

Perioperative Implications

Preoperative Preparation

- Consider preoperative placement of an IVC filter in high-risk pts.
- In high-risk procedure (e.g., hip surgery), neuraxial anesthetic may decrease DVT risk versus GA.
- For pts taking anticoagulant/antiplatelet drugs preoperatively:
 - Note the name, type, dosage, duration, and most recent dose.
 - Consider PT, PTT, and platelet count on day of surgery.
 - Confirm adequate blood product availability.
 - Explain risk and benefits of discontinuing medications perioperatively.
 - Consider and discuss with surgeon the role of reversal agents for urgent surgery or life-threatening bleeding.

Monitoring

- Noninvasive BP, ECG, SpO₂, ET/CO₂.
- In high-risk pts, consider arterial line for serial ABGs, central line for CVP.
- Consider availability of TEE in high-risk pts or cases of suspected PE.

Airway

- None

Preinduction and Induction

- SCDs prevent venous stasis; may activate fibrinolytic system.
- When possible, administer SQ heparin before incision.

Adjuvants

- Depends on etiology; examine specific etiology (e.g., hypercoagulability).
- Heparin, warfarin, direct oral anticoagulants, and thrombolytics all increase perioperative bleeding diathesis. These agents may have effects on the

pharmacokinetics of other drugs (verify specific effects).

Postoperative Period

- In high-risk pts, consider full anticoagulation postoperative as prophylaxis.
- If using SQ heparin, it should be administered every 8 h if possible.
- Continue SCDs, stockings until pt is ambulatory, but do not start in pts suspected of having DVT.

Anticipated Problems/Concerns

- PE represents life-threatening complication of DVT.
- Postthrombotic syndrome with chronic venous stasis, skin and wound effects.

Degenerative Disk Disease

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Risk

- Risk factors determined by spinal level
- Cervical spine: C3 and C4 most common; 10% of degenerative disk disease
- Thoracic: uncommon; can be related to trauma or tumor; 0.2–1.8% of disk disease
- Lumbar; very common; 85–90% of disk disease; third most common cause of chronic pain in USA

Perioperative Risks

- Difficult airway
- Spinal cord injury from airway manipulation or positioning
- Positioning injury from prone position
- Ischemic optic neuropathy

Worry About

- Cervical spine instability, nerve root entrapment, or chronic subluxation.

- Difficulty with intubation.
- Injury to the spinal cord, nerve roots.
- Pressure injuries or ventilatory difficulty with the prone position.
- Brachial plexus injury with the prone position.
- Optimum perfusion to the head. Ischemia, neck position, or venous congestion may contribute to ischemic optic neuropathy.
- Airway edema at the conclusion of surgery.

Overview

- Pain from herniation of an intervertebral disk with nerve root compression is the third most common chronic disease in USA and the most common indication for elective spine surgery.
- Incidence varies among spinal segments, being absent in sacral area; most common in lumbar area, next in cervical region, and uncommon in thoracic region.

Etiology

- Osteoarthritis
- Trauma
- Connective tissue diseases, such as rheumatoid arthritis or ankylosing spondylitis

Usual Treatment

- Conservative measures, including rest, exercise, physical therapy, heat, and traction.
- Symptoms are treated with analgesics and NSAIDs.
- During the acute phase, disk herniation can be treated with epidural steroid injection.
- Nonsurgical intervention, such as IDET.
- Surgery is performed to relieve compression on the spinal cord or specific nerve roots and to expand the space for nerve root exit from the spinal column.

Assessment Points

System	Effect	Assessment by Hx	PE	Test
HEENT	Difficult airway Visual acuity	Neck pain Patient report	Decreased ROM Patient report	Flexion/extension x-ray to detect instability Eye examination
RESP	Lung tumor can mimic symptoms of thoracic disk disease	Chest pain with chest excursion	Abnormal pulmonary auscultation	CXR, MRI
GI	GI malignancy can mimic symptoms of thoracic or lumbar disk disease	Truncal pain, abdominal pain	Abdominal mass	CT, MRI
RENAL	Pyelonephritis, cancer of prostate can mimic symptoms of lumbar disk disease	Lumbar pain, muscle spasm, fever/chills	Costovertebral angle tenderness to percussion	Urinalysis, prostate-specific antigen, lumbar spine x-ray, MRI, bone scan
CNS	Myelopathy, anterior spinal cord syndrome	Radiating pain, incontinence, sexual dysfunction, paraplegia	Long tract signs, abnormal reflexes, paresthesia, Babinski reflex	X-ray, MRI
PNS	Radiculopathy, absent deep tendon reflexes, peripheral nerve deficits	Sciatica, numbness, weakness of the extremities	Sciatic pain with ROM, motor deficits, Patchy sensory deficits	Electromyography
MS	Pain, decreased ROM, calcification	Pain, night pain, disability from work	Decreased ROM in spine	Spine x-ray, MRI

Key References: Rothman RA, Simeone FA: *The spine*, ed 54, Philadelphia, PA, 2011, Elsevier (Chapters 36–54); Popitz MD: Anesthetic implications of chronic disease of the cervical spine, *Anesth Analg* 84(3):672–683, 1997.

Perioperative Implications

Preoperative Assessment

- Evaluate coagulation if heavy aspirin or NSAID use, anticoagulants, or symptoms of bleeding.
- Airway assessment. If signs of cervical instability or other indicators of difficult airway management, flexion-extension x-ray of cervical spine.
- Antisialagogue if awake intubation.

- If spinal or epidural anesthesia planned, lumbar x-rays may be needed.
- Planned regional anesthesia may reduce minor complications, such as pain and nausea; intraop bleeding may be reduced.

Monitoring

- Potential for air embolism, greater with sitting position for posterior approach to cervical spine.

- Consider multilumen right atrial catheter; precordial Doppler if sitting position for cervical spine procedure.
- If large blood loss estimated, arterial line becomes indicated.

Airway

- If cervical spine not involved, then routine.
- If abnormal, choices include awake fiber optic intubation, asleep fiber optic intubation, inhalation

induction, and intubation with induction drugs and muscle relaxants with the head maintained in a neutral position, possibly with in-line stabilization.

- Increasing role for video laryngoscopy.

Induction

- If airway secured, induction dictated by other aspects of pt's health.
- If regional anesthesia, technical difficulty with placement due to anatomic abnormality of the spine.
- Consider paramedian dural puncture. Higher levels for dural puncture may result in a better block with spinal stenosis.

Maintenance

- Movement while prone with spinal cord exposed is dangerous. Avoid muscle relaxants after induction if motor evoked potential monitoring is planned.

- If regional anesthesia, be prepared to re-inject block if duration of surgery exceeds duration of action of local anesthetic injected.

Extubation

- Awake and supine are ideal.
- Rapid-emergence agents (propofol, sevoflurane) may facilitate neurologic exam in OR.

Adjuvants

- Injury in the prone position to eyes, lips, teeth, tongue, chin, brachial plexus, ulnar nerves, genitalia, peroneal nerves, skin of the patella, and ankles.
- Identify full neurologic function prior to extubation because reexploration for compressive hematoma could be indicated for major deficits.

Postoperative Period

- Neurologic checks to identify deficits; pain control.

- H₂-blocker therapy to prevent GI hemorrhage if large-dose steroid Rx chosen for nerve root swelling.
- Evaluate visual acuity.

Anticipated Problems/Concerns

- Difficult airway if cervical involvement.
- Air embolism: Avoid or withdraw N₂O if any symptoms.
- Transport bed availability and knowledge of how to remove frame, in case sudden transfer to supine position is necessary.
- Airway edema from prone position or anterior cervical dissection may present issues for immediate extubation. Consider leak test, and if in doubt, prolonged postoperative intubation with sedation may be indicated. Consider extubation over a tube exchanger.

Delirium (Postanesthetic) and Dementia

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Risk

- Risk factors for the development of POD can be categorized as pt or procedure related.
- Pt-related factors:
 - Age >75 y.
 - Preexisting cognitive dysfunction or depression.
 - Male sex.
 - Preexisting severe illness.
 - Polypharmacy (>3 medications) and use of psychoactive medications.
 - History of substance abuse.
 - Laboratory abnormalities (anemia, hypoalbuminemia, sodium, potassium, glucose).
- Procedure-related factors:
 - Cardiac, orthopedic, and vascular procedures associated with highest incidence.
 - Emergent or urgent procedures.
 - Poorly controlled postop pain.
 - Periop administration of anticholinergics, antihistamines, benzodiazepines, and meperidine.
- Factors lacking association with risk of POD are operative time, type of anesthetic (general vs. regional), and mode of postop analgesia (regional techniques vs. systemic opioids).

Perioperative Risks

- POD associated with increased morbidity and mortality, prolonged hospitalization, higher rates of hospital-acquired complications, persistent functional and cognitive decline, and institutionalization following discharge
- Increased risk for falls, development of pressure ulcers, prolonged intubation/reintubation, and need for urinary catheterization
- Increased cost of hospitalization

Assessment Points

System	Effect	Assessment by Hx	PE	Test
CNS	POD	Preop: Baseline cognitive function, risk assessment, current medications Intraop: Pharmacologic agents used, significant intraoperative events Postop: Pain score, use screening tool (CAM)	Inattention, disorganized thinking, fluctuating altered level of consciousness, psychomotor agitation, emotional lability, hallucinations, violent behavior, apathy	O ₂ saturation, ABG, CBC, electrolyte/blood glucose levels, CAM screening tool

Key Reference: Chaput AJ, Bryson GL: Postoperative delirium: risk factors and management: continuing professional development, *Can J Anaesth* 59(3):304–320, 2012.

Perioperative Implications

Preoperative Preparation

- Identify at-risk pts.
- Modify risk factors where feasible (medications, comorbidities, lyte abnormalities).
- Assess sensory impairments (visual and auditory) that may cloud postop picture.
- Consider proactive geriatric consultation.

Worry About

- Pt can demonstrate violent behavior that may place themselves or care providers at risk of harm.
- Rule out modifiable causes of delirium (metabolic abnormalities, progression of underlying disease, withdrawal).
- Drug-drug interactions can commonly precipitate changes in mental status.

Overview

- Dementia: Decline in cognition that represents a change from baseline level of function that interferes with independence and daily function.
- Delirium: Acute (h to d) change in baseline attention and awareness that fluctuates in severity during the course of a day and is accompanied by a disturbance in cognition. Three variants: hyperactive (psychomotor agitation, disturbed emotional state), hypoactive (decreased level of consciousness, apathy), and mixed.
- Incidence of POD is estimated to be 36.8%. It may be higher in pts >70 y of age.

Etiology

- The pathophysiology of POD is poorly understood and likely multifactorial. Current theories include the following:
 - Acute central cholinergic deficiency
 - Decreased GABA activity
 - Dopaminergic hyperactivity
 - Noradrenergic hyperactivity
 - Neuronal damage associated with inflammation (interleukins, interferon, TNF- α)
 - Global cerebral hypoperfusion
 - Surgical stress response

Usual Treatment

- Preventive measures:
 - Some evidence suggests benefit of early proactive geriatric consultation in elderly pts identified as at risk for POD.
 - Medications known to increase risk of POD (anticholinergics, antihistamines, benzodiazepines, opioids) should be replaced with alternatives that have minimal CNS effects whenever possible.
 - Medically optimize pt prior to surgery (comorbidities, electrolyte abnormalities, nutritional status, hemoglobin concentration).
 - Maximize environmental and situational awareness for pt through communication and room lighting appropriate for day/night.
- Treatment for established delirium:
 - Treat/remove reversible precipitating causes of delirium.
 - First-generation antipsychotics (haloperidol 1–2 mg PO q4h prn; decrease dose to 0.25–0.5 mg PO q4h prn for elderly).
 - Second-generation antipsychotics (olanzapine, risperidone) are equally effective but should be used with caution in elderly with dementia because use in this population has been associated with increased risk of stroke and death.
 - Midazolam/lorazepam for delirium associated with benzodiazepine withdrawal, alcohol withdrawal, or delirium associated with seizures.
 - Physostigmine 0.5–2 mg IM/IV prn for anticholinergic-induced delirium.
 - Consider one-to-one companion rather than applying physical restraints.

Monitoring

- Standard monitors.
- Monitor acid-base status, lytes, and blood glucose level when clinically indicated.

Airway

- Maintain adequate oxygenation and ventilation.

Preinduction/Induction

- Avoid premedication with centrally acting anticholinergics and benzodiazepines.

Maintenance

- As dictated by the type of surgery.
- Careful titration of analgesics is critical to avoid oversedation or inappropriate pain control that may contribute to agitation.

Extubation

- Standard criteria for extubation. Avoid hypoxia and hypercarbia.