Traditional Cancer Healing with Herbs and Mushrooms

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Traditional herbal medicine (THM) is a “core” from which modern medicine has evolved over time. Besides this, one third of people worldwide have no access to modern medicine and rely only on traditional medicine. To date, drugs of plant origin, or their derivates (paclitaxel, vinblastine, vincristine, vinorelbine, etoposide, camptothecin, topotecan, irinotecan, and omacetaxine), are very important in the therapy of malignancies and they are included in most chemotherapeutic regimes.

cancer anti-neoplastic compounds anticancer plants and mushrooms

1. Introduction

Cancer is the second greatest cause of mortality worldwide, accounting for nearly 10 million deaths in 2020 (World Health Organization, www.who.int/). Thus, this continuous challenge forces scientists to search for new antineoplastic drugs and approaches, and investigate their combinations, to better fight various types of malignancies.

Chemotherapy in combination with surgery is now the standard way to treat cancer. The NIH (National Institutes of Health) has a list of the cancer chemotherapeutic drugs (https://www.cancer.gov/about-cancer/treatment/drugs). Twenty-six of them are natural compounds derived from plants, actinomycetes, and marine organisms, or semi-synthetic derivates of these compounds. Despite the fact that this number does not look impressive, these compounds constitute the most frequently used drugs: doxorubicin, paclitaxel, docetaxel, etoposide, camptothecin, irino- and topotecan, vinblastine, vincristine, and vinorelbine. They are included in most chemotherapeutic regimes and have made a key impact on the chemotherapeutic cancer treatment. The chemical manipulation of these compounds continues to create new, improved drugs.

At the same time, it is important to remember that our planet harbors a great biodiversity with about 391,000 plant species worldwide. These individual species produce tens of thousands of chemical compounds with a wide range of biological activities. Undoubtedly, dozens if not hundreds of them possess antineoplastic activity and may become important anticancer therapeutics. This assumption is confirmed through the examples of the biological compounds already mentioned above, which have been successfully applied to cure various types of malignancies.

Furthermore, up to 2 billion people (approximately one third of the population) have no access to modern medicines. For instance, in high-income countries, where comprehensive medical services are generally

accessible, more than 80% of children with cancer are cured, opposed to less than 30% in low- and middle-income countries. Under these circumstances of economic disparity, people from poor countries have no other choice but to rely on traditional medicine, which represents empirically collected evidence over many hundreds of years. Firstly, traditional medicine relies on the application of plants which are reservoirs of thousands of biologically active compounds. Thus, different cultures have adapted to use certain plants in their region to treat a spectrum of illnesses, including malignancies.

The use of traditional medicine is beneficial not only due to a lack of access to modern medicine, but also through sociocultural factors. The best examples are India, China, and Japan.

The Ayurveda medical system, which has roots that are millennia old, is based on a holistic (“whole-body”) healing system, which deals not only with the body but also with the mind and spirit. A part of this system is associated with medical plants. Ayurvedic formulations are often complex and consist of several herbal-mineral ingredients, and are governed by well-described pharmacological principles of preparation, compatibility, and administration. With the support of the Government of India, a book in two parts - Ayurvedic Pharmacopoeia of India (API) - has been established. Part I (Volumes 1-6) of it contains information about natural substances (medical plants, minerals) whereas part II contains healing formulations which can be created from the constituents described in part I.

Ayurveda has been very popular in India for millennia, and is of considerable interest all over the world. It applies dozens of plants with strong antineoplastic properties, which are now the focus of anticancer research.

Another example is Chinese Traditional Medicine (TCM). This is also a holistic-body approach, which is aimed at restoring the body's balance and harmony between the natural opposing forces of “yin” and “yang”, which can block the free circulation of internal ‘’qi’’ energy and cause disease. Traditional Chinese medicine includes acupuncture, diet, herbal therapy, meditation, physical exercise, and massages. The material part of TCM has partially evolved into Chinese Proprietary Medicine (CPM). This takes the form of a finished product, such as a capsule, tablet, or injection, all featuring the effective ingredients for use are documented in TCM. CPM is a modern from of TCM which, due to standardization, can be used in modern medicine [1]. China’s government strongly supports this, exports CMP products to different countries for trials and therapy, and sets up research partnerships with the big international pharmaceutical companies.

Originally based on traditional Chinese medicine, Japan has created its own traditional medical system – Kampo – which has then evolved separately from TCM. Thus, Kampo is a uniquely Japanese form of medicine. It had been Japan’s primary health care system for over 1,500 years. Despite the government approval of the Medical Care Law in 1874, which called for the adoption of the German model of health care and legitimized only western medical licenses, Japanese physicians continued to use and develop Kampo. Thus, 148 Kampo formulation extracts, 241 crude drugs, and 5 crude drug preparations are reported to be officially approved by National Health Insurance system, as well as under the Good Manufacturing Practice (GMP) law, which was established by the government in 1987 to ensure that all Kampo products are of uniformly high quality. Kampo is mainly based on

plant extracts and formulations and is prescribed in line with modern drugs to treat various diseases including cancer, and takes part in various clinical evaluations.

All of these traditional medical systems use herbs to a large extent. Despite these three examples, various other regions have their own medical traditions where herbs play most important role (the traditional medicine of Maya, New Guinea, Philippines, etc.) which are not discussed there and are described in detail in several reviews.

Many of the herbs and formulations empirically defined over the centuries have also proven to be effective in preclinical and clinical investigations. They affect tumor cells both directly and through the modulation of the immune system, as well as through interrupts with cellular signaling pathways, miRNAs, and metabolic pathways, etc. The antineoplastic properties of folk medicine plants and mushrooms will be discussed here, the molecular mechanisms of their bioactive constituents, the advantages and limitations of using plants, mushrooms, and their active compounds, in parallel with modern antineoplastic drugs.

One group has summarized the information about some plants and mushrooms which have been applied by ethnomedicine to cure malignancies on five continents for a long time [2]. That group has considered their antineoplastic properties,, and will focus on the molecular mechanisms of their activity. Finally, based on the data collected, that group suggest two priority groups from the selected plants, mushrooms, and their bioactive compounds, for research and potential use in antineoplastic therapy.

2. How to integrate the worldwide knowledge of traditional cancer healing with herbs and mushrooms into modern molecular pharmacology?

Summarizing the information discussed in above content, several points can be highlighted several points that should help implement traditional herbal medicine in current medicine:

- To date, a lot of information about a number of plants and mushrooms, and their individual bioactive compounds with well-documented antitumor properties, has been accumulated. Their respective full-scale multi-level studies should be top priorities.

- Despite there being a lot of investigations on the anticancer properties of a certain plant using tumor cell models, only a limited number of studies have been carried out with implication of control non-tumor cell models and subsequent animal studies. As the next step, comprehensive studies on their effectiveness, toxicity to non-cancer cells and animal tissues in various doses, are required to turn on the green light for natural-derived extracts and individual compounds into the next pre-clinical or clinical investigation.

- Progress in standardization is highly required to transform anecdotal folk herbal medicine into modern molecular pharmacology with clear mechanisms of action. This process includes investments into big programs regarding investigations, monitoring, and certifications of manufacturing the final product.

- On the examples of etoposide, irino- and topotecan, vinorelbine, docetaxel and omacetaxine, the development of semi-synthetic derivates of newly identified natural compounds with significant anticancer properties may improve their characteristics and lead to new antineoplastic drugs.

- The study of a synergistic interaction of isolated natural compounds and crude plant- and mushroom-derived extracts with widely used anticancer therapeutics should help define the right dosage and compatibility between the natural and synthetic therapeutics.

- Natural compounds may sensitize tumors for modern therapeutics and be effective in adjuvant and neoadjuvant therapy.

- There is a variety of standardized dietary supplements made from plants and mushrooms with presumable antineoplastic properties. The important approach is to test their antitumor potential using animal models, especially in combination with relevant modern therapeutics.

- The pharmacological effects of active compounds are much higher in herbal extracts than in pure compounds due to co-existing constituents which may provide the pharmacokinetic synergy during intestinal absorption and the ‘’first-path’’ metabolism.

- Folk medicine may point to certain plants or mushrooms with highly potent anti-cancer properties and bioactive compounds. Herewith, the cooperation between cancer researchers and ethnobotanists or ethnomedicine specialists can benefit the development of new therapeutics.

To conclude, a systematic approach in studying the traditional herbal medicine is required to successfully integrate this unique knowledge into modern molecular medicine. This combined knowledge that encompasses both the empirical and theoretical approaches may provide a window of opportunities to facilitate the development of new chemotherapeutic strategies to treat malignancies.

References

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