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Review Article

Research progress on the application of Chinese herbal medicine in anal fistula surgery

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Abstract: Anal fistula is a rapidly developing anorectal disease that can lead to anal dysfunction if left untreated. Minimally invasive surgery is an important treatment option for anal fistula, as it can reduce the risk of anal sphincter injury and protect anal function. However, postoperative complications such as infection, pain, bleeding, edema, and fat liquefaction can occur, resulting in slow wound healing thus negatively impacting the patient's quality of life. Recent studies have shown that Chinese herbal therapy has distinct pharmacological effects and is more effective in treating postoperative complications in anal fistula patients compared to conventional drug therapy. It not only promotes wound healing but also reduces the occurrence of complications. Chinese herbs can also modulate relevant signaling pathways such as PI3K/Akt, HIF-1, and TGF-β/Smad to enhance the wound healing process. Various methods of Chinese herbal medicine (CHM) have been used to treat post-anal fistula operation wounds, including traditional Chinese medicine (TCM) sitz baths, external application of TCM, internal administration of TCM, anal absorption, and acupuncture, all of which have shown promising therapeutic effects in clinical practice. This article aims to review the theory and clinical application of CHM in anal fistula surgery in recent years and provide valuable references for its treatment.

Keywords: Anal fistula, Chinese herbal medicine, postoperative complications, signaling pathways

Introduction

Anal fistula, short for anorectal fistula, results from an abscess rupturing or being drained around the anorectum. It typically comprises an internal opening, an external opening, and a sinus tract and represents a chronic stage of perianal space infection [1]. The most common symptom of an anal fistula is repeated perianal ulceration and pus, accompanied by itching of the perianal skin. If a secondary infection occurs, the patient may experience local pain in the perianal area. Anal fistulas are difficult to heal on their own and are characterized by intermittent recurrent attacks and gradual worsening. It is the most common refractory anorectal disease in China [2]. According to statistics, the global incidence of this disease is 8%-25%, while in China, it is 1.67%-3.6%. It is more prevalent among young adults aged 20-40 years [3, 4].

Currently, clinicians mostly use surgical intervention to treat anal fistulas. However, due to the long duration of the disease, the complex condition of the patients, and the fact that postoperative incisions are typically located around the anus, which is a poorly exposed and humid area, patients may have difficulty keeping the area clean. This can lead to complications such as pain, itching, swelling, and fat liquefaction, resulting in slow wound healing and increased risk of infection [5].

Traditional Chinese medicine (TCM) can be used throughout the preoperative, intraoperative, and postoperative stages of anal fistula treatment. Through the comprehensive application of diet adjustment, drug therapy, surgical methods, and postoperative oral and external use of TCM, it provides patients with a more comprehensive and effective treatment option, promoting wound healing and reducing the

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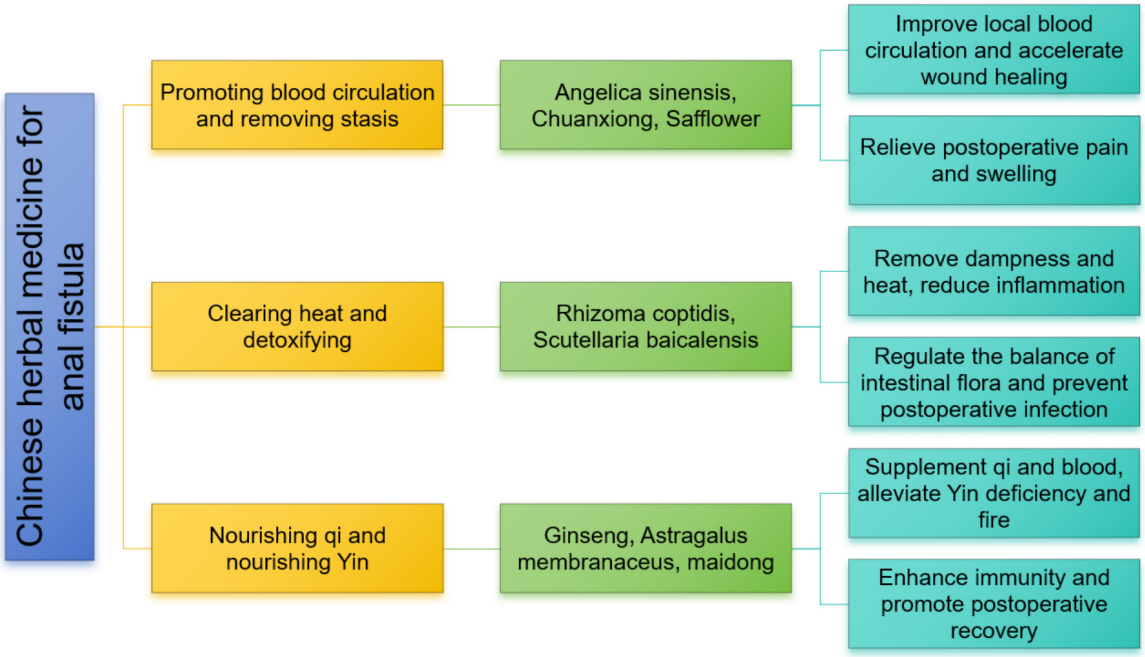

Figure 1. Three main approaches of CHM for anal fistula treatment. CHM, Chinese herbal medicine.

occurrence of adverse reactions. TCM posits that anal fistula formation is caused by heat and cohesion, poor blood supply, and adverse qi activity. Postoperative meridians are damaged, leading to dampness and heat, as well as qi and blood stasis. Compared to conventional clinical treatment methods, herbal remedies can help relax veins, relieve muscle tension, and balance qi and blood, thus accelerating wound healing and reducing complications [6, 7].

Additionally, Chinese herbal medicine (CHM) typically uses natural herbs, which have fewer side effects and are safer for the human body compared to chemical drugs. This is especially true for external application therapy, which does not stimulate the digestive tract organs and reduces the potential harm of drugs to the body. Furthermore, special treatment methods of CHM, such as Chinese herbal fumigation therapy, can directly target the affected area, using heat and medicinal properties to treat the anal fistula. This direct approach can have a more significant effect on treatment and also reduce patients' fear of surgery. Relevant studies have also shown that CHM can help eliminate wind and itching, reduce swelling and pain, clear heat and dampness, and promote postoperative recovery in patients with anal fistulas [8-10]. This review summarizes the research progress of CHM in anal fistula surgery, providing a reference for further study.

Basic theoretical basis of CHM in the treatment of postoperative anal fistula

TCM points out that the pathophysiological mechanism of anal fistula surgery mainly involves qi and blood imbalance, dampness and heat accumulation, and Yin deficiency with fire hyperactivity [11]. Anal fistula surgery can cause local qi and blood damage, resulting in poor circulation, forming a pathological state of qi stagnation and blood stasis. The surgical wound is prone to invasion by dampness and heat, which can accumulate in the intestine and affect wound healing [12]. Additionally, postoperative patients often experience symptoms of Yin deficiency and fire hyperactivity due to qi and blood consumption and loss of Yin fluid, which can manifest as wound pain, fever, and night sweats [13]. Relevant studies have shown that CHM has the effects of promoting blood circulation, removing blood stasis, clearing heat and toxins, invigorating qi, nourishing Yin, and reducing the above adverse symptoms in patients with anal fistula (**Figure 1**).

First and foremost, promoting blood circulation and removing blood stasis is an important

Table 1. CHM preparations for the treatment of anal fistula

CHM	Applicable situation	Main components	Main effect	Reference
Huoxue Zhitong Powder	It is suitable for all patients with postoperative pain and blood stasis	Frankincense, myrrh, angelica, kusnezoff monkshood root	Promote blood circulation and remove blood stasis, relax tendons and smooth collaterals, dispel wind and relieve pain	[23]
Buzhong Yiqi soup	It is suitable for patients with anal fistula of qi deficiency and anal falling	Astragalus, ginseng, angelica, licorice, tangerine peel, cohosh, bupleurum, baicalensis	Supplement qi, blood circulation, Yang lift sink	[24]
Bazhen soup	It is suitable for patients with qi and blood deficiency	Ginseng, atractylodes, Poria cocos, red licorice, angelica, white peony root medicine, cooked rehmannia, ligusticum chuanxiong, add ginger, jujube	Promote blood circulation, promote qi, dispel wind and relieve pain, invigorate spleen and qi, clearing heat and detoxification	[25]
Longdan Xiegan decoction	It is suitable for patients with anal fistula who have symptoms of damp heat, such as anal swelling and pain, discharge and so on	Gentian, gardenia, Scutellaria baicalensis, bupleurum, Ze diarrhea, wood tong, car front, Angelica, rehmannia, licorice	Clear the liver and relieve the fire, benefit the dampness and heat, and relieve the pain	[26]
Huangqi decoction	It is suitable for patients with anal fistula of damp-heat downward injection	Astragalus, Angelica, atractylodes, licorice	Invigorate qi, solid surface, collect sweat	[27]
Crane herb ointment		Crane grass, yellow cypress, baicalensis, Angelica, white peony root	Convergence and hemostasis, dry and wet insecticide	[28]
Huanglian Jiedu decoction		Coptis, Phellodendri Chinrnsis Cortex, baicalensis, gardenia	Clear away heat and detoxify, reduce swelling and relieve pain	[29]

CHM, Chinese herbal medicine.

method of CHM in treating qi and blood disorders after anal fistula surgery. CHM drugs such as Angelica sinensis, Ligusticum chuanxiong, and safflower can improve blood circulation and promote the dissipation of blood stasis [14, 15]. These drugs can enhance local blood circulation, promote tissue repair and regeneration, and accelerate wound healing. They can also alleviate postoperative pain, swelling, and other reactions, thereby promoting the recovery of patients with anal fistula [16].

Secondly, heat-clearing and detoxification is one of the main methods of CHM in treating damp-heat accumulation after anal fistula surgery. Heat-clearing and detoxifying drugs in CHM, such as Coptidis rhizoma, Scutellaria baicalensis, and Phellodendri chinensis cortex, have antibacterial, anti-inflammatory, and antiviral effects. These drugs remove heat and moisture from the intestines, reduce inflammation, and help clean and heal the wound [17, 18]. Additionally, heat-clearing and detoxifying drugs can regulate intestinal flora and prevent postoperative infections [19].

Furthermore, CHM can be an important method for treating Yin deficiency and fire hyperactivity in patients after anal fistula surgery by invigorating qi and nourishing Yin. Invigorating qi and nourishing Yin drugs in CHM, such as ginseng, Astragalus membranaceus, and Ophiopogon japonicus, have functions of tonifying qi, nourishing Yin, producing fluid, and moistening dryness. These drugs can replenish the qi, blood, and Yin fluid consumed by patients after surgery, and alleviate symptoms of Yin deficiency and fire hyperactivity, such as wound pain, fever, and night sweats [20, 21]. Moreover, invigorating qi and nourishing Yin drugs can enhance the body's immunity, improve the patient's resistance to infection, and promote postoperative recovery [22].

Mechanism of action of CHM in the treatment of postoperative anal fistula

Main components of the CHM and their efficacy

Patients with different clinical symptoms of anal fistula require varied treatment methods, and a single drug cannot fully address all the adverse complications of anal fistula. Therefore, they need to be treated with herbal preparations. Many commonly used Chinese herbs for the postoperative treatment of anal fistula (**Table 1**) each have unique compositions, efficacies, and clinical applications. Among them, the most commonly used preparation is Huoxue Zitong Powder, which is suitable for all patients experiencing postoperative pain and blood sta-

sis, and is helpful for wound healing and recovery [23].

Huoxue Zitong Powder is mainly composed of Chinese herbs such as frankincense, myrrh, Angelica sinensis, raw grass, and aconitum. It functions to promote blood circulation, remove blood stasis, soothe sinews, dredge collaterals, dispel wind, and relieve pain.

Frankincense: Spicy, bitter, and warm in taste, frankincense consists of spherical or teardrop-shaped particles that are light yellow with slight blue-green or brown-red tints. When chewed, it softens into a glue-like substance and can turn white in water. It promotes blood circulation, relieves pain, reduces swelling, and relaxes muscles and meridians.

Raw Grass: Spicy, bitter, and flat in taste, raw grass promotes blood stasis reduction and alleviates swelling in muscles.

Angelica Sinensis: Known for its blood-regulating effect, Angelica sinensis can regulate the female menstrual cycle, relieve symptoms such as irregular menstruation and dysmenorrhea, and has a moisturizing effect on the intestines, relieving constipation.

Grass: Rich in flavonoids, grass clears heat, detoxifies, reduces swelling and pain, promotes blood circulation, increases blood vessel elasticity, reduces blood fat and blood pressure, and enhances human immunity.

This comprehensive approach, using a combination of herbs with distinct properties, addresses various symptoms and promotes the overall healing process in postoperative anal fistula patients.

For patients with anal fistula who have qi deficiency and anal prolapse, Buzhong Yiqi Decoction is an effective treatment. It is mainly composed of astragalus, ginseng, Angelica, licorice, tangerine peel, cohosh, bupleurum, and Scutellaria baicalensis, which have the effect of tonifying qi, raising Yang, and alleviating depression [24]. Astragalus root is long, cylindrical, and slightly woody in appearance, with a surface ranging from pale tan to dark brown. It functions to tonify the spleen, supplement Yang, promote digestion, and act as a diuretic. Ginseng can tonify the spleen and lungs, improve heart function, increase myocardial contractility, regulate blood vessels, reduce blood viscosity, and resist myocardial ischemia and arrhythmia. Angelica sinensis can improve blood circulation, relieve pain and swelling, and improve anemia. Licorice can harmonize qi, reduce inflammation, relieve pain, redness, and itching, balance the body's energy, relieve fatigue, and improve physical and mental state. Dried tangerine peel can tonify qi, strengthen the spleen and stomach, and promote gas discharge. Cohosh and bupleurum can dispel heat, reduce fever, raise Yang, and help regulate the body's qi. Scutellaria baicalensis can clear heat and dampness, reduce inflammation, and detoxify.

Additionally, Ba Zhen Tang has a good therapeutic effect on patients with both qi and blood deficiency [25]. For patients with anal fistula who exhibit symptoms of damp-heat, such as anal swelling and pus discharge, Long Dan Xie Gan Tang can clear the liver, drain fire, promote diuresis, and effectively relieve these symptoms. This prescription mainly consists of CHM such as Gentiana scabra, Gardenia jasminoides, Scutellaria baicalensis, Bupleurum chinense, Alisma orientale, Akebia quinata, Plantago asiatica, Angelica sinensis, Rehmannia glutinosa, and Glycyrrhiza uralensis [26].

Gentiana scabra contains alkaloids, which have a calming effect. It can help lower blood pressure and inhibit pathogenic bacteria, enhancing the phagocytic ability of inflammatory cells [27].

Gardenia jasminoides (cape jasmine fruit) has been used for cooling blood, detoxification, and improving liver function. It can also improve symptoms such as jaundice and dark urine.

Alisma reduces water swelling, clears heat and toxins, and lowers lipid levels. It has anti-inflammatory and antibacterial effects and can reduce total cholesterol and fat levels in the blood [28].

Akebia has the effects of diuresis, clearing away heat and fire, dispelling wind and dampness, and can relieve symptoms such as rheumatism, muscle and bone pain, and soreness in the waist and knees.

Raw Rehmannia cools the blood, nourishes Yin, and can treat various bleeding syndromes caused by blood heat [29].

Licorice is often used as a harmonizing medicine in prescriptions. It can alleviate interactions between drugs, clear heat, detoxify, and is often used to treat sores, abscesses, and toxins caused by heat.

This comprehensive approach, using a combination of herbs with distinct properties, addresses various symptoms and promotes the overall healing process in postoperative anal fistula patients.

However, the choice of the appropriate preparation and dosage must be based on the patient's actual circumstances and the clinical doctor's advice to achieve the best therapeutic effect. Additionally, patients should pay attention to any potential adverse reactions when using herbal preparations and seek medical advice promptly if any abnormalities occur.

Pharmacological studies of CHM

In recent years, modern research on CHM in the treatment of postoperative anal fistula has made significant progress, including improvements and optimization of CHM preparations, pharmacodynamic research, pharmacological research, and clinical efficacy evaluation. Pharmacological research is a major clinical focus [30]. Firstly, through qualitative and quantitative analysis of the active ingredients in CHM preparations, the active components and their mechanisms of action have been clarified. For example, flavonoids, alkaloids, and other components in some CHM have anti-inflammatory, antioxidant, and wound healing properties. These findings provide a scientific basis for the treatment of postoperative anal fistula [31, 32]. Secondly, pharmacological studies have further revealed the mechanisms of action of CHM in the treatment of postoperative anal fistula. For instance, CHM regulates the body's immune function, improves microcirculation, and inhibits inflammatory responses [33].

CHM is characterized by having multiple components and multiple targets, and its mechanism of action is more complex than that of a single chemical drug. Network pharmacology is a new pharmacological analysis method developed based on systems biology, which is highly suitable for studying the mechanisms of action of Chinese herbal compounds. Relevant studies have found that some active ingredients in CHM and Chinese herbal compounds can promote wound healing after anal fistula surgery [34, 35]. Some scholars have used network pharmacology to study the mechanisms of action of the main active ingredients in CHM and have found that these components can regulate the phosphoinositide 3-kinase/protein kinase B (PI3K/Akt) signaling pathway, hypoxia-inducible factor-1 (HIF-1) signaling pathway, transforming growth factor-β (TGF-β)/Smad signaling pathway, and other pathways. This regulation can reduce inflammatory responses, promote new angiogenesis, accelerate wound fibrosis, and ultimately promote wound healing after anal fistula surgery. It can also improve the quality of wound healing [36, 37].

The PI3K/AKT signaling pathway is a key pathway involved in the occurrence and development of many diseases (**Figure 2**). It participates in various physiological processes such as cell growth, proliferation, differentiation regulation, and apoptosis [38]. PI3K is an important kinase involved in intracellular signal transduction and the regulation of cell proliferation, apoptosis, and differentiation [39]. AKT is the main downstream effector molecule of the PI3K/AKT signaling pathway. It is a serine/threonine kinase that can directly phosphorylate various transcription factors, such as NF-κB and mammalian target of rapamycin (mTOR), and participate in the regulation of various life activities [40]. The primary regulatory mechanism of the PI3K/AKT pathway is to promote PI3K to produce PIP3, which binds to phosphatidylinositol-dependent protein kinase 1 (PDK1) and AKT in cells, thereby activating AKT. Activated AKT regulates multiple downstream targets through phosphorylation and participates in physiological processes such as cell proliferation, survival, apoptosis, and metabolism [41]. Activation of the PI3K/AKT pathway can increase the secretion of vascular endothelial growth factor (VEGF) and regulate the expression of other angiogenic factors and hypoxia-inducible factors, thereby affecting wound healing progress [42].

After anal fistula surgery, PI3K binds to growth factors and other receptors, altering the protein structure of AKT and activating it. This then activates or inhibits a series of downstream substrates through phosphorylation, thereby

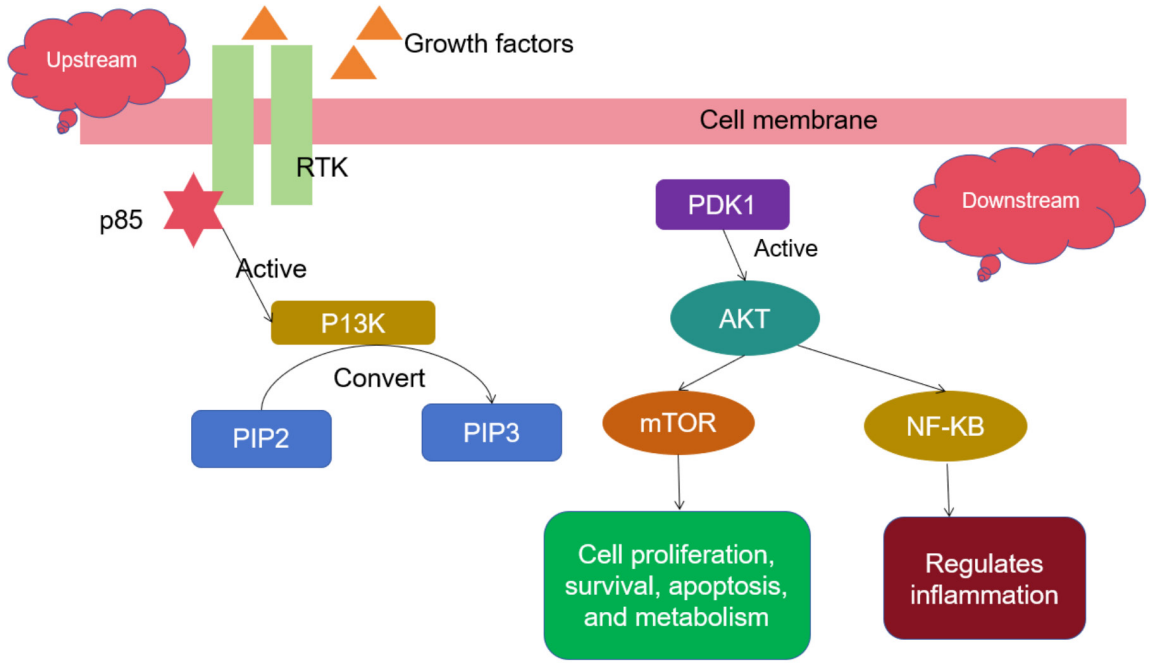

Figure 2. Major regulatory mechanisms of PI3K/AKT signaling pathway.

regulating cell proliferation, differentiation, apoptosis, migration, and other phenotypes. The activated PI3K/AKT/mTOR pathway not only upregulates the expression of VEGF, fibroblast growth factor (FGF), and epidermal growth factor (EGF), but also promotes cell growth and migration, angiogenesis, and collagen synthesis, induces epithelial-mesenchymal transition (EMT), and ultimately promotes wound healing [43]. A large number of capillaries and fibroblasts form granulation tissue, which continuously regenerates the capillaries, forms a vascular network, and improves microcirculation. This plays a crucial role in wound healing.

Lindner et al. [44] reported that the PI3K/AKT pathway is involved in the immune response process, which can increase serum levels of bFGF and TGF-β1. This activates the proliferation and differentiation of wound repair cells, promotes the generation of myofibroblasts and epithelial tissue regeneration, and contributes to the proliferation of granulation tissue. This, in turn, promotes the contraction and healing of wounds, which is of great significance for postoperative recovery in diseases such as anal fistula. Cuo et al. [45] showed that Angelica dahurica can activate the PI3K/AKT signaling pathway and enhance the synthesis of HIF-1α in a diabetic gene mouse model. This effectively enhanced angiogenesis in the regenerated tissue and promoted wound healing in vivo.

HIF-1 is a basic helix-loop-helix-PAS domain transcription factor composed of an oxygen-regulated α-subunit and a constitutively expressed β-subunit [46]. It plays a crucial role in regulating cytokine and cellular oxygen homeostasis, with its activity modulated by degradation or stabilization of the HIF-1α subunit. All three HIF-α subunits are highly sensitive to hypoxia, while the β-subunit remains insensitive to oxygen. Under normoxic conditions, prolyl hydroxylase-dependent hydroxylation of HIF-1α leads to its ubiquitination by the pVHL ubiquitin ligase, marking it for proteasomal degradation [47].

During hypoxia, HIF-1 regulates the transcription of numerous genes in a cell-specific manner. The accumulation of HIF-1α under hypoxic conditions forms the HIF complex, which activates angiogenic growth factor genes like VEGF, angiopoietin-2 (ANGPT2), and stromal cell-derived factor 1 (SDF-1), thereby promoting effective wound healing [48].

Dipsus, derived from Dipsus sichuanensis, is valued in TCM for toning the liver and kidney, strengthening muscles and bones, promoting

fracture healing, and halting bleeding [49]. Its main active component, dipsin VI, enhances the expression of HIF-1α and VEGF. Conversely, HIF-1α inhibitors can suppress dipsin VI-induced angiogenesis [50]. Dipsaponin VI, an extract of dipsaponin, accelerates full-thickness skin wound healing by boosting granulation tissue formation, collagen deposition and remodeling, and angiogenesis via the HIF-1α/VEGF pathway.

Curcuma Longa L, from the Zingiberaceae family, traditionally promotes blood circulation, alleviates pain, and regulates qi and meridians. Its dried rhizome treats various conditions like chest and hypochondriac pain, dysmenorrhea, tinea purpura, and rheumatic pain. Research by Kant et al. [51] highlights curcumin's ability to reduce mRNA expression of tumor necrosis factor (TNF), interleukin-1 (IL-1), and matrix metalloproteinase-9 (MMP-9), while enhancing IL-10, VEGF, TGF-β1, HIF-1, SDF-1, heme oxygenase-1, and endothelial nitric oxide synthase in granulation tissue. This promotes antioxidant enzyme activity of superoxide dismutase, catalase, and glutathione peroxidase in diabetic rats, thereby accelerating wound healing.

TGF-β belongs to the transforming growth factor-β superfamily of proteins, which are highly pleiotropic cytokines affecting the growth, differentiation, apoptosis, inflammation, and immune regulation of various cells [52, 53]. In mammals, there are three subtypes of TGF-β: TGF-β1, TGF-β2, and TGF-β3. TGF-β1 is mainly expressed in endothelial cells, hematopoietic cells, and connective tissue cells; TGF-β2 is primarily expressed in epithelial and nerve cells, while TGF-β3 expression is mainly concentrated in mesenchymal cells [54]. The Smad family of proteins are the main downstream effectors of the TGF-β signaling pathway, playing a key role in transmitting the TGF-β signal from cell surface receptors to the nucleus. Different Smads mediate the signal transduction of different TGF-β family members. According to their functions, Smad proteins can be divided into three subfamilies [55]: receptor-activated Smads (R-Smads): Smad1, 2, 3, 5, 8, 9; co-mediator Smads (Co-Smads): Smad4; and inhibitory Smads (I-Smads): Smad6, 7 [56].

TGF-β1 has a targeted differentiation effect on fibroblasts. In wound healing, TGF-β1 is produced and released by various cell types and plays an important role in early wound healing, chronic wound development, acute and chronic wound healing, control of cell migration, and scar formation [57-59]. Hesperidin, a major plant flavonoid, is the main active substance found in citrus peel [60]. Xiong et al. [61] have shown that hesperidin has various biological functions such as anti-diabetic, anti-hyperlipidemic, anti-ulcer, anti-inflammatory, anti-microbial, analgesic, anti-fungal, liver protective, anti-oxidative, anti-allergic, anti-cancer, anti-hypertensive, and anti-atherosclerotic properties. Li et al. [62] conducted research that demonstrated the positive effects of hesperidin treatment in diabetic rat models. The treatment significantly increased the expression of VEGF-C, Ang-1, Tie-2, TGF-β, and Smad2/3 mRNA, which led to accelerated angiogenesis and promotion of wound healing in chronic diabetic foot ulcers induced by STZ. Furthermore, animal experimental studies have also shown that Chinese herbal preparations can increase the expression of TGF-β1 and p-Smad3 proteins while reducing the expression of MMP-1 protein [63]. This inhibits the degradation of the extracellular matrix, promotes fibroblast proliferation, and accelerates wound healing.

Clinical application of CHM in the treatment of postoperative anal fistula

Fumigation and washing with CHM

TCM fumigation therapy, an ancient treatment technique involving steaming Chinese herbs followed by rinsing and immersion, has been a longstanding component of external TCM treatment [64]. Historical texts such as the Book of Rites and Huangdi Neijing have documented its use for treating various ailments by soaking in medicinal liquids. Today, fumigation and cleaning therapies with TCM are widely employed in postoperative anal fistula treatment, yielding satisfactory outcomes. Deng et al. [65] utilized Huangbai decoction comprising Wubeizi, Sophorae Flavescentis Radix, Phellodendri Chinrnsis Cortex, and other herbs to perform fumigation and hip baths on 100 postoperative anal fistula patients, comparing it with warm water hip baths. The results indicated superior effectiveness of TCM fumigation, showing reduced pain, edema, exudation, and shorter wound healing time ($P<0.05$).

In another study, Du et al. [6] administered TCM fumigation to 200 anal fistula patients post-surgery. One hundred patients received sitz baths with a self-prepared decoction aimed at clearing heat, drying dampness, and relieving pain (control group), while the other hundred received a decoction for Yiqi Fuzheng in addition to the control regimen (observation group). The observation group exhibited higher clinical effectiveness rates, improved serum indexes, and increased growth factor concentrations ($P<0.05$), indicating enhanced postoperative wound recovery compared to the control group. Significant differences between groups were noted in terms of postoperative wound secretion, wound granulation color score, and pain levels ($P<0.05$), highlighting the TCM hip bath's ability to reduce local exudation, promote blood circulation, and facilitate wound healing [7].

Further validation through animal experiments by clinicians demonstrated that TCM fumigation and washing can modulate protein kinase and AMP-activated protein kinase signaling pathways, inhibit wound inflammation, and promote angiogenesis and wound healing in rats with anal fistula [66]. Collectively, these cases support the conclusion that TCM fumigation and washing therapies effectively promote wound recovery post-anal fistula surgery, mitigate complications, and enhance patient prognosis.

External application of CHM in the treatment of postoperative anal fistula

External application of TCM is grounded in TCM principles, employing traditional herbal medicines and formulations for topical therapy tailored to specific disease conditions. Si applied a self-made ointment to treat 32 postoperative anal fistula patients, comparing its efficacy with petroleum jelly gauze. Results demonstrated significant pain reduction and shortened wound healing time in both groups, with superior outcomes observed in the CHM group. Analysis indicated that TCM ointment not only maintains wound moisture but also minimizes tissue damage and pathological adhesion, thereby enhancing wound healing [67].

In another study, Wang et al. [68] divided 66 anal fistula patients into a study group and a control group, with 33 cases in each group. The study group received Jiuhua ointment for dressing changes, while the control group underwent warm water baths with vaseline gauze. Results showed substantial improvements in granulation, edema, and bleeding among patients treated with Jiuhua ointment, demonstrating superior wound treatment efficacy compared to the control group ($P<0.05$).

Li et al. [69] conducted a study involving 68 patients post-anal fistula surgery. One group received saprophytic muscle powder combined with Hong ointment gauze for dressing changes, while the control group used moist burn ointment gauze. The study group exhibited significantly lower wound secretion and improved wound color scores, indicating higher treatment effectiveness than the control group ($P<0.05$).

The application of TCM externally in anal fistula treatment has shown promising results in clinical practice. These studies highlight its effectiveness in reducing pain, accelerating wound healing, and improving postoperative outcomes. Further research and clinical trials are warranted to explore and validate the full potential of TCM in enhancing surgical recovery and patient quality of life.

Internal administration of CHM in the treatment of postoperative anal fistula

In TCM surgery, alongside external therapies, oral Chinese herbal preparations are employed to regulate patients' constitution and promote wound healing guided by TCM principles of "eliminating, supporting, and reinforcing". Anorectal physicians often combine oral CHM with standard postoperative care for effective treatment of anal fistula patients. The objectives of oral CHM administration include clearing heat and toxins, reducing dampness and heat, promoting blood circulation, resolving blood stasis, and replenishing qi and blood.

Ye et al. [70] conducted a randomized study involving 42 anal fistula patients, divided equally into study and control groups. The control group received potassium permanganate solution for smoking and sitz baths, while the study group additionally received a self-made heat-clearing and detoxifying medicine. Results demonstrated significantly shorter wound healing time in the study group compared to the control ($P<0.05$), with lower pain scores observed in the study group as well ($P<0.05$).

Table 2. Clinical practice of internal administration of CHM for anal fistula

Method	Qi and blood tonic method	Results	Reference
Heat clearing and detoxification method	The observation group was treated with Qudu-Xiaozhong decoction for anal fistula, and the control group was treated with frankincense and tangerine peel	The scores of incision pain and wound exudation in the observation group were better than those in the control group, and the wound area was smaller (P<0.05)	[72]
Reduced heat and humidity therapy	The patients with anal fistula were treated with Qingre-Yangxue decoction, and the conventional western medicine treatment was used as a control	The secretion score of the observation group was lower than that of the control group (P<0.05), and the wound healing rate and wound healing time were significantly better than those of the control group (P<0.05)	[73]
Promoting blood circulation and removing blood stasis	The treatment group was given self-made Jianpi-Tongluo decoction to treat anal fistula, and the control group was given oral Chinese medicine placebo	The symptoms of spleen deficiency and blood stasis such as poor appetite, mental fatigue and drowsiness, local pain, thick dark purple tongue and pulse strings were significantly improved in the treatment group. The cure rate of the treatment group was significantly higher than that of the control group (P<0.05)	[74]
	28 patients with anal fistula were treated with Xuefu Zhuyu decoction combined with Kushen decoction	This method can reduce the pain of patients and improve their enthusiasm for intervention	[75]
Qi and blood tonic method	29 patients with anal fistula were treated with Danggui Buxue decoction	The wound healing was accelerated and complications were reduced	[76]
	30 patients with anal fistula were treated with Yiqi Shengxue decoction, and the conventional western medicine group was compared	The total clinical effective rate of the observation group was higher than that of the control group (P<0.05)	[77]

CHM, Chinese herbal medicine.

Huang et al. [71] reported that oral administration of Qingli Shire decoction in anal fistula treatment improved exudation and treatment effectiveness significantly (P<0.05).

Moreover, numerous other studies have underscored the clinical efficacy of oral CHM in anal fistula treatment [72-77], as summarized in **Table 2**.

Internal administration of CHM represents a valuable adjunct to conventional treatments in anal fistula surgery, facilitating quicker wound healing and improved patient outcomes. Further research is essential to elucidate specific mechanisms and optimize treatment protocols for enhanced therapeutic efficacy.

TCM anus therapy

Anorectal therapy, also known as "TCM retention enema", involves the insertion of a topical ointment or suppository containing specific medicinal ingredients into the anus. These substances are absorbed through the rectal mucosa to treat the affected area [78]. This method is widely favored in clinical practice due to its simplicity, minimal invasiveness, and low risk of side effects, making it highly acceptable to patients. Moreover, it possesses properties such as heat-clearing and detoxification, as well as promoting blood circulation and resolving blood stasis. In recent years, it has gained popularity in the treatment of anal fistula and other related conditions.

Zhang et al. [79] observed that TCM anus therapy significantly reduced hospital stays and wound healing times in patients (P<0.05). It also lowered levels of inflammatory factors such as IL-10, TNF-α, and hs-C-reactive protein.

Huang et al. [80], in a study involving patients with anal fistula, compared routine surgical treatment with symptomatic therapies including hemostasis and anti-infection measures. The study group received Qingre-Lishi decoction enemas, while the control group was administered metronidazole combined with dexamethasone enemas. Results indicated significantly lower incidences of crypt abscesses, gland abnormalities, inflammatory cell infiltration, and ulcers in the study group compared to the control (P<0.05). Additionally, symptoms such as anal distension, diarrhea, and abdominal pain improved following treatment with enemas.

TCM anus therapy demonstrates notable therapeutic effects by enhancing blood circulation, reducing inflammation, and accelerating heal-

ing processes, thereby improving overall patient prognosis.

Acupuncture therapy

TCM and acupuncture are rooted in the foundational principles of TCM treatment, which emphasize maintaining the balance of Yin-Yang, qi, and blood within the body's zangfu organs and meridians to promote health. Both modalities utilize these principles to address illnesses by harmonizing the body's internal balance of Yin-Yang, qi, and blood.

Acupuncture and moxibustion, prominent examples of TCM therapies, involve stimulating local nerves to regulate zangfu organs and enhance qi and blood circulation [81]. TCM texts note, "where there is pain, there is no free flow; where there is free flow, there is no pain", aligning with modern research on postoperative pain. Studies show that surgical trauma releases pain-inducing factors locally, and tissue ischemia from local anesthesia during surgery may complicate anal fistula recovery. Acupuncture and moxibustion stimulate the body's natural healing mechanisms through muscle and meridian stimulation, regulating visceral functions and overall bodily well-being, making them favored in clinical practice [82]. Fu et al. [83] investigated 241 post-anal fistula surgery patients, treating the control group with intramuscular compound diclofenac sodium and oral tamsulosin hydrochloride sustained-release capsules, and adding "Sanqi point" Dao-ma acupuncture for the observation group. Results demonstrated that acupuncture and moxibustion alleviated postoperative pain, reduced urinary retention, improved defecation, and accelerated wound healing, highlighting its clinical significance.

CHM and acupuncture are integral TCM treatments that mutually complement each other. In clinical practice, both methods are often employed synergistically for enhanced efficacy. This synergy ensures optimal treatment outcomes, potentially reducing the need for higher acupuncture stimulation levels once desired effects are achieved. For example, treating gastroptosis with weakened temper and depressed Zhongqi may combine Buzhongyiqi decoction with acupuncture at Buzhongwan and Zusanli acupoints. Although TCM and acupuncture may differ in therapeutic effects and mechanisms, their combined use can achieve superior results. Acupuncture swiftly alleviates pain symptoms in certain conditions, while Chinese herbal medicine provides long-term visceral regulation. Tailored treatment plans, combining acupuncture and herbal medicine, maximize the strengths of both modalities to improve patient outcomes, particularly in chronic disease management where regulating visceral functions and enhancing blood circulation are crucial.

Advantages and challenges of CHM in the treatment of postoperative anal fistula

Compared to conventional clinical treatments, CHM offers distinct advantages in postoperative anal fistula treatment. Firstly, it boasts minimal side effects. Unlike many chemically synthesized Western drugs, CHM derives from natural plants with complex components and multi-target mechanisms, reducing the likelihood of strong, singular side effects. Moreover, extensive clinical experience with CHM has deepened understanding of its side effects, adverse reactions, and preventive measures.

Secondly, CHM treatment after anal fistula surgery not only focuses on wound healing and symptom relief but also emphasizes overall body conditioning. By methods such as promoting blood circulation, removing blood stasis, clearing heat, detoxifying, invigorating qi, and nourishing Yin, CHM helps regulate qi-blood balance, enhance immunity, and support comprehensive rehabilitation [84]. This holistic approach makes CHM more comprehensive and enduring in the treatment of postoperative anal fistula.

Furthermore, CHM allows for personalized treatment plans tailored to each patient's specific condition, constitution, and symptoms. This individualized approach enhances treatment efficacy while minimizing unnecessary side effects.

Despite its benefits, CHM has limitations in treating anal fistula. Firstly, while CHM can alleviate symptoms, it may not fully cure complex or severely infected anal fistulas, where surgical intervention remains preferable. Additionally, compared to surgery, CHM treatment for anal fistula requires a longer duration and often involves continued use of TCM alongside

lifestyle and dietary adjustments to achieve optimal outcomes.

Moreover, the standardization of CHM preparations presents challenges. Variations among manufacturers in component content, extraction techniques, and quality standards can affect the stability and effectiveness of herbal preparations. Establishing unified standards for herbal formulations and enhancing quality control in cultivation, processing, and storage are crucial steps toward improving consistency and efficacy.

Furthermore, evaluating the clinical efficacy of CHM in anal fistula treatment poses challenges. The gradual and subtle effects of CHM make it difficult to assess using single quantitative measures. Individual variations and the complexity of the condition further complicate efficacy evaluation, highlighting the need for more scientific and comprehensive assessment methods.

In conclusion, while CHM offers certain benefits in anal fistula treatment, it cannot replace surgical intervention for severe cases. Patients should choose treatment methods based on individual conditions and medical advice. Future efforts should focus on developing standardized practices, conducting robust clinical trials, and advancing understanding of CHM's mechanisms to enhance its clinical application.

Summary and future directions

In summary, CHM offers external and oral methods for treating anal fistula, characterized by simplicity, minimal side effects, cost-effectiveness, and significant efficacy in promoting healing, pain relief, and improving quality of life. However, challenges such as addressing root causes and the need for prolonged treatment duration exist due to individual variability. Additionally, limited research on CHM's dynamic mechanisms and pharmacology, as well as insufficient large-scale clinical data, currently restrict broader application in medical practice.

Looking ahead, efforts should prioritize standardizing CHM application, expanding clinical trials, and deepening research into CHM's mechanisms in treating anorectal and surgical conditions. These steps are essential to maximize CHM's efficacy and integration into diverse medical fields.

Disclosure of conflict of interest

None.

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