

Preoperative Evaluation Renal and Nervous sys

Babol University of Medical Sciences
Anesthesiology Department
Miller's 2020

KIDNEY DISEASE

- During preoperative evaluation, it is important to establish the severity, type, and underlying cause of preoperative renal impairment.
- CKD is defined as GFR less than 60 mL/min/1.73 m² for at least 3 months, regardless of the underlying cause.
- Chronic kidney failure is defined as a GFR less than 15 mL/min/1.73 m² or the need for renal replacement therapy (i.e., dialysis).

- Creatinine concentration is often not an accurate indicator of renal function, especially in older individuals.
- The GFR can be reduced by 50% without a rise in creatinine concentration.

Calculation of estimated clearance according to the Cockcroft-Gault formula*:

[140 – age (years)] x ideal weight (kg)

([creatinine (mg/dl)] x 72)

* For women, multiply by 0.85

- www.kidney.org/professionals/kdoqi/gfr_calculator
- Calculating an eGFR is especially important in patients who are older, have elevated creatinine concentrations, or have other risk factors for CKD.
- Given the inaccuracy of these equations at lower creatinine concentrations, values of eGFR that are greater than 60 mL/kg/min/1.73 m² should simply be reported as “>60 mL/kg/min/1.73 m².”

- AKI is a sudden decrease in renal function with the possible decrease in urine output. Episodes of AKI can occur in individuals with or without CKD.

- Other Classifications:
 - RIFLE classification
 - The Acute Kidney Injury Network classification scheme

- AKI may be reversible if precipitating factors are identified and corrected.
- Classifying AKI into prerenal, renal, and postrenal causes allows for a systematic approach.
- Prerenal causes can often be differentiated by calculating the blood urea nitrogen-to-creatinine ratio. A ratio more than 20 suggests pre-renal etiologies, with hypovolemia or hypotension are most common.

- Patients with CKD have many associated comorbidities, both related to the underlying diseases that led to CKD and its resulting end-organ complications.
- **Cardiovascular issues** include hypertension, IHD, ventricular dysfunction (diastolic and systolic), heart failure, CVD, PAD, pericarditis, pericardial effusions, and valvular heart disease (valvular calcification with resulting regurgitation or stenosis).

- **Pulmonary hypertension** and increased cardiac output occur in patients with arteriovenous fistulas.
- CKD is also associated with **chronic anemia** due to reduced erythropoietin production by the kidneys. While treatable with erythropoiesis stimulating agents, complete “normalization” of hemoglobin concentration (i.e., 135 g/L vs. 113 g/L) may actually increase morbidity and vascular events.

- Hence, current KDIGO guidelines recommend using erythropoiesis stimulating agents to treat hemoglobin concentrations less than 90 g/L, but avoid increasing the concentration to above 130 g/L.

- Other hematological abnormalities include platelet dysfunction and increased bleeding, despite normal platelet counts, prothrombin times, and activated partial thromboplastin time (aPTT).
- Once dialysis is begun, patients become more prone to hypercoagulable states.

- Preexisting CKD is a risk factor for increased postoperative complications, including cardiac complications, AKI, acute stroke, and death.
- Preoperative identification of at-risk patients can facilitate care, such as preoperative hydration and avoidance of hypovolemia.

- Nonsteroidal antiinflammatory drugs (NSAIDs) and cyclooxygenase-2 (COX-2) inhibitors interfere with renal perfusion autoregulation and should be avoided or discontinued in patients with CKD.
- In contrast, these drugs do not increase the risk of postoperative AKI in patients with normal renal function.

- The preoperative evaluation of patients with CKD should emphasize the cardiovascular system, cerebrovascular system, intravascular volume status, and electrolyte status.
- The early stages of CKD typically cause no symptoms. The anesthesiologist should inquire about the cardiovascular systems (i.e., chest pain, orthopnea, paroxysmal nocturnal dyspnea), urine output, associated comorbidities, medications, dialysis schedules, and any hemodialysis catheter problems (e.g., infection, thrombosis).
- Information on the patient's target and current weight may be helpful for assessing volume status.

- Patients with CKD need an ECG and blood sampling to measure electrolyte, calcium, glucose, albumin, and creatinine concentrations.
- Further evaluation is needed if the ECG shows LVH (hypertension), peaked T waves (hyperkalemia), flattened T waves, a prolonged PR interval, or a prolonged QT interval (hypokalemia).
- A chest radiograph (infection, volume overload), echocardiogram (murmurs, heart failure), and cardiology evaluation may be necessary in some cases. Venous access sites or blood draws from the brachial, cephalic (antecubital), and central veins in the nondominant upper extremity should be avoided in patients who may eventually need fistulas in those locations for dialysis.

- Preoperative renal replacement therapy (dialysis) schedules should be coordinated with the timing of the planned surgery.
- Dialysis is important for correct volume overload, hyperkalemia, and acidosis before planned surgery. Ideally, elective surgery should be performed about 24 hours after dialysis.
- Performance of surgery shortly after dialysis should be avoided, because of the risks of acute volume depletion and electrolyte alterations. Specifically, dialysis leads to fluid shifts and electrolyte (i.e., sodium, potassium, magnesium, phosphate) imbalance, especially related to shifting of electrolytes between intracellular and extracellular compartments.

Contrast-Induced Nephropathy

- Contrast-induced nephropathy is defined as AKI that occurs after radiocontrast administration. Typically, the creatinine concentration increases within 24 to 48 hours after contrast exposure, after which it typically declines to baseline levels within 3 to 7 days.
- Recent (<24 hours) preoperative contrast exposure is also a risk factor for AKI following cardiac surgery.

- Even when renal function returns to normal, patients with contrast-induced nephropathy experience elevated risks of short-term and long-term mortality.
- Risk factors for contrast-induced nephropathy are CKD (especially diabetic nephropathy), heart failure, hypovolemia, and certain contrast exposure characteristics (i.e., high volume, ionic agents, hyperosmolal agents).

- Preventative strategies include avoiding volume depletion, discontinuing NSAIDs for 24 to 48 hours, using a low-risk contrast administration protocol (i.e., low volume of a low-osmolal or iso-osmolal agent), and periprocedure intravenous volume administration with normal saline.
- Despite initial promising results for N-acetylcysteine and sodium bicarbonate, a large trial found that neither approach prevented contrast-induced nephropathy.

NEUROLOGIC DISEASE

Cerebrovascular Disease

- The two main categories of stroke are hemorrhagic stroke and ischemic stroke.
- CVD has important perioperative implications. It is a risk factor for postoperative complications, including cardiac events, stroke, and death.
- Furthermore, the risks of postoperative cardiac complications and recurrent stroke are particularly increased when elective noncardiac surgery is performed within 9 months after a prior stroke.

- Importantly, if emergency surgery needs to be performed after a stroke, it may be preferable to not delay surgery.
- Specifically, while the risks of postoperative cardiovascular complications are very high when emergency surgery is performed within 2 weeks after an ischemic stroke, these risks were reduced when surgery proceeded within 72 hours after the stroke.
- This temporal pattern may be explained by progressively worsening cerebral autoregulation during the first 5 days after an ischemic stroke (which then recovers over the next 3 months).

- The preoperative evaluation should focus on the timing, presentation, etiology, and treatment of prior strokes or TIAs. It is important to document the etiology in order to distinguish carotid stenosis (i.e., atherosclerosis) from cardioembolic disease.
- The physical examination should include a brief neurologic exam to identify any preexisting deficits, auscultation for carotid bruits, and a precordial assessment to assess for murmurs or extra heart sounds.
- Depending on the underlying basis for CVD (i.e., atherosclerosis, atrial fibrillation), patients may be on long-term therapy with aspirin, P2Y12 inhibitors (e.g., clopidogrel), vitamin K antagonists, and DOACs.

- Both vitamin K antagonists and DOACs should be temporarily discontinued before surgery, Similarly P2Y12 inhibitor therapy should be interrupted before surgery, with the possible exception of cases with very recent coronary stent implantation.
- Continuing aspirin perioperatively does not prevent cardiovascular complications, but leads to an increased risk of major bleeding (a risk factor for perioperative stroke).
- Nonetheless, selective continuation of aspirin can be considered in patients with high-risk atherosclerotic CVD or recent stroke.
- In other cases, aspirin should be temporarily held 72 hours before surgery.

- In addition, concomitant CVD should be carefully considered in any decision to initiate new β -adrenergic blocker therapy in a patient awaiting noncardiac surgery.
- Although β -blockade does decrease perioperative cardiac risk, it also significantly increases the risk for acute postoperative stroke.

Seizure Disorder

- The seizure type (e.g., grand mal, absence) and specific symptoms (e.g., staring, focal findings) are important to document in the preoperative evaluation.
- It is important to determine the etiology of the seizure disorder because of possible associated morbidities, which include brain tumors, aneurysms, AVMs, classic epilepsy, drug toxicity, electrolyte disorders, infections, CVD, sickle cell disease, and SLE.
- The anesthesiologist should document the anticonvulsant dosing regimen and adequacy of seizure control. Routine measurement of serum drug levels of anticonvulsants is not indicated unless there are concerns about drug toxicity or ongoing breakthrough seizures. Indeed, patients with good control of seizures may have levels outside the therapeutic range.

- Anti-seizure medications have multiple side effects (e.g., bone marrow suppression, macrocytic anemia, leucopenia, hyponatremia), and testing may be needed based on suspected abnormalities.
- The most commonly ordered tests are CBC and electrolyte concentrations.
- All anticonvulsant therapy should be continued perioperatively.
- A patient with poorly controlled or new-onset seizures should be evaluated by a neurologist before any non-emergent surgery.

Parkinson Disease

- Parkinson disease is a degenerative disorder of the basal ganglia characterized by failure of dopamine secretion and diminished inhibition of the extrapyramidal motor system.
- Patients typically have diminution of spontaneous movements, rigidity (cogwheel rigidity is classic), resting tremor, masked facies, difficulty speaking, difficulty walking, depression, and dementia.
- Pharmacologic treatments include:
levodopa, dopamine agonists, monoamine oxidase type B inhibitors, anticholinergic agents amantadine, and catechol-O-methyl transferase inhibitors.

- Autonomic dysfunction (including orthostatic hypotension), excessive salivation, and impaired thermoregulation may also occur.
- Patients are at risk of pulmonary complications resulting from difficulty swallowing, altered mental status, increased aspiration risk, and ventilatory muscle dysfunction.
- Preoperative evaluation should assess the pulmonary system, signs of dysphagia, and degree of disability.
- Abrupt withdrawal of levodopa may exacerbate symptoms (especially dysphagia and chest wall rigidity) or precipitate neuroleptic malignant syndrome.

- The latter disorder is characterized by autonomic instability, altered mental status, rigidity, and fever.
- Some medications encountered in the perioperative setting, such as metoclopramide and phenothiazines, may exacerbate symptoms of Parkinson disease.
- Individuals with deep brain stimulators require deactivation of the devices before any procedures in which electrocautery will be used.
- Perioperative management of the device ideally should be coordinated with the surgeon and the clinician managing the device.

Central Nervous System Tumors

- The intracranial tumors can have mass effects that lead to associated symptoms, such as headaches, visual field defects, and increased intracranial pressure (with resulting gait disturbances, vomiting, cranial nerve deficits, bladder incontinence, bowel incontinence).
- Most intracranial tumors are detected either incidentally, or when patients develop seizures or symptoms related to mass effect.

- If the intracranial pressure becomes elevated, hypertension, bradycardia, arrhythmias, ECG abnormalities, and brainstem herniation may occur. Careful assessment of neurologic deficits is important.
- For patients with metastatic lesions, issues pertaining to the primary malignant disease and previous treatment (e.g., chemotherapy, radiation, corticosteroids, anticonvulsants) must be clarified. Continuation of preexisting corticosteroids (to treat cerebral edema) and anticonvulsant medications is important.
- Pituitary tumors are classified as functioning (associated with endocrine abnormalities) versus nonfunctioning, as well as benign versus malignant and require specific preoperative evaluation to each types of tumor and hormones they affect.

Multiple Sclerosis

- The preoperative evaluation should document the history and pattern of disease, especially symptoms and physical deficits affecting the respiratory system (including oxygen saturation).
- Medications, previous triggers, and preexisting neurologic deficits should be documented. Testing is generally directed toward associated disturbances (e.g., chest radiography and CBC if pulmonary infection is suspected) and any medication side effects.
- Patients with stable minor disease require no special testing. Related medications should be continued on the day of surgery. No clear association has been shown between the type of anesthetic or a specific anesthetic drug and disease exacerbations.

- Nonetheless, regional anesthesia may offer theoretical advantages for patients with respiratory compromise or cognitive dysfunction.

In the past, it was hypothesized that intrathecal administration of local anesthetics promoted demyelination in the spinal cord in patients with multiple sclerosis leading to exacerbation of disease. Alternatively, demyelinated regions of the spinal cord may be more susceptible to the neurotoxic effects of local anesthetics. However, both spinal and epidural analgesia and anesthesia have been used safely in patients with multiple sclerosis and should be considered.