NCLEX-RN PHARMACOLOGY • 2026 TEST PLAN

Bisphosphonates

Bone resorption inhibitors • Prototype drugs end in **"-dronate"**

Class: Bisphosphonates | System: Musculoskeletal / Endocrine | High-Alert: ONJ + Esophagitis

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1 Drug Overview

WHY WE GIVE IT (INDICATIONS)

- **Postmenopausal osteoporosis** — first-line treatment
- **Male osteoporosis** and **glucocorticoid-induced osteoporosis**
- **Paget's disease** of bone
- **Hypercalcemia of malignancy** (IV zoledronic acid, pamidronate)
- **Bone metastases** — multiple myeloma, breast cancer, prostate cancer
- Prevention of fragility fractures — hip, vertebral, wrist

HIGH-YIELD CLINICAL USE

- ✓ Given when **T-score ≤ −2.5** on DEXA scan (osteoporosis)
- ✓ Started only after **calcium and vitamin D are replete**
- ✓ Dental clearance obtained **before** initiating therapy

2 Mechanism of Action (Simplified)

Drug binds **hydroxyapatite** in bone matrix → taken up by **osteoclasts** → inhibits osteoclast activity & triggers apoptosis → **↓ bone resorption** → **↑ bone mineral density (BMD)** → **↓ fracture risk**

- **Bottom line:** Bisphosphonates shut down the bone-eating cells so the bone-building cells can catch up.
- Drug embeds in bone and persists for **months to years** — this is why drug holidays are possible after 3–5 years.

3 Therapeutic Effects

- ✓ ↑ **Bone mineral density** on DEXA (trend upward over 1–2 years)
- ✓ ↓ **Fracture risk** — vertebral, hip, non-vertebral
- ✓ ↓ **Serum calcium** in hypercalcemia of malignancy (within 2–4 days IV)
- ✓ ↓ **Bone pain** in Paget's disease and bone metastases
- ✓ **Normalized alkaline phosphatase** in Paget's disease (key marker)

HOW DO I KNOW IT'S WORKING?

DEXA T-score improves, fewer fragility fractures, serum Ca normalizes in malignancy, and ALP trends down in Paget's.

4 Side Effects & Adverse Reactions

COMMON (EXPECTED)

- **GI upset** — heartburn, dyspepsia, abdominal pain, nausea
- **Musculoskeletal pain** — bone, joint, muscle aches
- **Headache**
- **Mild hypocalcemia**, hypophosphatemia
- IV forms: Flu-like symptoms (fever, myalgia) within 24–72 hrs of first dose

SERIOUS / LIFE-THREATENING 🚨

- 🚨 **Esophagitis / Esophageal ulceration / Perforation** — from improper oral administration
- 🚨 **Osteonecrosis of the Jaw (ONJ)** — exposed, non-healing jaw bone; higher risk with IV + dental work + cancer
- 🚨 **Atypical femur fractures** — subtrochanteric / mid-shaft; warning = new thigh or groin pain
- 🚨 **Severe hypocalcemia** → tetany, laryngospasm, seizures, arrhythmias
- 🚨 **Acute kidney injury** — IV zoledronic acid / pamidronate, especially if dehydrated
- 🚨 **Atrial fibrillation** — reported with IV zoledronic acid
- 🚨 **Uveitis / scleritis** — red, painful eye; discontinue drug
- 🚨 Olmesartan-style enteropathy is NOT a bisphosphonate effect — don't confuse drug classes

TOXICITY RED FLAGS

New thigh/groin pain • jaw pain or loose teeth • severe heartburn or odynophagia • numbness / tingling / tetany • oliguria.

5 Priority Nursing Considerations

MONITOR

- **Assess** ability to sit/stand upright for 30–60 minutes before giving
- **Monitor** serum calcium, vitamin D, phosphate, magnesium
- **Monitor** renal function — BUN, creatinine, CrCl (especially IV)
- **Monitor** for Chvostek's and Trousseau's signs (hypocalcemia)
- **Assess** dental history — any planned dental surgery?
- **Monitor** DEXA scan every 1–2 years

HOLD / DO NOT GIVE IF:

- ✋ **CrCl < 35 mL/min** (alendronate, risedronate) or **< 30** (ibandronate, zoledronic acid)
- ✋ **Hypocalcemia** — correct calcium FIRST, then give
- ✋ Patient **cannot sit or stand upright** for 30+ minutes
- ✋ Active **esophageal disease** — achalasia, stricture, severe GERD
- ✋ **Upcoming invasive dental procedure** (jaw surgery, extractions)
- ✋ Patient is **pregnant or breastfeeding**

DRUG INTERACTIONS

- ⚠ **Calcium, iron, antacids, dairy, multivitamins** → bind drug and prevent absorption → separate by ≥30–60 min
- ⚠ **NSAIDs** → ↑ GI ulceration risk
- ⚠ **Aminoglycosides** → additive hypocalcemia
- ⚠ **Loop diuretics** → worsen hypocalcemia

6 Labs & Diagnostics

LAB	NORMAL	WHAT IT TELLS YOU
Serum calcium	8.5–10.5 mg/dL	Must be **normal** before dosing; ↓ = hold drug
Vitamin D (25-OH)	≥ 30 ng/mL	Must be replete before starting
Creatinine / CrCl	CrCl ≥ 35 mL/min	Low CrCl = contraindication
Phosphate	2.5–4.5 mg/dL	May drop — monitor
Magnesium	1.5–2.5 mg/dL	Watch with hypocalcemia
Alkaline phosphatase	44–147 U/L	Treatment response marker in Paget's
DEXA T-score	> −1.0 normal	≤ −2.5 = osteoporosis; track response

CRITICAL VALUE

Serum calcium < 8.5 mg/dL (especially < 7.5) with Chvostek's or Trousseau's sign → hold drug, notify provider, initiate calcium replacement, place on seizure precautions .

7 Administration & Safety

ORAL BISPHOSPHONATES (ALENDRONATE, RISEDRONATE, IBANDRONATE)

- **FIRST thing in the morning**, on an **empty stomach**
- With **6–8 oz (full glass) of PLAIN WATER only** — no juice, coffee, mineral water, milk
- **Sit or stand UPRIGHT for 30 minutes** (60 minutes for ibandronate/IV ibandronate oral)
- **No food, drink, or other meds** for at least 30 minutes after (60 for ibandronate)
- **Do NOT chew, crush, or suck** the tablet
- **Do NOT lie down** after taking

IV BISPHOSPHONATES (ZOLEDRONIC ACID, PAMIDRONATE)

- **Hydrate patient well** before and during infusion
- Infuse **slowly** — zoledronic acid over ≥ 15 min (bolus = renal injury / A-fib)
- Pre-medicate with **acetaminophen** for flu-like symptoms
- Monitor **renal function** before each dose
- Dosing: zoledronic acid 5 mg IV once yearly (osteoporosis); 4 mg q3–4 weeks (oncology)

HIGH-ALERT PRECAUTION

Never give oral bisphosphonate to a patient who is NPO, on bedrest, tube-fed while supine, or unable to swallow reliably — esophageal ulceration risk is immediate and serious .

8 Patient Education

MUST KNOW

- ✓ Take **exactly as prescribed** — administration rules are not optional
- ✓ Take **calcium 1,200 mg + vitamin D 800–1,000 IU daily** (separated from drug)
- ✓ **Weight-bearing exercise**: walking, resistance training
- ✓ **Fall prevention** — scatter rugs, lighting, non-skid shoes
- ✓ **Smoking cessation** and **limit alcohol** (≤ 2 drinks/day)
- ✓ **See dentist BEFORE** starting therapy and **tell every dentist** you're on a bisphosphonate

SEEK HELP IMMEDIATELY IF…

- 🚨 **New thigh or groin pain** (atypical femur fracture warning)
- 🚨 **Jaw pain, loose teeth, non-healing mouth sore** (ONJ)
- 🚨 **Severe heartburn, chest pain, painful swallowing, black stools**
- 🚨 **Muscle twitching, tingling around mouth, spasms** (hypocalcemia)
- 🚨 **Red, painful eye with vision changes** (uveitis)
- 🚨 **Irregular heartbeat** (A-fib with IV forms)

9 NCLEX Test Traps ⚠️

- ⚠ **Trap: "Take with food to reduce GI upset"** → WRONG. Must be **empty stomach**.
- ⚠ **Trap: "Take with orange juice or coffee"** → WRONG. **Plain water only.**
- ⚠ **Trap: "May lie down after"** → WRONG. Upright 30–60 min.
- ⚠ **Trap: "Take at bedtime"** → WRONG. First thing in the morning.
- ⚠ **Trap: Giving the drug with calcium-containing meds** → absorption falls to near zero. Separate!
- ⚠ **Trap: Confusing osteoporosis drugs:**
  - ⚠ Bisphosphonates (-dronate) = inhibit osteoclasts
  - ⚠ Denosumab (Prolia) = RANKL inhibitor (SubQ q6 months)
  - ⚠ Raloxifene (Evista) = SERM — **risk of DVT/PE**
  - ⚠ Teriparatide (Forteo) = **anabolic**, daily SubQ injection
  - ⚠ Calcitonin (Miacalcin) = **nasal** spray (alternate nostrils)
- ⚠ **Priority vs non-priority:** **Hypocalcemia and esophagitis are ABC/safety priorities** and beat ONJ and atypical fracture on an acute question.
- ⚠ **Trap: "Chew the tablet if hard to swallow"** → WRONG. Chewing = severe mucosal burn.

10 Memory Boosters

💊 "-DRONATE" = Drug class tag

Alen**dronate**, rise**dronate**, iban**dronate**, zole**dronic**, pami**dronate** — all bisphosphonates.

🌅 "SWIM" — Oral administration rules

Sit upright 30–60 min • **W**ater (plain, full glass) • **I**n the morning • **M**onitor — no food/meds for 30 min

🦴 "BONE-HARD" — Adverse effects

Bone/joint pain • **O**NJ (osteonecrosis of jaw) • **N**ephrotoxicity (IV) • **E**sophagitis • **H**ypocalcemia • **A**trial fibrillation (IV zoledronic acid) • **R**are femur fractures (atypical) • **D**ental clearance first

🔑 Pattern to remember

Any antiresorptive drug (bisphosphonates, denosumab) shares the same red-flag trio: **ONJ, atypical femur fracture, hypocalcemia**.

11 Most Tested Drugs in This Class

DRUG	ROUTE / FREQUENCY	KEY NCLEX POINT
Alendronate (Fosamax)	PO daily or weekly	Prototype; strict oral rules; most tested
Risedronate (Actonel)	PO weekly or monthly	Similar to alendronate; used in Paget's
Ibandronate (Boniva)	PO monthly or IV q3 months	Upright **60 min** (not 30); vertebral fx reduction only
Zoledronic acid (Reclast / Zometa)	IV once yearly (Reclast) or q3–4 wk (Zometa)	Renal toxicity, A-fib, flu-like symptoms; infuse ≥ 15 min; hydrate
Pamidronate (Aredia)	IV infusion	Hypercalcemia of malignancy; infuse over ≥ 2 hrs

KEY DIFFERENCES

- **Oral vs IV:** IV forms avoid GI toxicity but add renal + flu-like + A-fib risk
- **Ibandronate is the outlier:** 60-min upright rule and only proven to reduce vertebral fractures
- **Zoledronic acid** is the only once-yearly option — huge adherence win, but renal monitoring mandatory
- **Pamidronate** is reserved for hypercalcemia of malignancy, not routine osteoporosis

🧠 Clinical Judgment Snapshot

NCJMM • PRIORITY THINKING • DO THIS FIRST

#1 PRIORITY RISK WITH THIS DRUG

Severe esophagitis / esophageal ulceration from improper oral administration — followed by symptomatic hypocalcemia (tetany, laryngospasm, arrhythmia).

WHAT WILL HARM THE PATIENT FIRST?

Esophageal injury happens within **minutes to hours** of a single improperly taken dose. ONJ and atypical femur fractures are long-term risks — esophagitis and hypocalcemia are acute.

FIRST NURSING ACTION IN A SCENARIO

Before giving: verify serum calcium is normal AND confirm patient can sit/stand upright 30–60 minutes with a full glass of plain water.

If suspected esophagitis (new chest pain, odynophagia, hematemesis): hold drug, keep patient upright, NPO, notify provider, prepare for endoscopy.

If suspected hypocalcemia (+Chvostek's / Trousseau's, tingling, tetany): hold drug, check serum calcium STAT, initiate seizure precautions, prepare IV calcium gluconate per order.