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Taxus brevifolia: An Origin of Paclitaxel

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ABSTRACT

Cancer has become a global problem. Cancer can be shortly defined as uncontrolled growth of cells. The category of drugs used in treatment of cancer is known as anticancer drugs. The article provides information about cancer and anticancer drugs used to treat cancer. Also it describes detail information about *Taxus brevifolia* which is used to extract Paclitaxel, a potent anticancer drug. The source, chemical present in different parts, uses of *Taxus brevifolia* is also mentioned with mechanism and dosage form of Paclitaxel.

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INTRODUCTION:

1. Cancer:

Cancer has become an increasing health threat globally. One of six deaths is the cause of cancer. Cancer can be defined as uncontrolled growth of abnormal cells of a specific organ. Medical term for cancer is Neoplasm. The drugs used to treat cancer are called anticancer drugs or antineoplastic drugs. At present, chemotherapy is used mostly for the treatment of cancer. Chemotherapy is a type of cancer treatment which includes a single drug or combination of drugs that are capable of destroying causative organism without destroying host cells. Many herbal drugs are proven for their effective action against cancerous cells and are used to treat cancer from 20th century. Phytochemicals and their derivatives are capable to enhance therapeutic efficacy in cancer patients and reduce side effects [(2)].

2. Origin, chemical constituents, uses and taxonomy of *Taxus brevifolia*:

Paclitaxel was one of the first drugs to have a huge impact on cancer treatment and vincristine and vinblastine were two of the initial drugs to be isolated [(1)]. The anti-tumor activity of Paclitaxel was confirmed in 1977[(7)]. In 1992, FDA (Food and Drug Administration) granted approval for its use against refractory ovarian cancer [(7)]. WHO has recommended Paclitaxel as one of the essential anticancer drug in WHO's Model List of Essential Medicines 2023[(10)].

Paclitaxel was derived from a tree named as Pacific Yew tree which is a rare and slow-growing evergreen tree found in old-growth forest of Pacific Northwest[(7)]. Paclitaxel is a taxane derivative which is isolated from the bark of *Taxus brevifolia*, the Pacific Yew tree. Today, Yew is responsible for one of the most widely used anticancer agents in the world [(7)]. Paclitaxel has been recognized as one of the major active and potent chemotherapeutic drugs that have been discovered to show higher inhibitory activities against different types of cancer [(9)].

Paclitaxel is one of the chemical constituent found in the bark of Yew tree. It also contains taxane alkaloids, diterpenoids with taxane skeleton, lignans, bioflavonoids, steroids, sugar derivatives and diterpenes possessing tropone skeleton[(6)]. Paclitaxel is found in bark, leaves, twigs and roots of the Yew tree. Leaves of Taxus brevuifolia are used for cough, bronchitis

and asthma, while its fruits are used as sedatives and antispasmodic and bark is used as anti-tumor agent [6]. Traditionally it was used to treat common cold, cough, fever and pain [6].

Taxonomy of Taxusbrevifolia[5]:

Kingdom	Plantae
Phylum	Coniferophyta
Class	Pinopsida
Order	Taxales
Family	Taxaceae
Genus	Taxus
Species	Brevifolia

3. Mechanism of Paclitaxel:

There are different mechanisms through which the drugs act on human body to kill or destroy cancerous cells. Paclitaxel is able to prevent cell division via stimulating the development of microtubules, while some anticancer compounds killed cancer cells by preventing the production of microtubules and thus inhibiting the division[7]. It performs activity such as microtubule disruptor, block mitosis, induce apoptosis, microtubules are polymerized and stabilized, disruption of spindle formation and inhibition of translational machinery [1].

4. Administration of Paclitaxel:

Paclitaxel has a lower solubility in water; therefore, paclitaxel is normally formulated in a mixture containing a combination of dehydrated ethanol & cremophor EL(50 : 50, *v*/*v*)[9]. Paclitaxel is mostly sold in the form of injection with the brand name as Taxol[3]. It is administered by intravenous injection [4]. Paclitaxel injection is used to treat ovarian cancer, breast cancer, non-small cell lung cancer, esophageal cancer, cervical cancer, pancreatic cancer and Kaposi sarcoma [3, 4]. It is a prescription drug and it should not be taken without a doctor's prescription.

The drug discontinuation should not be done on own basis as it can lead to a serious health condition. Complete course should be taken to avoid any further problems related to cancer. When a patient skips the chemotherapy cycle, the disease may progress to the next stage, and the oncologists may have to change the complete course of treatment [8].

5. Drawback of *Taxus brevifolia*:

Although the drug is very useful but its extraction is too difficult. Hardly 0.1 gram of drug is obtained from 1 kg of bark. The tree is very rare and now it has become endangered plant. The demand for the drug is increasing but the number of trees are decreasing day-by-day.

It is very potent drug but if the intake is in high dose it can leads to toxicity and even death of patient. So after proper examination of patient body, then only the drug should be prescribed by an oncologist or doctor.

Result:

Cancer is found to be very dangerous and death causing disease. The treatment is important as well as difficult. The main target of treatment is to destroy cancerous cells and not the host cells. So it becomes difficult to search for such herbal drug that is capable to destroy cancerous cells without damaging host cells. Paclitaxel was found and approved for its anticancer activity. This drug can enhance many therapies and even may increase lifespan of cancer patients. The main aim of the article was to find herbal drug from nature origin having anticancer activity.

Conclusion:

It is concluded that cancer has been widely increasing at global level. Many advance technologies are used to treat cancer and even some can destroy it completely. Many herbal drugs are introduced for cancer treatment. The treatment course should be completed with all doses to prevent any resistance of drugs.

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