



Anti-CMV Antivirals

Ganciclovir • Valganciclovir • Foscarnet • Cidofovir • Letermovir

Drug Class: Antivirals

System: Infectious Disease / Immunology

2026 NCLEX-RN Test Plan

1 Drug Overview

WHY we give it: To treat or prevent **Cytomegalovirus (CMV)** infection — a herpesvirus that is harmless in healthy adults but **deadly in the immunocompromised**.

Key Indications

- ▶ **CMV retinitis** — leading cause of blindness in AIDS (CD4 <50)
- ▶ **CMV prophylaxis & treatment** in solid organ & HSCT (hematopoietic stem cell transplant) recipients
- ▶ **Congenital CMV** — leading infectious cause of hearing loss & neurodevelopmental delay
- ▶ **CMV pneumonitis, colitis, esophagitis, encephalitis**
- ▶ **Letermovir** = prophylaxis ONLY in adult HSCT patients (not treatment)



High-yield: CMV is the #1 opportunistic viral infection in transplant patients and AIDS patients with CD4 <50.

2 Mechanism of Action

● GANCICLOVIR / VALGANCICLOVIR (guanosine analog)

Activated by viral kinase (UL97) → phosphorylated to triphosphate form → inhibits viral DNA polymerase → **halts viral DNA synthesis**

● FOSCARNET (pyrophosphate analog)

Directly inhibits viral DNA polymerase → NO phosphorylation needed → works on ganciclovir-resistant strains

● CIDOFOVIR (cytidine analog)

Phosphorylated by *cellular* enzymes (not viral) → inhibits viral DNA polymerase → long intracellular half-life (dosed weekly/biweekly)

● LETERMOVIR (terminase inhibitor)

Inhibits CMV **terminase complex** (pUL51/pUL56/pUL89) → prevents viral DNA packaging → no functional virions produced

3 Therapeutic Effects

What tells you it's working?

- ▶ **↓ CMV viral load** on quantitative PCR (primary marker)
- ▶ **Negative CMV PCR** after treatment course
- ▶ **Improved retinitis** on fundoscopic exam — stabilized/healing lesions
- ▶ **Resolution of symptoms** — fever, fatigue, GI symptoms, cough
- ▶ **Prevention of CMV disease** in transplant recipients (letermovir)
- ▶ **Improved organ function** (e.g., liver enzymes in CMV hepatitis)

4 Side Effects & Adverse Reactions

✓ COMMON

- ▶ **Ganciclovir/Valganciclovir:** GI upset, fever, headache, fatigue, rash
- ▶ **Foscarnet:** Nausea, vomiting, fever, HA, penile/vulvar ulcers (drug deposits in urine)
- ▶ **Cidofovir:** Nausea, alopecia, fever, rash, proteinuria
- ▶ **Letermovir:** GI upset, HA, fatigue — **much safer profile**

🚨 SERIOUS / LIFE-THREATENING

- ▶ **BONE MARROW SUPPRESSION** — neutropenia, anemia, thrombocytopenia → SEPSIS risk (Ganciclovir/Valganciclovir — **#1 killer**)
- ▶ **NEPHROTOXICITY** — AKI, tubular damage (Foscarnet & Cidofovir — **#1 killer**)
- ▶ **SEVERE ELECTROLYTE ABNORMALITIES** (Foscarnet) → ↓Ca, ↓Mg, ↓K, ↓/↑Phos → **seizures, arrhythmias, tetany**
- ▶ **SEIZURES** (Foscarnet — from ↓Ca/Mg or direct CNS toxicity)
- ▶ **OCULAR HYPOTONY** & uveitis (Cidofovir)
- ▶ **TERATOGENICITY / CARCINOGENICITY / INFERTILITY** (all — except letermovir is safer)
- ▶ **Retinal detachment** in CMV retinitis patients (disease-related)

5 Priority Nursing Considerations

ASSESS & MONITOR

- ▶ **CBC w/ differential** — baseline, 2×/week → watch ANC & platelets
- ▶ **BUN / Creatinine / eGFR** — baseline & ≥2×/week (q48h for foscarnet)
- ▶ **Electrolytes** — Ca, Mg, K, Phos (CRITICAL with foscarnet)
- ▶ **CMV PCR viral load** — weekly during therapy
- ▶ **LFTs** — especially in transplant patients
- ▶ **Visual acuity / fundoscopy** — CMV retinitis patients
- ▶ **Signs of infection / bleeding / bruising** — neutropenia & thrombocytopenia
- ▶ **I & O** and daily weight

HOLD & NOTIFY PROVIDER IF

- ▶ **ANC < 500/mm³** (Ganciclovir/Valganciclovir)
- ▶ **Platelets < 25,000/mm³**
- ▶ **Hemoglobin < 8 g/dL**
- ▶ **Serum creatinine ↑ significantly** (>0.5 mg/dL rise → foscarnet/cidofovir)
- ▶ **CrCl < 55 mL/min** → contraindicated for cidofovir
- ▶ **Severe electrolyte abnormalities** (foscarnet)
- ▶ **Signs of seizure activity** (foscarnet)

CONTRAINDICATIONS

- ▶ **Pregnancy** (teratogenic) & lactation

- ▶ Hypersensitivity to acyclovir/valacyclovir (cross-reactivity with ganciclovir)
- ▶ Severe neutropenia or thrombocytopenia
- ▶ **Cidofovir**: sulfa allergy, SCr >1.5, CrCl <55, proteinuria ≥2+, concurrent nephrotoxic drugs



DRUG INTERACTIONS

- ▶ **Ganciclovir + Zidovudine (AZT)** → ↑↑ myelosuppression
- ▶ **Ganciclovir + Imipenem-cilastatin** → **SEIZURES**
- ▶ **Ganciclovir + Probenecid / Mycophenolate / TMP-SMX** → ↑ levels/toxicity
- ▶ **Foscarnet + Nephrotoxins** (aminoglycosides, amphotericin B, IV pentamidine, cyclosporine) → AKI
- ▶ **Foscarnet + IV pentamidine** → **SEVERE HYPOCALCEMIA**
- ▶ **Cidofovir + Nephrotoxins** — must D/C tenofovir, NSAIDs, aminoglycosides 7 days prior
- ▶ **Letermovir + Cyclosporine / Tacrolimus / Sirolimus** → ↑ immunosuppressant levels (adjust doses)
- ▶ **Letermovir + Statins** (simvastatin/pitavastatin contraindicated) → rhabdo risk

6 Labs & Diagnostics

- ▶ **ANC:** Normal >1,500 → **HOLD if <500**
- ▶ **Platelets:** Normal 150K–400K → **HOLD if <25K**
- ▶ **Hemoglobin:** ♂ 14–18 / ♀ 12–16 → **HOLD if <8**
- ▶ **Serum Creatinine:** 0.6–1.2 mg/dL → notify if rise >0.5
- ▶ **BUN:** 7–20 mg/dL
- ▶ **Calcium:** 8.5–10.5 mg/dL → **Foscarnet drops this — watch Chvostek/Trousseau**
- ▶ **Magnesium:** 1.5–2.5 mEq/L
- ▶ **Potassium:** 3.5–5.0 mEq/L
- ▶ **Phosphate:** 2.5–4.5 mg/dL
- ▶ **CMV quantitative PCR:** Primary marker of response — want **undetectable**
- ▶ **Urinalysis:** Proteinuria >2+ → STOP cidofovir
- ▶ **CD4 count:** Monitor in HIV patients

7 Administration & Safety

⚠ **HAZARDOUS DRUGS** — Handle with chemo-grade PPE (gloves, gown, mask, eye protection). Treat spills as cytotoxic. Never crush valganciclovir tablets.

- ▶ **Ganciclovir:** IV ONLY — infuse over ≥ 1 hour via central line preferred; **never IV push** (causes toxicity & phlebitis)
- ▶ **Valganciclovir:** PO WITH FOOD — dramatically ↑ bioavailability (~60%); swallow whole
- ▶ **Foscarnet:** IV via CENTRAL LINE; **pre-hydrate with 500–1000 mL NS** BEFORE each dose; infuse over 1–2 hrs with pump
- ▶ **Cidofovir:** Weekly IV; **MUST give with oral probenecid** (2 g 3 hrs before + 1 g 2 & 8 hrs after) + **1 L NS before**, optional 1 L after
- ▶ **Letermovir:** PO or IV once daily; IV infuse over 1 hr; can be taken without regard to food
- ▶ **Renal dosing:** Required for ALL except letermovir
- ▶ **Contraception:** Required during + 30 days after (women) / 90 days after (men)
- ▶ **High-alert:** Double-check dose & renal function; independent second nurse verification per facility policy

8 Patient Education

- ▶ **Report IMMEDIATELY:** fever, chills, sore throat, mouth sores (neutropenia → sepsis)
- ▶ **Report:** unusual bruising, bleeding gums, petechiae, blood in urine/stool (thrombocytopenia)
- ▶ **Report:** ↓ urine output, flank pain, swelling (nephrotoxicity)
- ▶ **Report:** tingling around mouth, muscle cramps, twitching, numbness (electrolyte imbalance — foscarnet)
- ▶ **Drink plenty of fluids** (2–3 L/day unless contraindicated) — protects kidneys
- ▶ **Valganciclovir:** take WITH FOOD, swallow whole (do NOT crush/chew — cytotoxic powder)
- ▶ **Contraception mandatory:** Both partners — pregnancy causes severe birth defects
- ▶ **Men:** use condoms during + 90 days after (sperm affected)
- ▶ **Regular eye exams** q4–6 weeks if CMV retinitis (even after treatment)
- ▶ **Avoid live vaccines** & crowds/sick contacts (immunosuppressed)
- ▶ **No breastfeeding** during therapy
- ▶ **Wear gloves** to handle pills/body fluids at home
- ▶ **Do NOT skip doses** — resistance develops quickly

9 NCLEX Test Traps ⚠️

- ▶ **ACYCLOVIR ≠ GANCICLOVIR** → Acyclovir = HSV/VZV. Ganciclovir = CMV. Do NOT confuse!
- ▶ **Ganciclovir's #1 toxicity is BONE MARROW SUPPRESSION** — not nephrotoxicity (common distractor)
- ▶ **Foscarnet & Cidofovir's #1 toxicity is NEPHROTOXICITY** — not bone marrow suppression
- ▶ **Foscarnet is for GANCICLOVIR-RESISTANT CMV** — or when bone marrow cannot tolerate ganciclovir
- ▶ **Valganciclovir = ORAL prodrug of ganciclovir** — same toxicities, better absorption (60%)
- ▶ **HYDRATE BEFORE** foscarnet & cidofovir — NOT after (prevents AKI)
- ▶ **Cidofovir REQUIRES probenecid** — reduces kidney uptake, prevents nephrotoxicity
- ▶ **Letermovir = PROPHYLAXIS only** (CMV-seropositive HSCT recipients) — NOT treatment of active disease
- ▶ **Priority action for fever in CMV patient on ganciclovir:** check CBC first (neutropenia)
- ▶ **Priority intervention during foscarnet seizure:** STOP infusion, protect airway, check Ca/Mg
- ▶ **Ganciclovir + imipenem** → seizures (classic interaction question)
- ▶ **First sign of hypocalcemia from foscarnet:** perioral tingling / paresthesias (before tetany)
- ▶ **CMV retinitis** — "**floaters, blurry vision, flashing lights**" in AIDS pt = EMERGENCY
- ▶ **Don't confuse** Cytovene (ganciclovir) with Cytotec (misoprostol) — similar-looking names

10 Memory Boosters

- ▶ 🧠 **"GANCI kills the GRANulocytes"** → Ganciclovir causes GRANulocytopenia (neutropenia)
- ▶ 🧠 **"FOScarnet = FOSSilizes your kidneys & electrolytes"** → nephrotoxicity + all 4 electrolytes down
- ▶ 🧠 **"CIDOfovir = KIDfovir"** → severe nephrotoxicity (kidney destroyer)
- ▶ 🧠 **"Letter-MOVE-her through transplant"** → LETERMOVIR = prophylaxis in HSCT
- ▶ 🧠 **CMV drug suffixes:** end in **-ciclovir** (gancic., valganc.) or **-fovir** (cido., leter.)
- ▶ 🧠 **"SIGHT" villain** → CMV attacks: **S**ight (retinitis), **I**ntestines (colitis), **G**rafts (transplants), **H**earing (congenital), **T**iny babies
- ▶ 🧠 **"The 4 F's of Foscarnet"** → **F**alling calcium, **F**its (seizures), **F**ailing kidneys, **F**oul penile ulcers
- ▶ 🧠 **"CIDO needs PRO"** → CIDOfovir needs PRObenecid + PRE-hydration
- ▶ 🧠 **CMV retinitis triad:** "Floaters, Flashes, Fuzzy vision" in AIDS
- ▶ 🧠 **Hold parameters — "5-2-5-8"** → ANC <500, Plt <25K, Hgb <8 (not 5)

Most Tested Drugs in This Class

DRUG	ROUTE	PRIMARY USE	#1 TOXICITY	KEY NCLEX POINT
Ganciclovir (<i>Cytovene</i>)	IV	CMV treatment (retinitis, colitis, pneumonitis)	Bone marrow suppression	Monitor CBC 2x/week; hold if ANC <500
Valganciclovir (<i>Valcyte</i>)	PO	CMV treatment/prophylaxis (outpt-friendly)	Bone marrow suppression	Take WITH FOOD; swallow whole; cytotoxic
Foscarnet (<i>Foscavir</i>)	IV	Ganciclovir-resistant CMV	Nephrotoxicity + ↓ electrolytes	Pre-hydrate; monitor Ca/Mg/K/Phos; seizure risk
Cidofovir (<i>Vistide</i>)	IV (weekly)	CMV retinitis when others fail	Severe nephrotoxicity	MUST give with probenecid + NS prehydration
Letermovir (<i>Prevymis</i>)	PO or IV	CMV prophylaxis in adult HSCT	GI upset (safest profile)	↑ tacrolimus/cyclosporine levels; NOT for treatment

 **Key differences: Ganciclovir family (-ciclovir) → bone marrow damage. Foscarnet & Cidofovir → kidney damage. Letermovir → new & gentler, prophylaxis only.**

Clinical Judgment Snapshot

The three questions the NCLEX wants you to answer in <60 seconds:

#1 PRIORITY RISK

Ganciclovir / Valganciclovir:
Severe bone marrow suppression
→ neutropenic sepsis

Foscarnet / Cidofovir: Acute
kidney injury + fatal electrolyte
disturbances (foscarnet)

WHAT HARMS FIRST

Neutropenia → infection & sepsis
(days–weeks)

Nephrotoxicity → rising Cr + AKI
(can occur after 1st dose of
foscarnet/cidofovir)

Hypocalcemia seizure (foscarnet)
→ *during infusion*

FIRST NURSING ACTION

**Before EVERY dose: CHECK CBC +
Creatinine + Electrolytes**

**If ANC <500, Plt <25K, or Cr ↑
significantly** → **HOLD drug & notify
provider**

**If perioral tingling during
foscarnet** → **STOP infusion, check
ionized Ca**

 **NCLEX RULE:** "Labs before the drug. Kidneys before foscarnet. Counts before ganciclovir. Probenecid before cidofovir."