

Preoperative Evaluation of Patients with Neurological Disease

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ABSTRACT

A thorough evaluation of patients with neurological diseases undergoing surgery can reduce perioperative morbidity and mortality, especially stroke. Various neurological disorders and neurosurgical procedures may influence the nature and extent of preoperative evaluation, selection and conduct of anesthesia, and perioperative management and care. Although anesthesiologists primarily perform a preoperative evaluation of neurological patients, neurologists can contribute further valuable information about the neurological condition and perioperative management of various neurological diseases to obtain the best possible outcome. This article outlines the basic elements of preoperative evaluation and highlights specific considerations for neurological patients undergoing surgery.

KEYWORDS: Preoperative evaluation, neurological disease, neurosurgery

Neurological patients tend to be older and sicker than their nonneurological counterparts. As the population ages, the number of elderly patients with comorbid neurological conditions undergoing various surgical procedures is expected to increase. A thorough preoperative evaluation is important, as it allows careful assessment of the patient's overall health status, stratifying his or her perioperative risk, determining if further tests, consultations or treatments are needed to optimize the patient's health before surgery, and planning the most appropriate management to ultimately reduce perioperative morbidity and mortality.¹

Preoperative evaluation of patients with preexisting neurological conditions undergoing nonneurological surgery and patients undergoing neurosurgery involves a thorough clinical assessment and diagnostic workup to determine the cause and extent of the patient's condition, and to ensure that the patient's comorbid conditions are under appropriate medical therapy, especially prior to elective procedures. Neurological and neuro-

surgical patients represent a heterogeneous population. The preexisting neurological disease may impact preoperative management and preparation for the surgical procedure, the choice of anesthetic agents and techniques, and the perioperative care. Optimal perioperative care requires an understanding of the pathophysiology of each patient's neurological condition. In this article, strategies for performing a complete preoperative evaluation in neurological and neurosurgical patients are discussed, and special considerations for perioperative management of specific neurological conditions to minimize morbidity and mortality are highlighted.

BASIC PREOPERATIVE EVALUATION

A complete history and physical and neurological examination are essential to identify patient-related characteristics and abnormalities that could influence the perioperative risk. A review of medical records and prior consultations is important because some neurological

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and neurosurgical patients may not be able to provide a complete history. Reviewing records of prior surgical procedures and anesthesia with particular attention to associated complications can help to predict future complications and to plan alternative surgical or anesthetic strategies to minimize the risk.

Medical Conditions

Several chronic conditions such as diabetes, hypertension, heart disease, arrhythmias, and epilepsy are commonly encountered in neurological and neurosurgical patients. Inquiring about existing and past medical conditions is important to identify patients at increased risk for perioperative complications. For example, patients with poorly controlled diabetes have an increased propensity toward infection and impaired wound healing.^{2,3} Hypertension is an important cause of perioperative bleeding, and chronic hypertension may shift the cerebral blood flow autoregulation curve to the right, resulting in increased susceptibility to cerebral hypoperfusion after perioperative hypotensive events. These concerns necessitate adequate control of blood pressure and glucose throughout the perioperative period. Eliciting a history of cardiac disease is of critical importance. The use of epinephrine or ketamine during anesthesia should be avoided in patients with coronary artery disease because of their vasoconstrictive and cardiostimulatory effects.^{4,5} In addition, the patient's ability to increase cardiac output in response to fluid shifts during surgery is an important determinant of survival after major surgeries. A history of a bleeding disorder is important to detect and reverse prior to surgery. Similarly, severe hepatic disease can result in impaired coagulation and wound healing, and should prompt the physicians to avoid sedatives, antibiotics, and anesthetics that are metabolized in the liver. Patients with a history of stroke or transient ischemic attacks (TIA) undergoing cardiac surgery are at increased risk for perioperative stroke.⁶ These patients should be thoroughly evaluated to determine the cause of stroke and to ensure that they are adequately treated to minimize the risk of stroke recurrence. Obtaining a dietary history and weight changes are important because malnutrition may lead to increased perioperative mortality.

Medications

Medications for chronic pain should be continued as normal in the perioperative period as this will help to achieve postoperative pain and blood pressure control. Similarly, most antihypertensive and antiarrhythmic agents should be continued without interruption throughout the perioperative period. A sudden cessation of antihypertensives, especially clonidine and guanfacine, should be avoided to minimize the danger

of rebound hypertension. The exception is angiotensin-converting enzyme inhibitors and angiotensin receptor blockers, which should be stopped on the day of surgery because their use can be associated with refractory intraoperative hypotension.^{7,8} Oral hypoglycemics should be held before surgery and substituted with sliding-scale insulin to improve perioperative glycemic control. For patients undergoing minor procedures, omitting oral hypoglycemic agent(s) on the morning of surgery and resuming it postoperatively may be acceptable.⁹ The exception is metformin, which is associated with the development of lactic acidosis. It should be discontinued at least one day prior to surgery and restarted 2 to 3 days postoperatively after testing for renal function.¹⁰

A large number of neurological patients are on antithrombotic therapies for secondary stroke prevention or nonsteroidal antiinflammatory agents (NSAIDs) for pain. Some advocate that NSAIDs be discontinued 2 to 3 days preoperatively to minimize the risk of intraoperative bleeding. However, continuation of NSAIDs throughout most nonneurosurgical procedures is likely safe.¹¹ Oral anticoagulation with warfarin should be withheld 5 to 6 days before major invasive and neurosurgical procedures. The time off anticoagulation should be minimized in patients at high risk for thromboembolic complications, such as those with mechanical valves, atrial fibrillation, or history of systemic embolism including embolic stroke. Bridging therapy with heparin or heparinoids after discontinuation of warfarin and early reinitiation of postprocedure anticoagulation in these patients is advised as soon as the risk of bleeding from the surgical site is minimal. Heparin may be stopped a few hours preoperatively and restarted after surgery.¹² Continuation of warfarin during surgery is likely safe in cutaneous surgeries, dental extractions and other limited oral procedures, and diagnostic, but not invasive, endoscopy or colonoscopy.¹¹ Aspirin and clopidogrel are discussed in the section on cerebrovascular diseases.

Patients treated with steroids prior to surgery may require steroid supplementation during the perioperative period. Patients undergoing minor surgery should take 1.5 to 2 times their usual dose on the morning of surgery and the normal dosage the following day.¹³ In case of a prolonged surgery, an additional dosage may be given perioperatively. Those undergoing major surgery should take 2 times their usual dosage preoperatively, receiving additional intravenous hydrocortisone during surgery and postoperatively, and resume the normal dosage within 48 to 72 hours.¹³

Several antiepileptic drugs can induce hepatic enzymes and alter the pharmacokinetics of anesthetic agents. Recommendations for the management of medications used to treat specific neurological disorders are summarized in Table 1.

Table 1 Preoperative Management of Neurological and Psychiatric Medications

Neurological Medications	
Antiparkinsonian Agents	
Carbidopa/ levodopa	Continue until the morning of surgery and restart as soon as possible after surgery to avoid withdrawal syndrome
Selegiline	Stop 2 weeks prior to surgery when possible
Bromocriptine, amantadine, pergolide	Continue
Entacapone, tolcapone	Continue to avoid withdrawal syndrome; check liver enzymes before surgery
Antiepileptic Medications	
Phenytoin, carbamazepine, valproic acid, clonazepam, phenobarbital, primidone, gabapentin, topiramate	Continue to avoid perioperative seizures
Antidepressants	
Amitriptyline, nortriptyline, imipramine, desipramine	Continue but exercise caution with perioperative drug choices due to perioperative additive anticholinergic effects
MAO inhibitors Pargyline, phenelzine	Stop 14–21 days prior to surgery to avoid perioperative medication interactions; for emergency procedures, avoid sympathomimetics, anticholinergics, and meperidine
SSRIs:	
Fluoxetine, sertraline, paroxetine, citalopram, fluvoxamine Venlafaxine, mirtazapine, nefazodone	Continue to avoid withdrawal syndrome
Venlafaxine, mirtazapine, nefazodone	No association with withdrawal syndrome known; no known interactions with anesthetic agents ¹⁴
Antipsychotics, Mood Stabilizers, Anxiolytics	
Phenothiazines	To avoid withdrawal dyskinesia or rebound agitation continue perioperatively if possible ¹⁵
Butyrophenones	Continue pre- and perioperatively; check serum levels prior to surgery; ¹⁰ obtain thyroid function tests if indicated; monitor serum sodium, avoid sodium wasting diuretics ¹²
Lithium	Continue to avoid withdrawal seizures
Benzodiazepines	Continue to avoid withdrawal seizures

MAO, monoamine oxidase; SSRIs, selective serotonin reuptake inhibitors. Adapted from Mercado DL, Petty BG.¹⁰

Physical and Neurological Examinations

Assessing the cardiovascular system and airway is an integral part of any preoperative evaluation. Special attention should be paid to the cervical spine; an unstable cervical spine, limited neck movements, and cervical cord compression are not uncommon in neurological and neurosurgical patients, especially after traumatic injuries. These patients may require cervical immobilization or in-line traction during intubation or fiberoptic intubation. A complete neurological examination is required to assess the patient's preoperative baseline neurological status. The severity of presenting neurological deficits in these patients could determine the degree of surgical urgency. Patients with a preoperative Glasgow Coma Scale score < 9 are more prone to develop hypoxia and hypercarbia, which may lead to elevated intracranial pressure.¹⁶ These patients should be ventilated at the earliest opportunity and stabilized prior to surgery.¹⁷

PREOPERATIVE INVESTIGATIONS

Routine laboratory tests, including complete blood count, coagulation parameters, and serum chemistry

profile, including electrolytes, serum glucose, and renal function tests should be obtained prior to surgery. Previously performed tests that show normal results can be used if there has been no intervening clinical event.¹² Ordering additional preoperative laboratory tests should be guided by medical history, physical examination, and type and nature of the planned procedure.¹⁸ A pregnancy test should be obtained for women of childbearing potential. Urinalysis may be indicated in patients susceptible to urinary tract infections, such as those with multiple sclerosis or spinal injury, and in patients undergoing a urological procedure.

Assessments of nutritional and fluid and electrolyte status is an essential component of preoperative evaluation. Malnourished patients are at increased risk for surgical morbidity and mortality.¹⁹ Assessing serum albumin level provides information about the patient's nutritional condition. Electrolyte abnormalities, as a result of the cerebral salt wasting, inappropriate anti-diuretic hormone secretion (SIADH), or central diabetes insipidus, should be closely monitored and corrected prior to surgery. Serum potassium and magnesium should be carefully monitored and corrected in

patients taking diuretics because these abnormalities can predispose to perioperative arrhythmias. Similarly, it is important to monitor serum glucose during the perioperative period, especially in diabetics or patients taking steroids.

A preoperative electrocardiogram is required for patients with cardiovascular or respiratory diseases, male patients older than 40 to 45 years of age and women older than 50 years of age, and patients with multiple risk factors undergoing high-risk cardiovascular surgeries. Clinical characteristics that may necessitate a preoperative chest x-ray include smoking, recent upper respiratory infection, chronic obstructive pulmonary disease, and cardiac disease.¹⁸ Further cardiac or pulmonary testing other than electrocardiogram or x-ray should be guided by the findings of the basic preoperative evaluation. For example, consider obtaining a transesophageal echocardiogram in patients with a history of stroke of undetermined etiology before cardiac surgery to evaluate for aortic sources of embolization. The finding of significant aortic atherosclerosis can lead to modification of the planned surgical technique to minimize the risk of recurrent stroke. Preoperative spirometry may be appropriate in patients with existing chronic pulmonary disease or asthma.²⁰ Furthermore, preexisting hypoalbuminemia is a powerful predictor of increased risk for postoperative pulmonary complications.²¹ Pulmonary function tests should be assessed preoperatively in patients with a low serum albumin level.²⁰

The type of planned surgery and the patient's clinical situation should dictate preoperative neurological testing. A frequently encountered scenario is the preoperative assessment of patients with suspected carotid stenosis undergoing major surgery. The decision should be individualized on a patient-by-patient basis. Patients with a history of stroke or TIA should be screened with Doppler ultrasound, or magnetic resonance imaging (MRI) or computed tomography (CT) angiography, if previous evaluation has not been done or if the patient's neurological status has worsened since the stroke.²² In patients in whom an asymptomatic high-grade stenosis is detected before undergoing a major cardiovascular surgery, consider brain imaging with CT or MRI to exclude clinically silent ipsilateral territorial infarcts and intracranial MRA or CTA, or transcranial Doppler to determine the hemodynamic significance of the area of stenosis and the status of intracranial blood flow. Patients in whom carotid stenosis is judged to be symptomatic or hemodynamically significant may require preoperative carotid revascularization to minimize their perioperative stroke risk.

GENERAL PREOPERATIVE MEASURES

Any respiratory infection should be treated prior to surgery to minimize postoperative pulmonary complica-

tions. Premedication with H₂-receptor blockers for patients at risk of aspiration due to gastroesophageal reflux disease, and β -blockers in patients with cardiac disease is advised.²³⁻²⁶ The use of long-acting sedatives should be avoided, whenever possible, to facilitate assessment of neurological status throughout the perioperative period. Neurological patients, particularly those with stroke, spinal injury, and brain tumors, are at increased risk for developing deep vein thrombosis (DVT)²⁷ due to prolonged immobility, leg weakness, and secondary hypercoagulability states.²⁸ It is important to start DVT prophylaxis preoperatively and continue until the patient is mobilized after the surgery. Perioperative use of subcutaneous or low-molecular weight heparin and/or intermittent pneumatic pressure is advised. Severely malnourished patients and patients without food intake for more than 3 days prior to surgery should receive preoperative nutritional supplementation.^{19,29} It is important to correct dehydration preoperatively, especially in patients taking diuretics or edema-lowering agents such as mannitol or hypertonic saline, to maintain adequate cerebral perfusion during the perioperative period. An important, yet often understated, aspect of preoperative evaluation is to provide patients with information about their planned surgery, possible complications, and their individual risk factors for perioperative complications. This should include discussing strategies for risk reduction, such as the importance of blood pressure and glycemic control, and compliance with medications. Patients should be encouraged to stop smoking preoperatively. Smoking cessation is an important overall health intervention, and surgery could provide the impetus for the patient to quit. There is some evidence to suggest that smoking cessation before surgery may minimize perioperative pulmonary complications and improve wound healing.³⁰ Patients are likely to benefit from preoperative knowledge of their risk stratification and be more compliant with suggested preoperative instructions.

PREOPERATIVE EVALUATION FOR PATIENTS WITH SPECIFIC NEUROLOGICAL DISEASE

Neuromuscular Diseases (Muscular Dystrophies, Myotonias, Amyotrophic Lateral Sclerosis, Myasthenia Gravis)

Patients with muscular dystrophy, myotonia, or amyotrophic lateral sclerosis (ALS) undergoing surgery have an increased risk for respiratory and cardiac complications. The risk of life-threatening cardiac dysrhythmia and depression of cardiac contractility should be carefully considered, and cardiac function should be evaluated preoperatively by electrocardiography, echocardiography, and telemetry. Patients with an atrioventricular

conduction delay should not receive halothane or other medications, such as atropine, that can further slow cardiac conduction. Preoperative pulmonary assessment should include spirometry with measurements of forced-vital capacity (FVC), maximal inspiratory and expiratory (MEP) pressures, and peak cough flow (PCF). For patients with FVC < 30%, preoperative use of non-invasive positive pressure ventilation should be considered. For patients with ineffective cough, defined as PCF < 270 L/min or MEP < 60 cm H₂O, preoperative manual- and mechanically assisted cough should be considered. Patients with muscular dystrophy are more sensitive to the myocardial depressant effects of inhaled anesthetics, and are prone to cardiac arrest during induction of anesthesia that uses volatile anesthetics alone or in combination with succinylcholine.³¹ Succinylcholine may also cause hyperkalemia that can cause lethal cardiac dysrhythmias and is linked to malignant hyperthermia in patients with neuromuscular disease. Inhalational anesthetic agents have also been implicated as a cause of acute rhabdomyolysis, resembling malignant hyperthermia, in these patients.³² Sensitivity to nondepolarizing neuromuscular blocking agents is also enhanced, resulting in an increase in both peak effect and duration of action. Therefore, all malignant hyperthermia triggering agents and succinylcholine must be avoided.³³ A total intravenous anesthetic technique for induction and maintenance of general anesthesia, such as propofol and a short-acting opioid, are preferred.³³ Patients with ALS can also have autonomic dysfunction, increasing their risk for cardiovascular complications, and pharyngeal muscle dysfunction, which increases the risk for aspiration pneumonia.

Patients with myasthenia gravis are at significant risk for pulmonary complications. Risk factors that increase the likelihood of postoperative respiratory insufficiency are duration of the disease longer than 6 years, history of chronic respiratory disease, treatment doses of pyridostigmine > 750 mg/day, and preoperative vital capacity under 3 L.³⁴ Although preoperative drug treatment may reduce the need for postoperative mechanical ventilation,³⁵ anticholinesterase drugs should be stopped the day before surgery, if the clinical status of the patient allows it, or on the morning of surgery because they increase the effect of succinylcholine (which is inactivated by plasma cholinesterase) and inhibit the effect of nondepolarizing neuromuscular blocking agents. The need for anticholinesterase drugs is decreased in the first 48 postoperative hours. These drugs must be restarted carefully and titrated to avoid the risk of a cholinergic crisis.³⁵ Intravenous neostigmine can be used to avoid fluctuating blood levels of these drugs during the perioperative period. Patients with myasthenia are highly sensitive to nondepolarizing agents, needing only 20 to 50% of the drug compared with other patients.³⁵ Even small amounts of nondepolarizing agents can cause a

significant respiratory muscle paralysis. Succinylcholine should also be avoided and carefully titrated short-acting nondepolarizing muscle relaxants, such as mivacurium or atracurium, should be considered for paralysis.³⁶ Agents affecting the neuromuscular junction, such as antiarrhythmics, calcium-channel blockers, and certain antibiotics, should be avoided.³⁵ Similarly, all the risk factors which predispose to neuromuscular functional impairment must be controlled; i.e., hypothermia, hypokalemia, and acidosis.

Patients with neuromuscular disorders have greater sensitivity to the respiratory depressant effects of opioids, barbiturates, and benzodiazepines. Such agents should be avoided or used with caution, particularly during the perioperative period. Preoperative cessation of smoking, chest physical therapy, use of bronchodilators, and treatment of respiratory infections are encouraged to minimize postoperative pulmonary complications. Postoperative deep breathing exercises or incentive spirometry are also recommended.²⁰

CEREBROVASCULAR DISEASES: STROKE AND TIA

Patients with a history of stroke or TIA are at increased risk for perioperative stroke after major cardiac and vascular surgical procedures.⁶ In contrast, a previous stroke or TIA appears to be a minor clinical predictor for the risk of perioperative cardiac complications.³⁷ In most cases, patients with few risk factors for perioperative stroke undergoing low-risk noncardiac surgery do not need further testing. However, in patients with stroke history and planned cardiac procedure, including aortic manipulation, performing a transesophageal echocardiography to identify aortic atherosclerotic plaques should be considered. Perioperative strokes are predominantly embolic, and are related in large part to perioperative atrial fibrillation, especially after cardiac procedures.^{38,39} Preoperative initiation of amiodarone or β -blockers may decrease the incidence of postoperative atrial fibrillation and stroke.⁴⁰

Antithrombotics are widely used for secondary stroke prevention. Abrupt discontinuation of antiplatelet agents before surgery may be associated with increased risk for stroke recurrence due to rebound hypercoagulability.⁴¹ Aspirin should be stopped only 2 to 3 days before major neurosurgical procedures. Continuation of aspirin therapy is acceptable during regional spinal anesthesia, nerve blocks, dermatological cutaneous surgeries, dental procedures, ophthalmological procedures, peripheral vascular procedures, cardiac surgeries, and endoscopies.¹¹ Clopidogrel, on the other hand, appears unsafe and should be discontinued 5 to 7 days before surgical procedures.⁴² There are no studies regarding the safety of dipyridamole, alone or in combination with aspirin, during surgery. It is therefore prudent to

withhold it 5 to 7 days preoperatively. We recommend substituting clopidogrel and dipyridamole with aspirin in patients at high risk for stroke during the preoperative period. For many patients taking warfarin for stroke prevention, the risk of perioperative discontinuation of anticoagulation exceeds the risk of bleeding complications. Preoperative bridging therapy with heparin is advised and warfarin is discontinued. Heparin can be stopped hours prior to the procedure and warfarin restarted 24 hours after surgery.

Preoperative assessment of stroke patients undergoing carotid revascularization should ensure that blood pressure is adequately controlled throughout the perioperative period, particularly in hypertensive patients, to minimize the risk for postoperative hyperperfusion syndrome.

Subarachnoid Hemorrhage

Cardiac ischemia resulting from increased sympathetic outflow, increased cardiac afterload, or impaired contractility is common after subarachnoid hemorrhage (SAH). Preoperative evaluation of these patients should include electrocardiography, echocardiography, and measurement of serum markers of myocardial damage. These patients are also more susceptible to develop electrolyte abnormalities, in particular hyponatremia secondary to cerebral salt wasting or SIADH, which could predispose them to seizures or cardiac arrhythmias. The patient's cardiac function and electrolytes should be optimized before undergoing surgery. Inotropic agents, such as dopamine, may be required preoperatively in patients with reduced cardiac output because this could impair the ability to tolerate barbiturates administered during surgery due to their myocardial suppressant effects. Maintaining adequate hydration and euolemia is important to minimize the risk of vasospasm during the perioperative period. In addition, the mean arterial blood pressure must be maintained within the autoregulatory range while avoiding high mean pressure to prevent rebleeding in patients with SAH due to ruptured aneurysm.

Multiple Sclerosis

Some reports indicate that anesthesia, especially regional anesthesia, may worsen multiple sclerosis.^{43,44} Therefore, the patient should be advised preoperatively that surgery and anesthesia could produce a relapse despite careful perioperative management.³⁶ Bladder dysfunction is not uncommon in multiple sclerosis. Therefore, testing urinalysis for urinary infection should be performed prior to surgery. Intermittent catheterization or use of anticholinergic agents may be necessary,²⁸ requiring cautious use of other anticholinergics such as atropine. Patients treated with corticosteroids may need

steroid supplementation during the perioperative period. For patients treated with baclofen in whom oral intake is interrupted perioperatively, a gradual change may be made to diazepam. Baclofen is not available for injection, and abrupt withdrawal may precipitate seizures or hallucinations.²⁸ Interferons and glatiramer acetate can be continued throughout the perioperative period.

Epilepsy

Perioperative seizures can lead to significant complications. The preoperative evaluation affords an opportunity to identify patients at high risk for seizure, such as patients with brain tumors, cerebrovascular disease, head injury, and metabolic disturbances,⁴⁵ and to prepare patients with known epilepsy for the surgery. It is important to ensure that the serum levels of antiepileptic drug(s) are therapeutic during the perioperative period. The prescribed medication should be continued until the morning of surgery and, if necessary, administered parenterally until oral intake can be resumed.³⁶ Furthermore, possible interactions between the anticonvulsant agent and the anesthetic drug have to be considered. For example, phenobarbital may accelerate and increase the magnitude of biotransformation of the anesthetic agent.³⁶ Conversely, the anesthetic agent may increase the likelihood of seizure activity. Anticonvulsant anesthetic drugs like barbiturates, benzodiazepines, propofol, halothane, or isoflurane should be considered.³⁵

Parkinson Disease

The established medication regimen should be continued until the morning of surgery (Table 1). Dependent on the length of the surgery, the short half-life of levodopa has to be considered. An interruption of more than 6 to 12 hours may result in severe muscle rigidity interfering with the ventilation management. This syndrome mimics neuroleptic malignant syndrome, including autonomic instability, fever, delirium, and muscle rigidity. Postoperatively, levodopa should be resumed via nasogastric feeding if the patient is not capable of swallowing. Alternative routes include parenteral or topical administration or parenteral administration of dopamine agonists such as bromocriptine if gastric administration is not possible. Phenothiazines and butyrophenones should be avoided because of their antidopaminergic properties.³⁶ Excessive salivation, dysphagia, and esophageal dysfunction in patients with Parkinson disease may result in aspiration pneumonia. Parkinson disease is also associated with a reduction in respiratory reserve capacity, which increases the risk of postoperative atelectasis and pneumonia.^{28,46} Preoperative pulmonary function testing and postoperative breathing exercises should be considered.

Alzheimer Disease (Dementia)

Currently used cholinesterase inhibitors may impair hepatic function requiring careful use of halogenated, volatile anesthetics. In patients treated with anticholinergic agents, measurement of liver enzyme levels should be considered. Glycopyrrolate should be used instead of atropine or scopolamine if anticholinergic drugs are necessary. Using anesthetic agents like propofol or sevoflurane may hasten postanesthetic recovery of mental status.³⁶

Spinal Cord Injury

Preoperative assessment of patients with spinal injuries should attempt to detect and treat secondary complications, such as sympathetic dysfunction, spinal shock, impaired respiratory muscle strength, and bradycardia or hypotension. These patients may require fluid and vasopressors and ventilatory support preoperatively.

CONCLUSIONS

The preoperative time is critical for any neurological patient undergoing surgery. Neurological patients are at an increased risk for perioperative cardiac and pulmonary complications after surgery. The secondary complications of neurological diseases such as aspiration pneumonia, respiratory difficulties, electrolyte abnormalities, autonomic dysfunction, and muscle weakness can adversely influence postsurgical outcome. A thorough preoperative assessment considering the complex pathophysiology of each individual patient is essential to improve perioperative care and to optimize patient's outcome.

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