

Clinical Evidence Analysis of Traditional Chinese Medicine Intervention in Preventing Recurrence After Thermal Ablation of Thyroid Nodules

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Abstract: Thyroid nodules are common endocrine disorders in clinical practice. Thermal ablation has been widely adopted due to its advantages of minimal invasiveness and rapid recovery, yet postoperative recurrence remains a clinical challenge. Traditional Chinese Medicine (TCM) intervention has shown potential value in preventing postoperative recurrence. This article systematically reviews recent clinical research evidence and analyzes the efficacy of TCM intervention in preventing recurrence after thermal ablation of thyroid nodules. Existing evidence suggests that TCM intervention based on syndrome differentiation can reduce postoperative recurrence rates, promote absorption in the ablated area, and improve clinical symptoms. The underlying mechanisms may be related to the regulation of cytokines such as transforming growth factor and insulin-like growth factor, as well as the improvement of thyroid function. This review summarizes the current status of clinical research, characteristics of intervention protocols, mechanisms of action, and existing problems, aiming to provide a reference for clinical practice.

Keywords: thyroid nodules; thermal ablation; traditional Chinese medicine; postoperative recurrence; clinical evidence

1. Introduction

Thyroid nodules are common and frequently occurring clinical diseases. The widespread use of high-resolution ultrasound has significantly improved their detection rate, which ranges from 20% to 76% in adults, and the majority of nodules are benign. For nodules accompanied by compressive symptoms, cosmetic concerns, or malignant potential, thermal ablation, including microwave ablation and radiofrequency ablation, has become an important local therapeutic approach due to its advantages of minimal invasiveness, rapid recovery, and preservation of thyroid function[1].

Nevertheless, the problem of recurrence after thermal ablation should not be overlooked. Clinically, some patients develop new nodules around the ablation zone or experience continuous growth of residual lesions, with a recurrence rate of 10% to 30%. How to effectively prevent postoperative recurrence and improve long-term therapeutic efficacy has become a key focus of clinical research.

Traditional Chinese Medicine (TCM) has a long history in the treatment of thyroid diseases, with a mature theoretical system for Yingbing (goiter). Recent studies have demonstrated that TCM intervention contributes to reducing the postoperative recurrence rate and accelerating patient rehabilitation. The Guidelines for the Integrated Traditional Chinese and Western Medicine Diagnosis and Treatment of Thermal Ablation for Thyroid Nodules and Related Diseases issued in 2021 also affirmed the synergistic therapeutic effect of TCM. This paper systematically reviews the relevant clinical evidence and investigates the role of TCM intervention in preventing recurrence after thermal ablation, so as to provide a reference for clinical decision-making.

2. Current Status of Clinical Research

2.1 Overview of Research

Clinical studies on TCM intervention for preventing recurrence after thermal ablation of thyroid nodules are limited but increasing annually. Main research types include randomized controlled trials and case series. Interventions involve TCM decoctions, proprietary Chinese medicines, and integrated Chinese-Western medicine approaches. Most studies have follow-up periods of 6 to 24 months, with observation indicators covering recurrence rates, ablation volume reduction, clinical symptom scores, thyroid function, and safety. Regarding research quality, recent studies show improvement in randomization, control group design, and sample size estimation. However, challenges persist, including considerable heterogeneity and a lack of large-scale, multicenter studies.

2.2 Post-ablation Recurrence Rates and Efficacy of TCM Intervention

Postoperative recurrence is a core efficacy indicator. Chen Haidong et al. [2] randomized 60 patients with nodular

goiter into control and experimental groups (30 each). All underwent microwave ablation. The control group received oral levothyroxine postoperatively, while the experimental group received Peitu Xiaoying Formula for 3 months. Results showed that the 12-month recurrence rate was significantly lower in the experimental group ($P < 0.05$).

Another study on Xingqi Xiaoying Formula after microwave ablation of benign thyroid nodules randomized 60 patients into a TCM group and a control group (regular follow-up only). The TCM group received the formula for three courses (3 weeks each, with 1-week breaks). The TCM group showed superior outcomes in promoting absorption in the ablated area and reducing recurrence risk[3].

A randomized controlled study on modified Yueju Pill for thyroid cysts after microwave ablation reported that the observation group (conventional treatment plus modified Yueju Pill) achieved greater cyst volume reduction ($P < 0.05$) and a significantly higher overall efficacy rate compared with the control group[4].

Additionally, an early case series (83 cases) on Yingliu Formula for postoperative recurrence of thyroid nodules reported a total efficacy rate of 75.90%, including 12 cured and 51 improved cases, suggesting TCM has therapeutic value[5].

Although these studies vary in intervention protocols and observation periods, the overall trend is consistent: TCM combined with ablation offers advantages over ablation alone or ablation combined with Western medicine in reducing recurrence rates.

3. Analysis of TCM Intervention Protocols

3.1 Characteristics of Syndrome Differentiation and Treatment

The understanding of the TCM pathogenesis of thyroid nodules after thermal ablation is becoming increasingly sophisticated. Professor Zuo Xinhe believes that the pathogenesis after thermal ablation is primarily attributed to heat toxin attacking the superficial aspects, stagnant heat binding internally, latent pathogenic factors lingering, and qi deficiency with yin deficiency. The fundamental treatment principle is nourishing yin, clearing heat, resolving phlegm, and dispelling stasis. Clinical treatment employs formulas that clear heat, detoxify, resolve phlegm, dispel stasis, promote diuresis to reduce swelling, nourish yin, and clear heat[6]. This understanding reflects the pathogenesis characterized by both "heat toxin" and "healthy qi deficiency" after ablation.

3.2 Commonly Used Formulas and Their Effects

From existing studies, the Peitu Xiaoying Formula (Fuzheng Xiaoying Decoction) primarily strengthens the body's resistance, consolidates the foundation, resolves phlegm, and reduces goiter, making it suitable for patterns of spleen and stomach weakness with phlegm-dampness congealing. The Xingqi Xiaoying Formula focuses on soothing the liver, regulating qi, resolving phlegm, and dissipating nodules, making it suitable for the pattern of qi stagnation and phlegm congealing. The modified Yueju Pill emphasizes promoting qi circulation to relieve depression, activating blood, and dispelling stasis, suitable for the pattern of qi depression and blood stasis. The Yingliu Formula primarily resolves phlegm, softens hardness, reduces goiter, and dissipates nodules.

Although each formula has its emphasis, they all reflect the basic compatibility principles of resolving phlegm, dispelling stasis, regulating qi, and strengthening the body's resistance, which aligns with the fundamental pathogenesis of thyroid nodules: "qi stagnation, phlegm congealing, and blood stasis."

3.3 Intervention Timing and Course

Regarding the timing of TCM intervention initiation, most existing studies adopt the model of starting TCM treatment immediately after surgery, with intervention courses typically lasting 1 to 3 months. Chen Haidong et al. used a 3-month postoperative oral TCM regimen. The Yueju Pill study employed a 1-month continuous medication regimen. The Xingqi Xiaoying Formula study used a protocol of three courses, each lasting 3 weeks. Overall, intervention courses of 1 to 3 months are common, but the optimal course requires further investigation.

4. Exploration of Mechanisms

4.1 Regulation of Cytokines

Cytokines play a significant role in the development and progression of thyroid nodules. Chen Haidong et al. measured levels of transforming growth factor- α (TGF- α), insulin-like growth factor-1 (IGF-1), and transforming growth factor beta-1 (TGF- β 1). Results showed that TGF- α and IGF-1 levels in the experimental group decreased significantly compared to the control group, while TGF- β 1 levels increased significantly, whereas no statistically significant changes were observed in the control group. This suggests that the Peitu Xiaoying Formula may inhibit nodule proliferation and promote absorption

in the ablated area by regulating the expression of these cytokines.

4.2 Effects on Thyroid Function

Stability of thyroid function is crucial for preventing postoperative recurrence. The study by Chen Haidong et al. found that the experimental group showed no significant changes in thyroid function, while thyroid-stimulating hormone (TSH) levels in the control group decreased significantly after treatment. Similarly, the Yueju Pill study found that the observation group showed greater improvement in TSH, FT3, and FT4 levels compared to the control group. These results suggest that TCM intervention may help maintain stable thyroid function, avoiding stimulation of residual tissue proliferation due to TSH fluctuations.

4.3 Effects on Quality of Life

Beyond objective indicators, improvement in quality of life is a significant advantage of TCM intervention. The Yueju Pill study evaluated quality of life using a scale and found that the observation group showed significantly greater improvement in physiological, psychological, and social function scores compared to the control group ($P < 0.05$). This indicates that TCM intervention focuses not only on disease control but also on improving the overall state of the patient.

5. Existing Problems and Prospects

5.1 Deficiencies in Study Design

Existing studies provide preliminary evidence but have limitations. Sample sizes are generally small, with most being single-center exploratory studies lacking large-scale, multicenter validation. Follow-up periods are short (1–2 years), insufficient to assess long-term recurrence. Considerable heterogeneity in interventions, control settings, and outcome indicators limits evidence integration and comparison.

5.2 Deepening Mechanism Research

Current mechanistic research is mostly limited to detecting a few cytokines, lacking systematic exploration. Recurrence after ablation involves inflammation, tissue repair, and cell proliferation—processes through which TCM likely exerts multi-target effects. Future research should integrate modern molecular biology techniques to explore specific targets and signaling pathways.

5.3 Need for Standardization

The 2021 guideline provides an important reference, but its TCM protocols remain general and require further specification. Future efforts should focus on conducting high-quality clinical studies based on evidence-based medicine to promote the development of standardized integrated diagnosis and treatment protocols.

6. Conclusion

Synthesizing existing clinical evidence, TCM intervention shows promising effects in preventing recurrence after thermal ablation of thyroid nodules. Syndrome differentiation-based TCM protocols can reduce postoperative recurrence rates, promote absorption in the ablated area, and improve clinical symptoms and quality of life. The underlying mechanisms may be related to regulating cytokine expression and stabilizing thyroid function. However, the quality of existing evidence needs improvement, and more high-quality clinical studies with rigorous designs, adequate sample sizes, and sufficient follow-up are necessary to provide more reliable evidence-based support for clinical application. With the continuous advancement of the integrated traditional Chinese and Western medicine model, the value of TCM in the comprehensive postoperative management of thyroid nodules will be further demonstrated.

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