

Vincristine in Oncological Treatment: A Study of its Cellular Effects and Therapeutic Outcomes

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DESCRIPTION

Vincristine is a chemotherapy drug derived from the periwinkle plant *Catharanthus roseus*, plays an essential role in the treatment of various types of cancer. It is primarily used to treat childhood cancers such as leukemia, lymphoma and certain solid tumors as well as adult cancers like non-Hodgkin's lymphoma and certain types of breast cancer. Vincristine's mechanism of action, clinical uses, side effects and challenges in administration make it a significant drug in oncology. This contributes to its side effect profile, which can range from mild to severe, depending on the dosage and individual patient characteristics.

Mechanism of action

Vincristine acts by binding to tubulin, a protein that forms microtubules, structures essential for cell division. In normal cell division, microtubules form the mitotic spindle that helps in separating chromosomes. Vincristine disrupts the polymerization of tubulin into microtubules, thereby hesitating the cell cycle in the metaphase stage, preventing further division and inducing cell death. This mechanism is particularly effective in rapidly dividing cancer cells, which makes vincristine effective in treating aggressive cancers. However, while it targets cancer cells, vincristine can also affect normal cells, particularly those in tissues that are actively dividing such as hair follicles the digestive tract and bone marrow.

Clinical uses

Acute Lymphoblastic Leukemia (ALL): Vincristine is one of the main drugs used in combination with other agents like methotrexate and prednisone to treat ALL in children and adults.

Hodgkin's lymphoma: It is used in regimens like cyclophosphamide, doxorubicin, vincristine, prednisone to treat various types of lymphoma.

Neuroblastoma: Vincristine is included in treatment protocols for this childhood cancer where it helps shrink tumors and prevent metastasis.

Wilms tumor: A common kidney cancer in children, vincristine is part of the treatment regimen to achieve favorable outcomes.

Administration and dosage

Vincristine is typically administered intravenously as it is not effective when taken orally due to poor absorption. The dosage depends on the patient's age, body surface area and specific cancer being treated. It is commonly given in cycles, where the patient receives vincristine over a period of several weeks followed by a rest period. This cyclical approach allows normal cells to recover while targeting cancer cells during their division phases. One of the challenges with vincristine administration is its potential neurotoxicity. The drug can cause peripheral neuropathy, which manifests as tingling, numbness and pain in the hands and feet. In some cases, severe nerve damage may occur, which may require dose adjustments or discontinuation of the drug.

Side effects and toxicity

Neuropathy: Vincristine's primary side effect is peripheral neuropathy, which can cause tingling, numbness or pain in the extremities. In severe cases, this can lead to motor dysfunction and long-term nerve damage.

Constipation: The drug can cause gastrointestinal problems, with constipation being one of the most frequent issues. This is often severe and requires medical intervention.

Immunosuppression: Vincristine can suppress bone marrow activity, which can lead to a decrease in white blood cells, increasing the risk of infections.

Severe liver and kidney toxicity: Although rare, vincristine can sometimes affect the liver and kidneys, requiring careful monitoring during treatment.

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CONCLUSION

Vincristine remains one of the most important and effective drugs in the collection of cancer treatments. Despite its potential side effects, the impact it has had on survival rates for cancers like leukemia and lymphoma cannot be excessive. The drug's ability to disrupt the microtubule formation in rapidly

dividing cells is central to its success and ongoing study continues to improve its use in combination therapies to further enhance its therapeutic benefit. As with any effective chemotherapeutic agent, the careful balance between efficacy and toxicity is acute and advancements in treatment protocols are continually being developed to ensure the best outcomes for patients.