thought to involve a complex series of immunologic events in a genetically susceptible person. Infectious agents (especially viral), may predispose the disease (24, 25).

## Anaesthetic considerations in patients with MS

Autonomic dysfunction can be seen in patients with MS (26). They exhibit an increased sensitivity to sympathomimetics used to manage hypotension (27). Preload should be adequately maintained for hemodynamic stability. Increases in temperature as well as metabolic and hormonal changes associated with surgery are thought to be responsible for exacerbation of symptoms that may occur postoperatively (28). A temperature change of as little as 0.5°C may block impulse conduction in demyelinated fibers (28).

### Regional anaesthesia in patients with MS

The use of regional anaesthesia, ie, central neuraxial blocks, in patients with MS is controversial. Both spinal and epidural anaesthesia have been used safely, but unpredictable progression of the neurologic symptoms has been observed (29). The mechanism by which spinal anaesthesia may exacerbate MS is unknown, but it is speculated that demyelinated areas of the spinal cord might be more sensitive to the effects of local anaesthetics (30). In fact, it has been suggested that lidocaine can be used to unmask silent demyelinating lesions in MS, making it a diagnostic tool (31). Epidural anaesthesia has been found to be innocuous in obstetric analgesia and anaesthesia. However, in one study, patients who received concentrations of bupivacaine greater than 0.25 % experienced postpartum relapses (30-32).

Because MS is a disorder of the central nervous system, peripheral nerve block anaesthesia should be a more appropriate choice than spinal anaesthesia. Peripheral nerve block anaesthesia may be considered the technique of choice for patients with MS when the surgical procedure allows it (33).

Although not contraindicated, lumbar plexus blocks and paravertebral blocks may have a prolonged duration of action in patients with MS. In one report, a patient who received a paravertebral block for an inguinal hernia repair developed a flaccid paralysis of both lower extremities. The block regressed slowly, with fully recovery, in 12.5 h. It was postulated that in peripheral blocks near the central neuraxis, uptake of local anaesthetics into the spinal cord may cause a prolonged duration or unpredictable response in patients with MS; similar to spinal anaesthetics (34).

### Myasthenia gravis

Myasthenia is caused by autoimmune-mediated destruction of post-synaptic acetylcholine receptors. Patients may suffer other neurological disease such as multiple sclerosis as shown in 2.3% among a large group of myasthenic patients (35).

Rapid deterioration is possible after stress, fatigue, delivery, infection or anticholinesterase overdose. Whereas the effect of succinylcholine is unpredictable as a result of

therapy with cholinesterase inhibitors, sensitivity to all non-depolarizing muscle relaxants will be increased (36).

For central nerve blocks, weak concentrations of LA causing the least motor impairment should be selected. LA administration may reveal the first symptoms leading to the diagnosis of myasthenia. For labour pain, epidural analgesia may be beneficial because it will decrease stress and fatigue. Perineal anaesthesia allows forceps delivery to shorten the second stage and decrease fatigue. In case of C-section, a single intrathecal dose may affect respiratory muscles more severely and unpredictably than an epidural or low-dose CSE technique. A report of 10 cases has shown that both labour analgesia and C-section anaesthesia may be safely performed using the epidural route (37).

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