

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.

Anticipated Problems/Concerns

- Treatment agents associated with significant side effects:
 - First-generation antipsychotics (haloperidol): Greater incidence of extrapyramidal side

effects, neuroleptic malignant syndrome, QT prolongation

- Second-generation antipsychotics (olanzapine, risperidone): Lesser incidence of extrapyramidal side effects, more sedation, neuroleptic malignant

syndrome, increased risk of stroke/death in elderly with dementia

- Psychologic stress on family members and caregivers should not be underestimated

Depression, Unipolar

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Risk

- Affects 2–4% of population; equal occurrence by gender; highest in 25–44 y.
- Lifetime risk 10–25% for women and 5–12% for men; at any point in time, 5–9% women and 2–3% of men suffer from this.
- Approximately 15% of pts with major depression commit suicide. Older than 55 y has fourfold increase in death rate.

Perioperative Risks

- Most periop issues arise from interactions between antidepressant medications and anesthetic agents. Withdrawal of antidepressant medications can increase risk of suicide.

Overview

- Depression is the most common psychiatric disorder.

- Dx is clinical and based on persistent presence of 2 wk of symptoms.
- Distinguished from normal sadness and grief by severity and duration of disease.
- Medication and psychotherapy combination most effective; majority of pts recover.

Etiology

- Unknown pathophysiology, but suspect abnormalities of amine neurotransmitter (serotonin, dopamine, and norepinephrine) pathway
- Multifactorial; familial pattern thought to exist

Usual Treatment

- SSRI: Works by blocking reuptake of serotonin at presynaptic membranes with little effect on adrenergic, cholinergic, histaminergic, or other neurochemical system. Associated with fewer side effects.

- Tricyclic antidepressant: Inhibit synaptic reuptake of norepinephrine and serotonin. Also affect other neurochemical systems, including histaminergic and cholinergic systems, resulting in side effects, such as postural hypotension, prolonged QRS intervals (>0.1), cardiac dysrhythmias, and urinary retention.
- MAOI: Prevents breakdown of catecholamine and serotonin. Orthostatic hypotension is most common side effect observed. Significant systemic Htn associated with ingesting food containing tyramine or sympathomimetic drugs.
- ECT for pts who are resistant to antidepressant medications or with medical contraindication to antidepressants.

Assessment Points

System	Effect	Assessment by Hx	PE	Test
HEENT	Dehydration	Dry mouth, blurred vision	Glaucoma, retinal detachment decreased visual acuity	Fundoscopy exam
CV	AV conduction delays, bradycardia, tachyarrhythmia, hypertensive crisis, hypotension	Angina, symptoms of CHF, need for cardiac pacemaker, thrombophlebitis	Volume status, BP, S ₃ gallop	12-lead ECG (± stress test), ECHO
RESP	Resp depression	CHF, severe pulmonary disease	S ₃ , rales, wheezing	CXR, ABGs
GI	Delayed gastric emptying	Reflux		Gastroendoscopy
ENDO	Variable catecholamine levels	Symptoms suggestive of pheochromocytoma	Unexplained severe Htn	VMA levels
RENAL	Urinary retention	Difficulty urinating		
CNS	MS, neuroleptic malignant syndrome, seizures, coma, ALS, CJD Alzheimer disease	Recent CVA, intracranial surgery, intracranial mass lesion	Neurologic deficits, symptoms of increase ICP	CT, MRI, neurologic exam, toxicology screen
MS AND COLLAGEN DISORDERS		Severe osteoporosis, major fractures, RA, SLE	Fractures, joint pain, and limited mobility	Skeletal x-rays, MRI

Key References: Sullivan PF, Neale MC, Kendler KS: Genetic epidemiology of major depression: review and meta-analysis. *Am J Psychiatry* 157(10):1552–1562, 2000; Uppal V, Dourish J, Macfarlane A: Anaesthesia for electroconvulsive therapy. *Contin Educ Anaesth Crit Care Pain* 10(6):192–196, 2010.

Perioperative Implications

- Serotonin syndrome
 - Potentially life-threatening drug reaction from interactions between SSRIs, atypical and cyclic antidepressants, MAOIs, opiates, and antibiotics, (e.g., phenelzine and meperidine, phenelzine and SSRIs, linezolid and citalopram)
 - Symptoms include agitation, delirium, autonomic hyperactivity, hyperreflexia, clonus, and hyperthermia
 - Treatment involves discontinuing the suspected agent(s), supportive measures, and control of autonomic instability, excess muscle activity, and hyperthermia.
 - In mild cases lorazepam, propranolol, or cyproheptadine (a 5-HT antagonist available only in oral form that binds to serotonin receptors) can be administered

- Fluoxetine
 - Potent hepatic cytochrome P-450 inhibitor, which increases plasma concentration of drugs that depends on P-450 for clearance.
 - Fluoxetine may increase the concentration of tricyclic antidepressants by twofold to fivefold.
 - Some cardiac antidysrhythmic and beta-blockers may also be potentiated as a result.
- Tricyclics
 - Anticholinergic effect causes CV abnormalities, such as orthostatic hypotension and cardiac dysrhythmias.
 - Due to increased availability of neurotransmitters in the CNS, anesthetic requirement may be increased. Likewise, increased availability of norepinephrine may cause exaggerated BP response in reaction to indirect-acting vasopressor, such as ephedrine.

- Acute treatment with tricyclics (first 2–3 wk) is associated with potential significant Htn, whereas long-term treatment is associated with downregulation of receptors.
- Tachydysrhythmias have been observed following administration of pancuronium, ketamine, meperidine, or local anesthetics containing epinephrine to pts who are also on imipramine.
- MAOIs
 - Anesthetic requirement may be increased due to increased concentration of norepinephrine in the CNS.
 - Serotonin syndrome from combining MAOI and meperidine has been noted.
 - Current belief is to continue MAOIs during the periop period, despite previous thought of discontinuing MAOIs 14 d prior to elective surgery.