

The Target and Mechanism of Pingxiao Capsule Against Cancer and Improving Body Immunity

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Abstract. The increasing incidence and mortality of malignant tumors pose a major threat to global health. Current treatments, such as chemotherapy and radiotherapy, are effective but can cause serious side effects to the human body. Pingxiao Capsule, a traditional Chinese medicine (TCM), has emerged as a promising alternative or adjunct therapy for cancer treatment. However, the current research on Pingxiao capsule mainly focuses on the observation of clinical efficacy, and relatively little on the basic research. This article reviewed the epidemiological characteristics of malignant tumors, the limitations of conventional treatment, and the unique advantages of Pingxiao capsule in anti-cancer and immunoenhancement therapy. The pharmacological composition, clinical application, anticancer target, mechanism of action and immunomodulatory effect of Pingxiao capsule were studied. Understanding the various benefits of Pingxiao capsule can pave the way for its wide application in clinical practice in the future. Future studies can further explore the active ingredients in Pingxiao capsule and their mechanism of action, and optimize the formulation of drugs to improve efficacy and safety.

Keywords: Pingxiao capsule; Chinese medicine; Tumor therapy; Anticancer mechanism; Immune enhancement.

1. Introduction

Cancer is the leading cause of disease death worldwide, and it poses a major threat to human health and quality of life. Recent epidemiological trends show a steady increase in morbidity among populations in different regions, significantly affecting morbidity and mortality around the world. Cancer imposes a significant economic and psychosocial burden, highlighting the urgent need for effective treatment strategies that are accessible to the average family. Current treatments, including chemotherapy, radiation and targeted therapy, are effective in many cases but often come with severe side effects and limited durability of response. In this context, complementary and alternative medicines, particularly TCM, are in the spotlight for their potential to enhance standard cancer care and improve patient outcomes. Pingxiao capsule is a TCM preparation composed of a variety of traditional herbs. Each component contains unique bioactive substances, such as polysaccharides, flavonoids, alkaloids, volatile oils, coumarins, etc. These components can play a variety of pharmacological effects in the human body, such as anti-oxidation, anti-inflammatory, promoting apoptosis, inhibiting tumor angiogenesis, etc. It has good anti-cancer and immunomodulatory effects.

At present, the research on Pingxiao capsule mainly focuses on the observation of clinical efficacy, while the basic research is relatively few. In addition, with the popularity of the concept of precision medicine, the future research of Pingxiao capsule will pay more attention to the development of personalized treatment plans, and screen out the most sensitive patient groups through genetic testing and other means, so as to achieve more accurate and effective treatment. Therefore, it is necessary to further explore the main active ingredients of Pingxiao capsule for anti-tumor and related mechanisms, in order to find the effective ingredients of Pingxiao capsule for anti-tumor clinical effect and pharmacological action, and to provide reference and support for further development of the clinical application value of Pingxiao capsule for anti-tumor. The objective of this study was to investigate the anticancer and immune-enhancing targets and mechanisms of Pingxiao capsule. By elucidating its pharmacological and clinical effects, this study is helpful to enrich anti-cancer treatment strategies and improve the quality of life and survival outcomes of patients.

2. The Basic Situation of Pingxiao Capsule

2.1. Composition and Basic Curative Effect

Pingxiao capsule is a type of TCM preparation evolved from the "saltpeter alum Powder" in the Synopsis of Golden Chamber. It contains turpentine, cyanothorax, Wulingzhi, alum, saltpeter, dry lacquer, stir-fried fructus aurantii with bran and Strychnine powder. It has the effects of promoting blood circulation and removing blood stasis, dispersing nodules and eliminating swelling, detoxifying and relieving pain. Clinical studies have shown that it can shrink tumor and alleviate cancer pain symptoms [1]. These herbs can improve blood circulation, disperse blood stasis, reduce toxicity and pain.

2.2. Clinical Application

Pingxiao capsule has been widely used in cancer treatment and adjuvant therapy, especially in combination with chemotherapy and radiotherapy. For example, Qiu Rongliang from the Radiology Department of Henan Cancer Hospital conducted a clinical study on the application of Pingxiao capsule combined with radiotherapy in 76 cases of nasopharyngeal carcinoma [2], which showed that its efficacy not only improved the effect of conventional treatment, but also reduced the adverse reactions. Pingxiao capsules have been shown to improve patients' quality of life by reducing pain, fatigue and cancer-related symptoms such as anorexia. In addition, it can reduce the severity of side effects caused by chemotherapy, such as nausea, vomiting, and leukopenia [3]. Since its introduction 30 years ago, Pingxiao capsule has been widely used in the field of adjuvant anti-tumor in hundreds of hospitals across the country, and studies have proved that it can inhibit malignant solid tumors such as thyroid cancer, lung cancer, gynecological tumor and digestive tract tumor, and is effective against benign solid tumors such as cystic hyperplasia and goiter of the breast [4-5].

3. The Anti-cancer Target and Mechanism of Pingxiao Capsule

3.1. Analysis of Bioactive Components of Pingxiao Capsule

In recent years, the research of Pingxiao capsule in the field of anticancer has gradually deepened, and its inhibitory effect on a variety of malignant tumors has been widely recognized. A number of clinical trials and basic studies have shown that Pingxiao capsule has significant growth inhibition effect on various tumor types such as thyroid cancer, lung cancer, nasopharyngeal cancer, breast cancer (BC) and digestive tract tumor, and has no obvious toxicity to major organs, which may be because Pingxiao capsule activates the apoptosis signaling pathway of tumor cells [6].

The active ingredients in Pingxiao capsules, Yujin contains volatile oils and curcumin, Siderweed contains flavonoids, mesoglucinol derivatives, Wuling lipid contains volatile oils, alum contains Cr, Ca, Al, K, saltpeter has Cu, Ba, Na, Se, Ca, dry paint contains specific compounds of flavonoids are sulfur chrysanthemum, purpurin and fiseropper. Fructus aurantii stir-fried with bran contains volatile oils, flavonoids and coumarins, especially alkaloids in Strychnine powder and flavonoids in cranium, dried lacquer and fructus stir-fried with bran, which are important material basis for its anticancer effect [7-8]. These components can act on key signaling pathways and molecular targets within tumor cells, thereby interfering with the normal physiological function of tumor cells. For example, certain alkaloids inhibit signaling pathways such as P13K, Akt, and mTOR, a signaling pathway that is abnormally activated in a variety of tumors and is critical for tumor cell growth and survival. Flavonoids may inhibit the proliferation of tumor cells by interfering with the expression of MAPK signaling pathway or cell cycle regulation proteins [9]. Secondly, by influencing the expression of cell cycle regulation proteins, apoptosis-related genes and intercellular adhesion molecules, Pingxiao capsule can inhibit the proliferation rate of tumor cells, promote their apoptosis, and reduce their ability to infiltrate and metastasize [10].

3.2. Interferes with Tumor Metabolism

The active ingredient of Pingxiao capsule can inhibit energy metabolic pathways such as glycolysis and oxidative phosphorylation in tumor cells, reduce ATP production and energy supply, and thus weaken the survival ability of tumor cells. At the same time, these components can also interfere with DNA replication, RNA transcription and protein translation processes. In addition, Pingxiao capsule can also induce autophagy and apoptosis of tumor cells to accelerate death [11].

3.3. Inhibit Angiogenesis

Pingxiao capsule has also been shown to have anticancer effects by inhibiting tumor angiogenesis. In Pingxiao capsule, Yu Jin and Xianhecao have the effects of promoting blood circulation and relieving pain, promoting qi and resolving depression, and can down-regulate the expression of angiogenic factors such as vascular endothelial growth factor (VEGF), thus inhibiting the formation of tumor neovascularization and cutting off the supply of nutrients and oxygen to tumors. In addition, studies have found that Antexiao capsule can inhibit the secretion of VEGF by non-small cell lung cancer A549 cells and inhibit the phosphorylation of VEGF receptor 2, thus inhibiting tumor angiogenesis and blocking the growth of non-small cell lung cancer [12].

3.4. The Synergy with Other Anticancer Drugs

3.4.1 Sensitization, Efficacy and Toxicity Reduction

In addition to being used alone, Pingxiao capsule can play a significant role in sensitizing, enhancing efficacy and reducing toxicity when combined with chemotherapy drugs and targeted drugs [13]. Studies have found that patients treated with DCF regimen (docetaxel + cisplatin + fluorouracil) plus Pingxiao capsule had lower incidence of toxic and side effects and 1-year mortality [13]. Wang Lichen's team found that the application of Pingxiao capsule combined with TPF regimen (docetaxel + cisplatin + fluoride uracil) in neoadjuvant chemotherapy for oral squamous cell carcinoma can increase the clinical effective rate from 63.26% in the single TPF group to 81.63%, and can make the relevant microRNA in the regulation of oral squamous cell carcinoma tissues normal [14]. Gu Herder set the patients with NP regimen (vinorelbine + cisplatin) plus Pingxiao capsule as the observation group, and found that the cellular and humoral immunity levels of the patients in the observation group were higher than those in the control group, and the toxic and side effects of chemotherapy were less [15]. From these studies, it can be concluded that on the one hand, Pingxiao capsule can enhance the sensitivity of tumor cells to chemotherapy drugs, so that chemotherapy drugs can achieve better therapeutic effect at lower doses; On the other hand, it can also reduce the toxic side effects of chemotherapy drugs on normal cells and protect the body from damage. These synergistic effects may be related to Pingxiao capsule's ability to regulate immune function and promote the distribution and metabolism of chemotherapy drugs in tumor tissues.

3.4.2 Improve Immune Level and Reduce Toxic Side Effects

Pingxiao capsule enhances the overall therapeutic effect by improving the immune level of the body, and can promote the activity and proliferation of immune cells, especially T cells, B cells and natural killer (NK) cells, which play an important role in the immune response of the body, and can also improve the quality of life of patients by alleviating the toxic and side effects of chemotherapy drugs [16].

4. The Target and Mechanism of Pingxiao Capsule to Improve the Immunity of Tumor Patients

The role of Pingxiao capsule in improving the overall immunity of the body cannot be ignored. Pingxiao capsule also has the effects of invigorating qi and nourishing blood, warming channels and clearing collaterals, which can strengthen the body and resist external evil in the theory of TCM. It can not only directly act on the immune system, but also indirectly improve immunity by improving

the overall condition of the body. Specifically, Pingxiao capsule can improve patients' appetite and digestive function, increase the absorption and utilization of nutrients, and thus provide adequate energy and nutritional support for the body [17]. At the same time, it can also enhance the physical strength and endurance of patients, improve the sleep quality and mental state of patients, improve the quality of life [18], and further promote the improvement of the body's immunity.

4.1. Enhance the Activity and Proliferation of Immune Cells

Various active ingredients in Pingxiao capsule can directly act on immune cells, such as T cells, B cells and NK cells, and trigger downstream signal transduction pathways by activating receptors on the surface of these cells, such as T cell receptor (TCR) and B cell receptor (BCR) [19]. These pathways include JAK, STAT, etc., whose activation promotes the proliferation, differentiation and activation of immune cells, and further enhances the activity of immune cells by regulating the secretion and expression of cytokines. These cytokines play an important role in the immune response.

4.2. Regulate Immune Balance

Pingxiao capsule can inhibit over-activated inflammatory response. Many studies using rat BC as a model have confirmed that Pingxiao capsule can inhibit the proliferation of BC in rats by reducing estradiol and increasing progesterone levels [20]. By regulating the levels of estradiol, glutathione peroxidase, superoxide dismutase, malondialdehyde and tumor necrosis factor α (TNF- α) in the serum of BC rats, oxidative stress disorder can be balanced to improve immune function [21], and the occurrence of BC in rats can be reduced by inhibiting tumor angiogenesis [22]. Reduce the production and release of inflammatory factors such as TNF- α , so as to avoid the accidental injury of immune cells to normal tissues, and promote the apoptosis and clearance of immune cells, especially those that have been aged or have abnormal functions, to ensure the renewal and maintenance of immune cells.

5. Conclusion

In summary, Pingxiao capsule has shown a unique target and mechanism in anti-cancer and immunity enhancement, which can play an anti-cancer effect by inhibiting tumor growth and invasion, targeting key molecules of tumor cells, and coordinating with other anti-cancer drugs. At the same time, it can also enhance the immune function of the body by enhancing the activity and proliferation of immune cells, regulating immune balance and improving the overall immunity of the body. These research results provide strong scientific evidence for the application of Pingxiao capsule in anti-tumor therapy.

Pingxiao capsule is a TCM compound preparation, which has the advantages of low side effects and high safety, and is suitable for long-term use. Therefore, Pingxiao capsule has a broad application prospect in anti-tumor therapy. Understanding the multifaceted benefits of Pingxiao capsule can pave the way for its widespread use in clinical practice and promote its potential as a complementary or alternative cancer treatment.

Future studies can further explore the active ingredients in Pingxiao capsules and their mechanism of action, and optimize the formulation of drugs to improve efficacy and safety.

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