



GENERAL ANESTHETICS

NCLEX-RN Pharmacology Infographic | 2026 Test Plan

CLASS: Inhaled (Volatile) + IV Anesthetics | **SYSTEM:** CNS / Perioperative

KEY DRUGS: Propofol • Ketamine • Etomidate • Sevoflurane • Isoflurane • Desflurane • Nitrous Oxide • Midazolam



1. DRUG OVERVIEW — Why We Give It

- **Primary purpose:** Produce unconsciousness, amnesia, analgesia, and muscle relaxation for surgery/procedures.
- **Induction of anesthesia:** Propofol (gold standard), etomidate (hemodynamically unstable), ketamine (asthma/trauma/shock).
- **Maintenance of anesthesia:** Inhaled agents (sevoflurane, isoflurane, desflurane) ± nitrous oxide.
- **Procedural sedation:** Propofol, ketamine, midazolam, dexmedetomidine.
- **ICU sedation:** Propofol, midazolam, dexmedetomidine (for intubated patients).
- **Status epilepticus / refractory seizures:** Propofol, midazolam, thiopental (barbiturate coma).



2. MECHANISM OF ACTION (Simplified)

GABA-A AGONISTS (most IV & inhaled agents):

- ↑ GABA-A receptor activity → ↑ Cl⁻ influx → neuron hyperpolarization → CNS depression → unconsciousness
- Includes: Propofol, Etomidate, Barbiturates, Benzodiazepines, most Volatiles

NMDA ANTAGONIST (Ketamine & Nitrous Oxide):

- Blocks NMDA (glutamate) receptor → dissociative anesthesia + analgesia + amnesia
- Ketamine → ↑ sympathetic outflow → ↑ HR, ↑ BP, bronchodilation

STAGES OF ANESTHESIA (memorize for NCLEX):

Stage	Name	Key Features
I	Analgesia / Induction	Loss of pain, conscious → drowsy; amnesia begins
II	Excitement / Delirium	⚠️ DANGER — irregular breathing, vomiting risk, HTN; get through FAST
III	Surgical Anesthesia	✅ GOAL — regular breathing, unconscious, no reflexes
IV	Medullary Paralysis	💀 TOXIC — respiratory arrest, CV collapse, death

3. THERAPEUTIC EFFECTS — What Tells You It's Working

- ✅ Unconsciousness with no response to verbal/tactile stimuli
- ✅ Amnesia of the procedure (anterograde)
- ✅ Smooth, regular respirations (Stage III) OR safely ventilated airway
- ✅ Absent movement / surgical stimulation tolerated
- ✅ Hemodynamic stability — HR & BP within acceptable perioperative range
- ✅ BIS monitor (bispectral index) reading 40–60 = adequate anesthesia
- ✅ Post-op: patient arouses, airway patent, protective reflexes return (gag, cough, swallow)

4. SIDE EFFECTS & ADVERSE REACTIONS

COMMON (expected, manageable):

- Hypotension (especially propofol, inhaled agents)
- Respiratory depression / apnea on induction
- Bradycardia (propofol); tachycardia + HTN (ketamine)
- PONV — post-op nausea/vomiting (esp. inhaled agents, nitrous oxide)
- Post-op shivering, hypothermia
- Pain at IV site (propofol — "milk of amnesia")
- Emergence delirium/agitation (ketamine, sevoflurane in peds)

🚨 SERIOUS / LIFE-THREATENING — MUST RECOGNIZE

► MALIGNANT HYPERTHERMIA (MH) — inherited; triggered by VOLATILE anesthetics + succinylcholine. Signs: ↑↑ ETCO₂ (earliest), masseter rigidity, tachycardia, muscle rigidity, hyperthermia (LATE), rhabdomyolysis → hyperkalemia → cardiac arrest. ANTIDOTE: DANTROLENE.

- ▶ PROPOFOL INFUSION SYNDROME (PRIS) — prolonged high-dose infusion (>48 h, >4 mg/kg/hr). Metabolic acidosis, rhabdomyolysis, hyperkalemia, cardiac failure, AKI. OFTEN FATAL.
- ▶ ANAPHYLAXIS — propofol (egg/soy allergy risk), volatile agents, neuromuscular blockers.
- ▶ LARYNGOSPASM / BRONCHOSPASM — esp. during Stage II or extubation.
- ▶ ASPIRATION PNEUMONITIS — loss of airway reflexes + full stomach.
- ▶ EMERGENCE REACTIONS (ketamine) — vivid hallucinations, nightmares, dissociation; ↑ in adults; pre-treat with midazolam.
- ▶ ADRENAL SUPPRESSION (etomidate) — even a single dose blocks 11-β-hydroxylase; avoid in septic shock.
- ▶ ↑ ICP (ketamine — historical concern; now cautious use); ↓ seizure threshold possible.
- ▶ HEPATOTOXICITY — halothane (rare, now largely replaced).
- ▶ NITROUS OXIDE — B12/methionine synthase inactivation → megaloblastic anemia, neuropathy with chronic use; expands closed air spaces (pneumothorax, bowel obstruction, middle ear).

5. PRIORITY NURSING CONSIDERATIONS

ASSESS (pre-op):

- NPO status — verify per facility policy (aspiration risk)
- Allergies — especially egg/soy (propofol), latex, muscle relaxants
- Personal/family history of MH — RED FLAG
- Baseline vitals, airway (Mallampati), weight, labs, ECG
- Current meds — MAOIs, opioids, benzos, herbals (kava, St. John's wort)
- Pregnancy status (women of childbearing age)

MONITOR (intra-op & post-op):

- Continuous ECG, SpO₂, ETCO₂ (gold standard for ventilation), BP q3–5 min
- Temperature — MH can rise 1–2°C every 5 min
- Level of consciousness, pupils, reflexes
- BIS monitor 40–60 during surgery
- Aldrete score in PACU (≥9 or returned to baseline = discharge ready)

HOLD / NOTIFY IMMEDIATELY if:

- Rising ETCO₂ + masseter rigidity + tachycardia → suspect MH → STOP volatile + call team
- SpO₂ < 90% or apnea lasting > 30 sec
- SBP < 90 mmHg or MAP < 65 mmHg
- New arrhythmia, PVCs, wide QRS (hyperkalemia from MH/PRIS)
- Temperature > 38.5°C intra-op without another source
- Propofol infusion > 48 h or > 4 mg/kg/hr — reassess for PRIS

CONTRAINDICATIONS:

- Volatiles + succinylcholine: personal/family Hx of MH → ABSOLUTE
- Propofol: egg/soy allergy (relative); do NOT use in pediatric ICU sedation
- Etomidate: avoid in septic shock / adrenal insufficiency
- Ketamine: uncontrolled HTN, recent MI, severe CAD, psychosis (relative)

- Nitrous oxide: pneumothorax, bowel obstruction, middle ear surgery, air embolism, 1st trimester pregnancy, B12 deficiency

DRUG INTERACTIONS:

- Opioids + benzos + anesthetics → ↑↑ respiratory depression (synergy)
- Alcohol, kava, valerian → additive CNS depression
- MAOIs + ketamine/meperidine → hypertensive crisis, serotonin syndrome
- Grapefruit juice → ↑ midazolam levels (CYP3A4)

6. LABS & DIAGNOSTICS

Lab / Test	Why It Matters	Critical / Abnormal =
ETCO ₂ (capnography)	Earliest sign of MH; ventilation status	↑↑ Rising rapidly → MH until proven otherwise
Potassium (K ⁺)	MH & PRIS cause rhabdo → hyperK	> 5.0 mEq/L → cardiac arrhythmia risk
CPK / Myoglobin	Detects rhabdomyolysis (MH, PRIS)	↑↑ CPK; dark/tea-colored urine
ABG	Metabolic acidosis in MH / PRIS	pH < 7.35, ↑ lactate, ↓ HCO ₃ ⁻
Core temperature	MH detection	> 38.5°C intra-op without cause
Glucose	Stress response / sepsis	Monitor in etomidate use
LFTs (AST/ALT)	Halothane hepatitis (rare)	↑↑ with volatile use
CBC / H&H	Baseline for surgery	Hgb < 8 → transfusion threshold
Coags (PT/INR/PTT)	Bleeding risk pre-op	INR > 1.5 → hold surgery per protocol
Triglycerides	Propofol is lipid emulsion	> 500 mg/dL → pancreatitis risk on long infusion

7. ADMINISTRATION & SAFETY — HIGH-ALERT MEDICATIONS

⚠ HIGH-ALERT: All general anesthetics are on ISMP's High-Alert list

- ▶ Administer ONLY by anesthesia-trained providers (CRNA, MDA) or per facility protocol.
- ▶ Resuscitation equipment + reversal agents MUST be at bedside: Ambu-bag, suction, crash cart, dantrolene (if volatiles used).
- ▶ Continuous SpO₂, ETCO₂, ECG, BP — NEVER administer without monitoring.
- ▶ Two-RN independent double-check for infusions in ICU/PACU.

DRUG-SPECIFIC ADMIN PEARLS:

- PROPOFOL: Lipid emulsion — STRICT aseptic technique. Discard vial/tubing in 12 hours (6 h if drawn into syringe). Use dedicated IV line. Injection pain → use large vein + lidocaine pre-treatment.
- KETAMINE: IV or IM. Dim lights, quiet room, minimal stimulation during emergence. Pre-medicate with midazolam to ↓ emergence reactions.
- ETOMIDATE: Rapid IV push — watch for myoclonus (common, benign); avoid continuous infusion due to adrenal suppression.
- INHALED AGENTS: Delivered via vaporizer on anesthesia machine; scavenging system to protect OR staff. Sevoflurane = go-to for pediatric mask induction.
- NITROUS OXIDE: Always co-administer ≥ 30% O₂ to prevent diffusion hypoxia. Deliver 100% O₂ for 3–5 min after d/c.
- MIDAZOLAM: Reversal = FLUMAZENIL (use cautiously — can precipitate seizures in chronic benzo users).

8. PATIENT EDUCATION

BEFORE SURGERY:

- NPO guidelines: no solids 6–8 h, no clear liquids 2 h pre-op (verify facility policy)
- Report ALL meds, herbals, supplements, alcohol, recreational drug use
- Report family/personal history of problems with anesthesia (MH, pseudocholinesterase deficiency)
- Remove contacts, jewelry, dentures, nail polish (affects pulse oximetry)
- Arrange a ride home — NO driving 24 h after anesthesia

AFTER SURGERY:

- Expect drowsiness, sore throat (intubation), nausea, shivering — all temporary
- Do NOT drive, operate machinery, sign legal documents, or drink alcohol for 24 h
- Have a responsible adult stay with you for at least 24 h
- Cough, deep breathe, use incentive spirometer every hour while awake → prevents atelectasis/pneumonia
- Early ambulation → prevents DVT
- Advance diet slowly (clear liquids → regular) as tolerated

CALL PROVIDER / 911 IF:

- Difficulty breathing, chest pain, severe nausea/vomiting that won't stop
- High fever (>101°F / 38.3°C), muscle pain/rigidity, dark urine — late MH signs
- Unable to urinate in 8 h post-op
- Signs of infection at IV/surgical site (redness, pus, streaking)
- Confusion or excessive sleepiness that doesn't improve

9. NCLEX TEST TRAPS

WHAT STUDENTS GET WRONG

- ▶ TRAP: Thinking "high fever" is the first MH sign. WRONG — rising ETCO_2 is the EARLIEST sign; temperature spikes LATE.
- ▶ TRAP: Giving Tylenol for MH fever. WRONG — first action is DANTROLENE + stop the trigger agent + 100% O_2 .
- ▶ TRAP: Treating propofol hypotension aggressively with fluids only. Remember the dose-dependent vasodilation — ↓ dose first, then support BP.
- ▶ TRAP: Using succinylcholine + volatile together in MH-susceptible patient. NEVER. Use non-depolarizing NMBs (rocuronium) + TIVA (propofol).
- ▶ TRAP: Giving flumazenil routinely to reverse midazolam. Risk of seizures in chronic benzo users — use only for true overdose.
- ▶ TRAP: Assuming "awake" = "safe to discharge." Use Aldrete score; gag/cough reflexes must return before PO intake.
- ▶ TRAP: Ketamine raising ICP is OUTDATED dogma — current evidence shows it's safe in many neuro patients, but NCLEX may still test the classic answer (avoid in ↑ ICP).
- ▶ TRAP: Nitrous oxide is "safe/mild" — but it EXPANDS trapped air (pneumothorax, bowel obstruction, middle ear, eye surgery with SF6 gas) and inactivates B12.
- ▶ TRAP: Etomidate for septic shock. Hemodynamically stable at induction BUT adrenal suppression = worsens outcomes in sepsis.
- ▶ TRAP: Confusing emergence delirium (ketamine, peds sevo — happens in PACU) with post-op delirium (elderly, day 1–3 post-op).

PRIORITY vs NON-PRIORITY:

-  PRIORITY: Airway → Breathing → Circulation (ABCs always first in PACU)
-  PRIORITY: Rising ETCO_2 + tachycardia → MH workup BEFORE checking temp
-  NON-PRIORITY (do AFTER ABCs): Documenting, calling family, offering fluids

10. MEMORY BOOSTERS — Mnemonics & Patterns

"SAME" — Stages of Anesthesia:

- S — Sedation/analgesia (I)
- A — Agitation/excitement (II) 
- M — Maintenance/surgical (III) 
- E — Expired/medullary depression (IV) 

"MH CRISIS" — Malignant Hyperthermia response:

- M — Muscle rigidity / Masseter spasm
- H — Hyperthermia (LATE)
- C — CO_2 rising (ETCO_2 — earliest!)
- R — Rhabdomyolysis → hyperK
- I — Initiate DANTROLENE 2.5 mg/kg IV
- S — Stop trigger + 100% O_2
- I — Ice / cool to 38°C
- S — Support (fluids, insulin/D50 for K^+ , bicarb for acidosis)

"POND" — Propofol cautions:

- P — Pain on injection (large vein + lidocaine)
- O — Only 12 hours hang time (lipid → bacterial growth)
- N — No egg/soy allergy
- D — Drops BP (hypotension, bradycardia)

"KETAMINE" effects:

- K — Keeps BP/HR up (unique — sympathomimetic)
- E — Emergence hallucinations
- T — Trauma / shock friendly
- A — Asthma — bronchodilates
- M — Muscle tone preserved (airway reflexes intact)
- I — ICP concerns (classic teaching)
- N — NMDA blocker
- E — Emotional — pre-treat midazolam

RULE: "If it ends in -FLURANE, it's INHALED + MH risk."

- Sevoflurane, Isoflurane, Desflurane → all volatile → all potential MH triggers



MOST TESTED DRUGS IN THIS CLASS — Quick Compare

Drug	Best For	Watch For / Avoid
Propofol (Diprivan)	Induction & maintenance; ICU sedation; RSI	Hypotension, egg/soy allergy, PRIS, 12-h hang time
Etomidate (Amidate)	Induction in cardiac/hypotensive pts	Adrenal suppression, myoclonus — AVOID in sepsis
Ketamine (Ketalar)	Trauma, shock, asthma, pediatric, analgesia	Emergence rxn, ↑ BP/HR, ↑ ICP (classic), ↑ secretions
Midazolam (Versed)	Pre-op anxiolysis, procedural sedation	Resp depression + opioids; reverse: FLUMAZENIL
Sevoflurane	Peds mask induction; adult maintenance	MH trigger, emergence delirium in peds
Isoflurane	Maintenance — cheap, stable	MH trigger, pungent (not for induction)
Desflurane	Fast on/off — outpatient surgery	MH trigger, airway irritant → laryngospasm
Nitrous Oxide (N ₂ O)	Adjunct; dental/OB analgesia	Expands air spaces, B12 inactivation, diffusion hypoxia
Thiopental (barbiturate)	Historical; refractory SE / ↑ ICP	Hypotension, laryngospasm, porphyria — AVOID

Drug	Best For	Watch For / Avoid
Dexmedetomidine (Precedex)	ICU sedation w/o resp depression	Bradycardia, hypotension

KEY DIFFERENCES TO REMEMBER:

-  HEMODYNAMICS: Propofol DROPS BP · Etomidate NEUTRAL · Ketamine RAISES BP
-  MH RISK: ALL volatiles + succinylcholine = TRIGGERS · Propofol/etomidate/ketamine = SAFE
-  RESPIRATORY: Most cause apnea · Ketamine & dexmedetomidine PRESERVE respiration
-  PEDS: Sevoflurane = mask induction of choice · Propofol NOT for long-term peds ICU sedation
-  REVERSALS: Midazolam → FLUMAZENIL · Opioids → NALOXONE · NMBs → SUGAMMADEX/neostigmine



CLINICAL JUDGMENT SNAPSHOT (NCJMM)

? #1 PRIORITY RISK with General Anesthetics

- ▶ AIRWAY COMPROMISE + RESPIRATORY DEPRESSION — every anesthetic can stop breathing. No airway = no patient.
- ▶ Close 2nd: MALIGNANT HYPERTHERMIA with volatile agents + succinylcholine — rare, genetic, fatal without dantrolene.

? What Will HARM the Patient FIRST?

- ▶ HYPOXIA from apnea or airway obstruction — brain damage in 4–6 minutes.
- ▶ ASPIRATION from lost protective reflexes.
- ▶ HYPOTENSION → hypoperfusion → organ damage.
- ▶ In MH: rising ETCO₂ → acidosis → hyperkalemia → lethal arrhythmia (VF/asystole).

? FIRST Nursing Action in Key Scenarios

- ▶ Post-op patient SpO₂ drops to 85% → OPEN AIRWAY (head-tilt/jaw-thrust) + give 100% O₂ FIRST, then call provider.
- ▶ Rising ETCO₂ + masseter rigidity intra-op → STOP volatile agent + 100% O₂ + call for DANTROLENE & MH cart.
- ▶ Propofol infusion running > 48 h with new metabolic acidosis → STOP infusion, draw CK/K⁺/ABG, notify MD (PRIS).
- ▶ Post-ketamine patient hallucinating in PACU → DIM lights, reduce stimulation, reorient calmly, give midazolam per order.
- ▶ Patient with egg allergy receiving propofol → HOLD drug, notify anesthesia, document, consider alternative induction.
- ▶ Suspected aspiration → TURN patient to side, SUCTION airway, give O₂, obtain CXR, notify provider.

► Post-op patient not waking up → ABCs first → check glucose, temp, last dose of anesthetic/opioid, consider reversal.

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