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A review on leukemia by novel bio-active natural product

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Abstract

Cancer is a major public health burden which is growing continuously. An attempt has been made to review some medicinal plants used for the prevention and treatment of leukemia (blood cancer). Although some chemical compounds in drugs form are available yet they are not successful. Either they are producing side effect or not curing completely. Herbal medicines have a vital role in the prevention and treatment of cancer. With advanced knowledge of molecular science in isolation and structure elucidation techniques, Many Anticancer herbs or plants have been identified which produce their therapeutic effect by inhibiting cancer-activating enzymes and hormones. Various anticancer agents including taxol, vinblastine, vincristine, the camptothecin derivatives, topotecan and irinotecan, and etoposide are in clinical use all over the world.

Keywords: Leukemia, natural product, herbal medicine for leukemia

Introduction

Leukemia is a type of cancer that generally affects stem cells of blood. These stem cells are the basic cells which develop into different types of blood cells. Under Leukemia condition, bone marrow produces abnormal cancerous blood cells that eliminate the normal and healthy blood cells. White blood cells are more to prone to become cancerous than RBCs and platelets.

Blood stem cells are of two types

1. Lymphoid cells
2. Myeloid cells

Lymphoid cells

Lymphoid stem cells are developing into a type of White blood cells or lymphocytes. These lymphocytes play a major role in maintenance of body defense mechanism by fighting against infections.

Myeloid cells

These are developed into RBCs which carries oxygen, granulocytes and monocytes which help to maintain body defense mechanism by fighting against infections, platelets which help in clot formation to prevent bleeding.

Leukaemia has been recognized since 1845, when a report was published on a patient who died of the disease which have shown an amplified number of blood cells. Twenty years later it was found that diagnosis of leukaemia could be possible through bone marrow puncture. [2] Leukaemia is one of the most common types of cancer worldwide. Decreased in incidence of infectious diseases and increased human life span caused prevalence of leukaemia. The use of therapeutic herbs in developing countries as cures against leukaemia is prominent. [3]

Leukaemia is diagnosed 10 times more often in adults than in children and more common in males than females. In the year 2000, nearly 2, 56,000 children and adults around the world developed some form of leukaemia, and 2,09,000 died from it. [17]

- There are an estimated 381,774 people living with or in remission from leukemia in the US.
- In 2018, 24,370 people died from leukemia (14,270 males and 10,100 females).
- In 2010 to 2014, in both males and females, leukemia was the sixth most common cause of cancer deaths

Classification

1. Acute myeloid leukemia (AML)
2. Chronic myeloid leukemia (CML)
3. Chronic lymphocytic leukemia (CLL)

Acute myeloid leukemia-

This condition arises when original acute leukemia cell starts growing and increase in no. drastically as a result they knockout the normal cells and in turn the new normal cells reduces, which affects the RBC count (anemia), low platelet count (bleeding risk), and low neutrophil count (risk of infections).

Chronic myeloid leukemia

CML or Myelogenous leukemia is also considered as slow growing leukemia as it arises due to undesirable genetic changes. Genetic changes affects the myeloid cells (immature) as a result it leads to the formation of abnormal genes i.e. BCR-ABL, these genes in turn result in the formation of chronic myeloid leukemia cells and they start growing rapidly in bone marrow, as the number increases they starts seeping into the blood and affect the blood cells.

Chronic lymphocytic leukemia

Those leukemic cells which is responsible for causing disease they starts dividing and form too many large lymphocytes which are non-functional in nature. These cells start replacing normal cells (bone marrow cells) and interfere with normal lymphocytes and in turn affect the patient immune response or immunity.

Signs & symptoms

- Tiredness or no energy
- Shortness of breath during physical activity
- Pale skin
- Mild fever or night sweats
- Slow healing of cuts and excess bleeding
- Black-and-blue marks (bruises) for no clear reason
- Pinhead-size red spots under the skin

- Aches in bones or joints (for example, knees, hips or shoulders)
- Low white cell counts, especially monocytes or neutrophils.
- In 2018, 60,300 people are expected to be diagnosed with leukemia. [42]

Plants as anti-cancer drug

Natural product is a substance produced by a living organism which is found in nature. Natural products are complex compounds that possess diverse activity. Several species belonging to the marine flora have been screened for natural products that can have significant biological activities & potential for drug development. These compounds interact with their target molecule and may be able in the form of drug for the treatment of various diseases. These efforts have yielded the isolation of number of drugs from bioactive compounds produced by marine organism. Thus, Natural product presents many challenges to the structural and synthetic organic chemistry. Marine natural products proved their efficacy against a number of diseases.

Compounds derived from the plants have been the main source of medicines and drugs which can be useful in the treatment of cancer. Vinblastine, vincristine, topotecan and irinotecan, etoposide, derived from epipodophyllotoxin, the camptothecin derivatives, and paclitaxel (taxol) are included in this category. Many leukemic patients often take plant extracts along with prescribed medicine. Industry also has arisen selling plant extracts as drugs which can be useful in various diseases. A number of agents from plant extracts are in under clinical trials based on the particular activity against blood cancer such as combretastin A4 phosphate and flavopiridol.



Fig 1: Plant derived natural products in controlling and curing leukemia

Major biological properties of herbs attributed to potential Antileukaemic effect.

- *Hibiscus cannabinus* used as an Antioxidative and have Antileukaemic activity, it helps to Induced apoptosis in WEHI-3B, HL-60, and K562 cells.
- *Euphorbia formosana* is used for its Antileukaemic activity, it generally helps to treat leukaemia and other

malignancies and Induces apoptosis in various leukaemic cell lines.

- *Allium sativum* (garlic) is used for its Antileukaemic activity and directs the cytotoxic effect on cancer cells with a free radical activity.

- *Moringa oleifera* used for its Antileukaemic and Antiproliferative activity and its Ethanolic extract killed most of the leukaemic cells.
- *Achillea fragrantissima* is used for its Hepatoprotective antileukaemic activity and help to arrest the Cell cycle and induce apoptosis in CML cells.
- Grape seeds cause Cell death and Apoptosis of Leukaemic cells and in turn it forces leukemia cells to commit cell suicide.

Besides this there are many fruits available which may treat leukemia like grape seed, pomegranate, carrot etc. They may force either leukemia cell to commit cell suicide or may increase percentage of CD₃ or CD₉. Carrot contains beneficial agents, such as β -carotene and poly acetylenes, which could be effective in the treatment of leukaemia while Pomegranate juice (PGJ) induced apoptosis by altering in the cell cycle. Grape seed are products from whole grape seeds which are rich in vitamin E, flavonoids, linoleic acid, and phenolic OPCs.

Conclusion

The use of medicinal plant products to manage or arrest the carcinogenic process provides an alternative to the use of conventional allopathic medicine for treatment of the disease. Many herbs have been evaluated in clinical studies and are currently being investigated to understand their tumoricidal properties against various cancers.

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