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Original Research Article

Ethnopharmacological review of anticancer activity of vinca and turmeric

Amit G Nerkar[1,2,*], **Rushikesh P Nagarkar**[3]

[1]*Founder and Director, Ateos Foundation of Science Education and Research, Pune, Maharashtra, India*
[2]*Dept. of Pharmacy, Siddhant College of Pharmacy, Pune, Maharashtra, India*
[3]*Siddhant College of Pharmacy, Pune, Maharashtra, India*

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ABSTRACT

Natural products with immunomodulatory effects are widely used in the treatment of many diseases, including autoimmune diseases, as well as cancer and inflammatory diseases. They have attracted great interest as therapeutic agents in recent decades because they offer inexpensive and less toxic products than synthetic chemotherapy agents. Immunomodulators are substances that have the ability to improve or suppress the host's defense response, which can be used for prevention and in combination with other treatments. The anticancer effects of these immunomodulators result from their anti-inflammatory, antioxidant and apoptosis-inducing, anti-angiogenic and anti-metastatic effects. In addition to preventing tumor growth and proliferation, these natural immunomodulators, such as curcumin and Vinca, can also be used as a preventive treatment against cancer. In contrast, immunostimulants can induce and activate humoral and cell-mediated immune responses against the tumor, which facilitates the recognition and destruction of a pre-existing tumor.

1. Introduction

Cancer is a complex disease that results from the uncontrolled growth and division of abnormal cells. It can occur in any part of the body and spread to other parts of the body, making it difficult to treat. The impact of cancer on society is significant both in terms of human suffering and financial costs.

1.1. Here are some ways cancer affects society

1. Human suffering: Cancer can cause physical pain, mental suffering and emotional trauma to patients and their families. It can affect all aspects of a person's life, from work to relationships and daily activities. The impact of cancer on a patient's quality of life can be devastating.
2. Mortality: Cancer is one of the leading causes of death worldwide. In 2020, it caused an estimated 9.9 million deaths worldwide. Certain cancers, such as pancreatic and lung cancer, have particularly high death rates.
3. Financial costs: Cancer treatment can be expensive and the financial burden of cancer is significant. The costs of cancer treatment include not only the cost of treatment, but also the loss of productivity and quality of life. In 2020, the global economic cost of cancer was estimated at $1.16 trillion.
4. Health system: The high incidence and prevalence of cancer places a significant burden on health systems. Cancer patients require special care and the resources needed to treat cancer can be limited. The demand for cancer treatment is expected to continue to grow as the population ages and the incidence of cancer increases. [1]

* *Corresponding author*.
E-mail address: dragnerkar@gmail.com (A. G. Nerkar).

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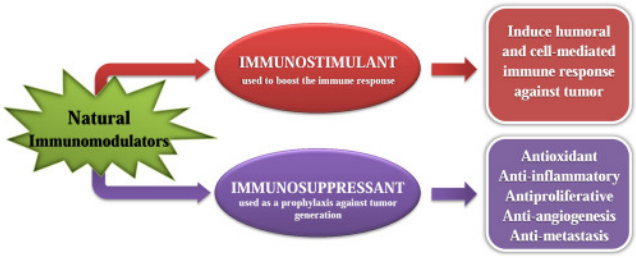
5. Research and development: the search for new and better cancer treatments is an ongoing process. Research and development in the field requires significant resources and investments. Although advances in cancer treatment have been made in recent years, much remains to be done to improve outcomes for cancer patients.[2]

Vinca and turmeric are natural compounds that have been studied for their potential anti-cancer effects. Vinca alkaloids are a group of compounds derived from the Madagascar evergreen (Catharanthus roseus), while turmeric is a spice derived from the turmeric plant (Curcuma longa). Here is an overview of these compounds and their potential anticancer effects:



1.2. Vinca

Vinca alkaloids are used clinically as chemotherapy agents for various types of cancer, including leukemia, lymphoma, and solid tumors such as breast, lung, and ovarian cancer.

1. Vinca alkaloids prevent the formation of microtubules necessary for cell division. This leads to the arrest of cell growth and induction of apoptosis or programmed cell death.
2. Vinca alkaloid has an immunomodulatory effect in addition to its anticancer effect, which can improve the body's ability to fight cancer.[3]

1.3. Turmeric

1. Curcumin is the active compound in turmeric that has been studied for its potential anti-cancer effects.
2. Curcumin has anti-inflammatory, antioxidant and immunomodulatory effects that may contribute to its anti-cancer effects.
3. The ability of curcumin to inhibit the growth and reproduction of cancer cells, to induce apoptosis and angiogenesis (formation of new blood vessels necessary for tumors) has been studied.[4]

1.4. Combining vinca and turmeric

1. Some studies have examined the combination of vinca and turmeric for their potential synergistic anticancer effects.
2. One study found that a combination of vinblastine (a vinca alkaloid) and curcumin inhibited the growth of breast cancer cells more effectively than either compound alone.
3. The mechanism of action of the synergistic effect is not well understood, but may involve the modulation of multiple signaling pathways.[5]

2. Vinca

Overview of vinca alkaloids and their mechanism of action.

Vinca alkaloids are a group of natural compounds derived from the Madagascar periwinkle (Catharanthus roseus). They are widely used in chemotherapy for many types of cancer, including leukemia, lymphoma, and solid tumors such as breast, lung, and ovarian cancers. The two most commonly used vinca alkaloids in clinical practice are vincristine and vinblastine.[5–12]

The mechanism of action of periwinkle alkaloids involves the inhibition of microtubule formation, which is essential for cell division. Microtubules are tubular structures composed of the protein tubulin, which play an important role in maintaining the structural integrity of the cell and in the formation of the mitotic spindle during cell division.[13] Vinca alkaloid binds to tubulin and prevents its polymerization into microtubules, resulting in cessation of cell growth and division. Specifically, vinca alkaloid binds to the beta subunit of tubulin, inhibiting the formation of microtubule bundles and leading to the formation of abnormal microtubule structures.[14] In addition to their effects on microtubules, periwinkle alkaloids have immunomodulatory effects, which may contribute to their antitumor activity. Specifically, they have been shown to boost the activity of natural killer cells, which play a key role in the immune response to cancer.

The specific mechanism of action of vinca alkaloids may vary depending on the type of cancer and the stage of the cell cycle. For example, in white blood cells, the alkaloid vinca can induce apoptosis (programmed cell death) by disrupting the assembly of the spindle apparatus during cell division. In solid tumors, vinca alkaloids can inhibit the formation of new blood vessels (angiogenesis) by disrupting microtubule function in endothelial cells.[15–19]

2.1. Preclinical and clinical studies on the use of vinca alkaloids in cancer treatment[20–25]

Vinca alkaloids are an important class of chemotherapeutic agents that have been used for decades to treat various types of cancer. The following is an overview of preclinical and clinical studies on the use of vinca alkaloids in the treatment of cancer:

2.1.1. Preclinical studies

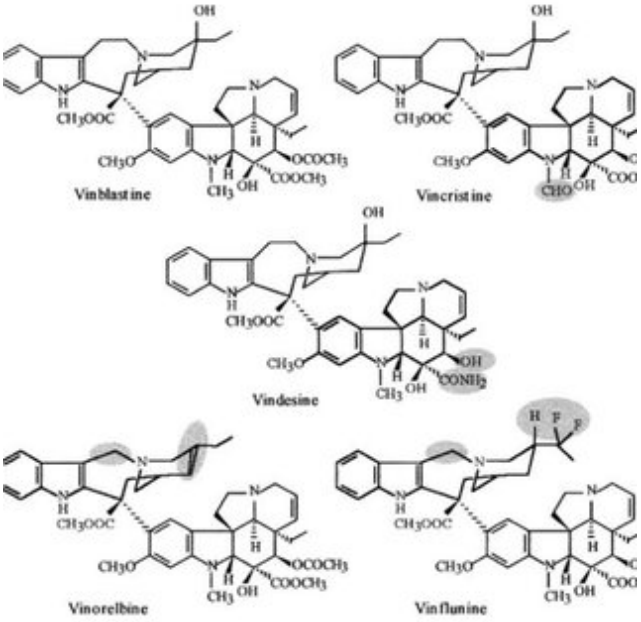
1. Preclinical studies have shown that periwinkle alkaloids have potent antitumor activity against a variety of tumors, including leukemia, lymphoma and solid tumors such as breast, lung and prostate, ovaries.
2. In addition to the effect on microtubule function, vinca alkaloid has also been shown to have immunomodulatory effects, which can improve the body's ability to fight cancer.
3. Preclinical studies have investigated the use of vinca alkaloids in combination with other chemotherapy, radiation and immunotherapy agents, with promising results.

2.1.2. Clinical studies

1. Clinical studies have confirmed the effectiveness of vinca alkaloids in the treatment of many types of cancer, including acute lymphoblastic leukemia (ALL), Hodgkin's and non-Hodgkin's lymphoma, breast cancer, and lung cancer.
2. Vincristine, in particular, is an important component of chemotherapy regimens for ALL children and has contributed to significant improvements in survival rates for this disease over the past decades.
3. Vinca alkaloids have also been studied in combination with other chemotherapeutic agents, such as cisplatin and taxanes, with promising results.
4. However, the use of vinca alkaloids has been associated with a range of adverse events, including peripheral neuropathy, gastrointestinal symptoms, and bone marrow suppression, which may limit use and require careful management.

Overall, preclinical and clinical studies have demonstrated the effectiveness of vinca alkaloids in the treatment of various types of cancer. Ongoing research is aimed at optimizing their use, both as standalone agents and in combination with other therapies, while minimizing their associated side effects.

2.2. Chemical constituents of vinca[6]



3. Turmeric

Overview of curcumin and its mechanism of action

Curcumin is a natural compound found in turmeric, extracted from the root of the turmeric plant (Curcuma longa). It has been extensively studied for its potential health benefits, including anti-cancer activity. Here is an overview of curcumin and its mechanism of action:

1. Curcumin is a polyphenolic compound with powerful antioxidant and anti-inflammatory properties. It has been shown to regulate several important signaling pathways involved in cancer development and progression, including the NF-κB pathway, the PI3K/Akt pathway, and the MAPK pathway.
2. Curcumin has been shown to induce apoptosis (programmed cell death) in many types of cancer cells, including breast, prostate, lung, colon and leukemia cells . This effect is thought to be mediated by up-regulation of pro-apoptotic proteins and down-regulation of anti-apoptotic proteins.[7]
3. Curcumin has also been shown to inhibit cancer cell growth and invasion by regulating cell cycle progression and regulating the expression of matrix metalloproteinase (MMP), which is involved involved in the breakdown of extracellular matrix proteins.[8]
4. In addition to its direct effect on cancer cells, curcumin has been shown to have immunomodulatory effects, including activation of natural killer cells and suppression of regulatory T cells, which may contribute to part of its anticancer activity.[9]

5. Curcumin has also been shown to inhibit angiogenesis, the process by which new blood vessels form to provide nutrients to cancer cells. This effect is thought to be mediated by downregulation of vascular endothelial growth factor (VEGF), a key regulator of angiogenesis.[10] Overall, curcumin's mechanism of action is complex and involves the regulation of multiple signaling pathways and cellular processes involved in cancer development and progression. Its powerful antioxidant and anti-inflammatory properties, combined with its effects on apoptosis, cell proliferation, invasion, angiogenesis, and immune function, make it become a promising candidate for the development of new anti-cancer therapies. However, more research is needed to fully understand its potential and optimize its use in cancer treatment.[11]

3.1. Preclinical and clinical studies on the use of curcumin in cancer treatment[26,27]

Curcumin has been extensively studied for its potential for cancer treatment in preclinical and clinical studies. Here is an overview of the current state of research:

3.1.1. Preclinical studies

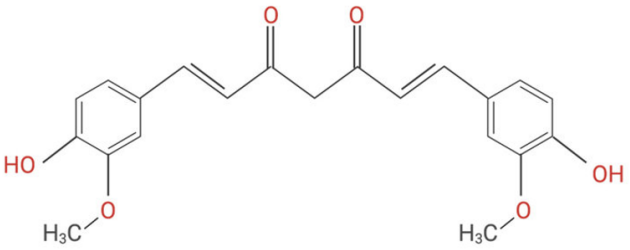
1. Preclinical studies have shown that curcumin has potent anticancer activity against many types of tumors, including breast, prostate, lung, colon and pancreatic cancers.
2. In addition to its effects on cancer cells, curcumin has been shown to have anti-inflammatory and antioxidant effects, which may contribute to its anti-cancer activity by reducing oxidative stress and inflammation.
3. Preclinical studies have also investigated the use of curcumin in combination with other chemotherapy, radiation and immunotherapy agents, with promising results.

3.1.2. Clinical studies

1. Clinical studies have investigated the use of curcumin as a treatment for cancer in humans, although most studies to date have been small and limited.
2. Studies have shown that curcumin is safe and well tolerated at doses up to 8 grams per day in humans, with very few side effects reported.
3. Clinical studies have shown that curcumin can inhibit the growth and spread of human cancer cells, especially when combined with other therapies.
4. However, curcumin's bioavailability is low, meaning it is rapidly metabolized and eliminated from the body, which may limit its effectiveness in cancer treatment.

Overall, preclinical and clinical studies have shown that curcumin has potent anticancer activity and may be a promising candidate for the development of new cancer therapies. However, more research is needed to optimize its use in humans, especially with regard to improving its bioavailability and understanding its mechanism of action in the human body.

3.2. Curcumin structure[7]



4. Synergistic Effect of Vinca and Turmeric

The combination of periwinkle and turmeric alkaloids has been studied for its potential synergistic effects in cancer treatment. Here is an overview of the current state of research:

1. Vinca alkaloids, such as vincristine and vinblastine, are potent anticancer agents that work by disrupting microtubule function and preventing cell division.[28]
2. Turmeric and its active compound, curcumin, have been shown to have powerful anti-inflammatory and antioxidant effects and have been studied for their potential against cancer.[29,30]
3. Studies have investigated the combination of periwinkle and turmeric alkaloids in preclinical cancer models, including breast cancer, colon cancer and leukemia, with promising results.[31]
4. The combination of periwinkle alkaloids and turmeric has been shown to have a synergistic effect in inhibiting cancer cell growth and inducing apoptosis of cancer cells.
5. This combination has also been shown to improve the effectiveness of chemotherapy and radiation therapy in preclinical cancer models.[32]
6. Potential mechanisms underlying the synergistic effects of vinca and turmeric may include regulation of key signaling pathways involved in cancer development and progression, such as pathways NF-κB and the PI3K/Akt pathway, as well as inhibition of angiogenesis and metastasis.[33,34]

5. Conclusion

Periwinkle alkaloids and turmeric (especially curcumin) have been extensively studied for their anti-cancer potential. Vinca alkaloids work by disrupting microtubule function

and preventing cell division, while turmeric has anti-inflammatory and antioxidant effects.

Preclinical studies have shown that both compounds have potent antitumor activity against a variety of tumors, and they have been studied in combination with chemotherapy, radiation, and immunotherapy agents. with promising results.

Clinical studies have shown that both compounds are safe and well tolerated at appropriate doses and can inhibit the growth and spread of human cancer cells. However, curcumin's bioavailability is low, which may limit its effectiveness in cancer treatment. Studies have investigated the combination of periwinkle alkaloids and turmeric for potential synergistic effects in cancer treatment, with promising results in preclinical cancer models. Further research is needed to optimize the combination and study its safety and effectiveness in humans. Overall, vinca and turmeric are promising candidates for the development of new cancer therapies.

6. Source of Funding

None.

7. Conflict of Interest

None.

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Author biography

Amit G Nerkar, Founder and Director https://orcid.org/0000-0002-1377-8466

Rushikesh P Nagarkar, Final year UG Student

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