



Microtubule Inhibitors



Key Concept

- All are M-phase specific → Act during mitosis (spindle formation/function)
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Core Mechanism (Big Picture)

Microtubules are essential for forming the mitotic spindle → separating chromosomes during cell division.

These drugs either:

- Prevent microtubule formation, OR
- Prevent microtubule breakdown

Result: Mitotic arrest → apoptosis 🦴

Flowchart: Role of Microtubules in Mitosis

Normal mitosis → Microtubule formation (spindle assembly) → Chromosome alignment → Spindle breakdown → Cell division completes

With microtubule inhibitors → Disrupted spindle function → Mitotic arrest (M phase) → Cell death



Drug Table

Class	Drugs	Mechanism	Clinical Use	Adverse Effects
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Taxanes	Paclitaxel, Docetaxel	Stabilize microtubules	Breast, ovarian cancer	Myelosuppression, neuropathy
Vinca alkaloids	Vincristine, Vinblastine	Inhibit microtubule formation	Leukemias, lymphomas	Neurotoxicity / myelosuppression



Drug-by-Drug Notes

Taxanes

(Paclitaxel, Docetaxel)



Mechanism

- Hyperstabilize polymerized microtubules → Prevent depolymerization (breakdown) → Microtubules become "frozen" ❄️
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Flowchart: Taxane Action

Taxanes → Stabilize microtubules → Prevent spindle breakdown → Spindle cannot reorganize → Mitosis cannot complete → Cell death

Clinical Uses

- Breast cancer 🎯
 - Ovarian cancer
 - Other solid tumors
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! Adverse Effects

- Myelosuppression 
 - Peripheral neuropathy 
 - Hypersensitivity reactions
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Mnemonic

“Taxanes TAX (stabilize) society”

→ Stabilize = microtubules don't break down (this breakdown is actually needed for normal microtubule function)

2 Vinca Alkaloids

(Vincristine, Vinblastine)



Mechanism

- Bind β -tubulin $\rightarrow$ Prevent polymerization of microtubules $\rightarrow$ Spindle cannot form
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Flowchart: Vinca Alkaloid Action

Vinca alkaloids $\rightarrow$ Bind β -tubulin $\rightarrow$ Prevent microtubule formation $\rightarrow$ No mitotic spindle $\rightarrow$ Chromosomes cannot separate $\rightarrow$ Mitotic arrest $\rightarrow$ cell death



Clinical Uses

- Leukemias
 - Lymphomas (Hodgkin & non-Hodgkin)
 - Solid tumors
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! Adverse Effects

● Vincristine

- Neurotoxicity (axonal neuropathy) 🧠
 - Constipation / paralytic ileus 🚫
 - Minimal myelosuppression
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● Vinblastine

- Myelosuppression 💉 (dose-limiting)
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🎯 Exam Mnemonics

- "VinCRISTine CRISPs the nerves" → Neurotoxicity
 - "VinBLASTine BLASTS the marrow" →
Myelosuppression
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Comparison Table

Feature	Taxanes	Vinca Alkaloids
Effect on microtubules	Stabilize	Prevent formation
Spindle effect	Cannot break down	Cannot form
Key toxicity	Neuropathy + myelosuppression	Neuro (vincristine) / marrow (vinblastine)
Mechanism style	"Freeze" microtubules ❄️	"Destroy formation" 💥

Summary

- All microtubule inhibitors → M-phase specific
- Taxanes → stabilize microtubules (no breakdown)
- Vinca alkaloids → prevent microtubule formation

- Vincristine → neurotoxicity (NO marrow suppression)
 - Vinblastine → myelosuppression
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-> The End <-