

# Application of Traditional Chinese Medicine in Targeted Treatment of Gastric Cancer

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**Abstract.** In recent years, gastric cancer, a highly prevalent and lethal malignant tumor worldwide, remains a key focus of medical research. Traditional Chinese Medicine (TCM) offers unique advantages in cancer prevention and treatment, particularly in its holistic approach and syndrome differentiation. This article systematically reviews the theoretical basis of TCM's "strengthening the body's resistance, dispelling pathogenic factors, and harmonizing yin and yang" approach to treating gastric cancer. Integrating this with modern research findings, we summarize the mechanisms of action of TCM monomers (such as curcumin) and compound formulas in targeted gastric cancer therapy. Studies have shown that TCM, through its multi-target and multi-pathway mechanisms, not only delays gastric cancer progression but also provides new adjuncts to modern precision medicine. However, analyses have revealed that the complex composition of TCM, the difficulty in targeting targets, and the variability in preparation processes remain major challenges in its clinical application. Overall, the application of TCM in the targeted treatment of gastric cancer holds significant theoretical and clinical significance. Future research is needed to strengthen the mechanisms of action of active ingredients, optimize preparation processes, and promote the deep integration of TCM with modern medicine, thereby providing new avenues for the development of novel, highly effective, and low-toxic anticancer drugs.

**Keywords:** Traditional Chinese medicine; targeted treatment; gastric cancer.

## 1. Introduction

Research on the application of traditional Chinese medicine (TCM) in the targeted treatment of gastric cancer in recent years, TCM plays a role in the medical field with a position that can not be ignored. The treatment theory of TCM pays more attention to the overall balance of the body rather than local symptoms. This special research direction makes TCM serve as an important part in the targeted treatment of malignant tumors. Gastric cancer is a common disease in malignant tumors.

According to statistics, there were about 970000 new cases of gastric cancer in the world in 2022, and about 660000 cases died of gastric cancer, with the incidence and mortality ranking the fifth in the number of deaths from malignant tumors [1]. Existing studies have shown that today, when modern technology is introduced into important research, the theoretical system of TCM in the treatment of gastric cancer is relatively complete, and there are enough data to support clinical application, but its targeted therapy still needs to be further studied. Therefore, the study of the application of TCM in the targeted treatment of gastric cancer can provide a clear idea for clinical treatment.

In modern medical research, the TCM for the treatment of gastric cancer is mostly Qi tonic drugs, and other less commonly used drugs are diuretic and detumescence drugs, Qi regulating drugs and heat clearing and detoxification drugs [2]. Taking curcumin as an example, curcumin is a yellow polyphenol extracted from the rhizome of *Curcuma longa*, a Zingiberaceae plant. It is the main component of *Curcuma longa* and has significant anti-tumor effect. There are a lot of research results on the intervention of TCM on the further expansion and deterioration of gastric cancer, involving a variety of active ingredients of TCM monomer and TCM compound, but there is a lack of combing and summarizing in this research field.

This article will start from the theoretical basis of TCM targeted healing of gastric cancer, and further explore how TCM targeted therapy of gastric cancer. This article will involve the explanation of TCM syndrome differentiation and therapy in the etiology and pathogenesis of gastric cancer, and

the mechanism of action of active ingredients of TCM; Curcumin and other drugs are listed to explain the application of monomer TCM in the targeted remedy of gastric cancer. Through in-depth study of the active ingredients of TCM and its mechanism of action, we can provide new ideas and methods for the treatment of gastric cancer, which has important theoretical value and clinical significance.

## **2. Theoretical Basis of Traditional Chinese Medicine (TCM) in Targeted Treatment of Gastric Cancer**

### **2.1. TCM Understanding of Etiology and Pathogenesis of Gastric Cancer**

There is no nomenclature and direct record of "gastric cancer" in the classics of traditional Chinese medicine, but according to the clinical manifestations of gastric cancer, it can be studied in the parts of "epigastric pain", "nausea", "choking diaphragm", "accumulation", "symptomatic scrofula", "Fuliang" and "abdominal distension". Nowadays, the research of TCM tumor is more and more in-depth, and the differentiation of clinical syndromes of gastric cancer has gradually become a system. For example, modern TCM oncology classifies gastric cancer into seven syndrome types: disharmony between liver and stomach, phlegm and Qi obstruction, Qi stagnation and blood stasis, stomach yin deficiency, spleen and stomach Qi deficiency, Qi and blood deficiency, and spleen and stomach deficiency and cold [3].

In the category of TCM, the pathogenesis of gastric cancer can be summarized as spleen and stomach deficiency and failure, blood stasis and phlegm obstruction, cancer toxin and emotional disease [4]. In the theory of TCM, the spleen governs the movement and transformation, which is embodied in digestion and absorption, water and moisture metabolism; The stomach is in charge of receiving and regulating. "Jing Yue Quan Shu" points out that spleen stomach deficiency will lead to "the failure of healthy qi and the stagnation of evil". It is intended to explain that spleen stomach deficiency will result in the weakening of digestive function, the decline of metabolic efficiency, the impairment of immune function, the retention of pathological products such as "phlegm dampness, blood stasis, turbid poison" in the body, and the gradual formation of tumors.

In the concept of TCM, "all diseases are caused by phlegm". It is believed that phlegm and blood stasis have a very wide range of pathogenicity, and the body Qi, blood and phlegm turbid under the interference of toxin and pathogen is easy to block the Zang Fu organs and meridians and form lumps. At the same time, "on the spleen and stomach" mentioned that "happiness, anger, fear, loss of vitality, spleen and stomach qi decline, lack of vitality." it is not difficult to find that negative emotions can damage the body, weaken the constitution, reduce immunity and lead to tumor formation.

In the field of modern medicine, the occurrence of gastric cancer is a complex multi factor and multi-step process, involving the interaction of multiple factors such as genetics, environment, lifestyle and microbial infection. The specific mechanisms can be summarized as follows: Helicobacter pylori infection, diet and environmental factors, genetic factors, chronic gastric diseases, and molecular mechanisms (the occurrence of gastric cancer involves oncogene activation, tumor suppressor gene inactivation, cell proliferation, apoptosis imbalance and other molecular changes), which jointly promote the evolution of normal gastric mucosa to gastric cancer.

### **2.2. Mechanism of Action of Active Ingredients of Traditional Chinese Medicine**

The active ingredients of TCM have unique advantages in disease treatment through multi-target synergy. The active components of TCM have complex and diverse chemical structures, including alkaloids, flavonoids, polysaccharides, volatile oils and so on. Their pharmacological effects are often achieved through multiple targets. For example, apoptosis regulation, signaling pathway intervention, ion regulation and metabolic effects. These specific and complex mechanisms provide technical and theoretical support for the targeted treatment of gastric cancer.

Among them, alkaloids are a kind of natural organic nitrogen-containing compounds contained in TCM plants, which are named for their alkalinity. At present, most known alkaloids have complex

ring structure and strong biological activity [5]. For example, isaindigotone is a natural quinoline alkaloid extracted from *Radix Isatidis*, which was isolated from *Radix Isatidis* powder by Qin et al. In 1997. Its structure is formed by conjugation of pyrroloquinazoline and a benzyl group, which enables isaindigotone to form a distorted or coplanar conformation between its aryl and the target [6]. Alcaraz et al. Reported the activity of isaindigotone for the first time. They found that isaindigotone can clear the superoxide produced by human neutrophils or xanthine stimulation. In addition, it can inhibit the activity of 5-LO in human neutrophils and has potential activity to control inflammatory response [7].

### **3. Specific Application of Traditional Chinese Medicine in Targeted Treatment of Gastric Cancer: Take Curcumin As An Example**

Curcumin is a polyphenol compound extracted from the rhizome of *Curcuma longa*, which has multiple biological activities such as anti-inflammatory, antioxidant and anti-tumor [8]. In the treatment of gastric cancer, the targeting mechanism of curcumin is complex and diverse, involving the regulation of cell proliferation, induction of apoptosis, inhibition of invasion and metastasis and epigenetic regulation. In terms of cell proliferation inhibition and cycle regulation, curcumin can block gastric cancer cell cycle at a specific stage and inhibit cell proliferation. The mechanism involves regulating the expression of cell cycle related proteins. In addition, curcumin can induce apoptosis of gastric cancer cells through a variety of pathways, including mitochondrial pathway, endoplasmic reticulum pathway and death receptor pathway. Curcumin can also inhibit the invasion and metastasis of gastric cancer cells by down regulating the expression of matrix metalloproteinases.

In the molecular docking study of curcumin in the healing of gastric cancer, the gene targets of gastric cancer disease were obtained by using Discenet, therapeutic target database and GeneCards Database and reprocessed by using uni UniProt Database [9]. A total of 1447 gene targets were collected. The confirmed targets of curcumin were obtained by superpred, and the possible targets of curcumin were predicted by swisstarget prediction database. Then the UniProt database was used to reprocess, and 149 targets acting on curcumin were retrieved and screened, and 69 potential targets of curcumin in were determined. The top five core targets were protein kinase (akt1), epidermal growth factor receptor (EGFR), signal transducer and activator of transcription 3 (STAT 3), hypoxia inducible factor-1  $\alpha$  (hifra) and E1A binding protein 300 (ep300). By modifying the dosage form to improve the solubility, bioavailability and transmembrane permeability of curcumin, the plasma half-life can be prolonged and targeted drug delivery can be achieved to enhance the curative effect.

Curcumin can inhibit the growth of gastric cancer cells by triggering reactive oxygen species (ROS) in vivo, and protect gastric cancer cells from ROS damage by activating the oxidative stress related gene (keap1-nrf2) signaling pathway in gastric cancer cells. According to Wang Yan's research, curcumin can affect the mechanism of gastric cancer by regulating ROS and keap1-nrf2 signaling pathway [10]. Knockdown of Nrf2 combined with curcumin treatment can also significantly increase ROS production, which has a synergistic inhibitory effect on gastric cancer cells.

However, curcumin, as a targeted drug, faces challenges such as unclear mechanism of action and inconsistent clinical standards. In practical clinical application, traditional Chinese medicine appears more as an auxiliary treatment.

### **4. Challenges Faced by Traditional Chinese Medicine Targeted Therapy for Gastric Cancer**

Precise target localization is a key technical requirement in the treatment of gastric cancer, and the complexity of TCM ingredients brings difficulties to precise localization. TCM monomer and compound usually contain a variety of active ingredients, which may produce interference information through different signaling pathways, increasing the difficulty of determining the main target. In addition, the quality control of TCM preparations also has a significant impact on the

stability of curative effect. Due to the natural characteristics of the source of TCM, the TCM extraction and purification process of its effective components may be interfered by many factors, such as raw material quality, production technology and so on, resulting in differences in efficacy between different batches. This inconsistency not only affects the reliability of clinical research results, but also limits the promotion and application of TCM in the international market. Therefore, how to identify the key targets in the complex components of TCM and ensure the stability of the quality of the preparation has become an important challenge in the research of TCM targeted therapy for gastric cancer.

## 5. Conclusion

Traditional Chinese medicine believes that gastric cancer is mostly caused by deficiency of vital energy and phlegm and blood stasis. The treatment emphasizes strengthening the vital energy and eliminating pathogenic factors, regulating yin and Yang. Modern studies have confirmed that the active ingredients of TCM play an important role in the treatment of gastric cancer. In the treatment of gastric cancer, the combination of modern medicine and TCM theory can better grasp the pathogenesis and provide strong support for clinical treatment. Existing studies have carefully analyzed the active components of TCM, and alkaloids have significant potential activity in controlling inflammatory response. Curcumin extracted from the rhizome of *Curcuma longa* has multiple potential targets in targeted drug delivery, and can also regulate the signaling pathways of ROS and keap1-nrf2, thereby affecting the mechanism of gastric cancer. However, the treatment of gastric cancer with traditional Chinese medicine still faces the challenges that the complexity of components leads to the difficulty of target localization and the difference of preparation technology affects the stability of curative effect.

This paper analyzed the theoretical basis of TCM in the treatment of gastric cancer, combined with the existing research results of alkaloids and curcumin in the treatment of gastric cancer, summarized the targeted administration of TCM as an auxiliary means in the remedy of gastric cancer, and systematically combed the research status of TCM in the treatment of gastric cancer. This paper provides a reference for the development of high-efficiency and low toxicity TCM anticancer drugs, in order to promote the deep integration of traditional Chinese medicine and modern precision medicine, and open up a new path for the treatment of gastric cancer.

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