Research Progress of Dai and Western Medicine in the Treatment of Gouty Arthritis

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Abstract This paper reviews the pathogenesis, diagnostic criteria, and treatment means of gouty arthritis from the perspectives of Western medicine and Dai medicine in order to provide a reference for clinical medication.

Key words Gout, Dai medicine, Western medicine, Research progress

1 Introduction

Gouty arthritis (GA) is defined as pathological damage and an inflammatory reaction caused by urate deposition[1]. GA presents with a sudden, acute, and rapid onset of severe pain at night or in the early morning hours. This pain is accompanied by a number of symptoms, including redness, swelling, heat, pain, and dyskinesia. It primarily affects the first metatarsophalangeal joint and is most commonly unilateral[2]. The treatment of GA by Dai medicine has been demonstrated to have a remarkable effect, and various methods have been employed, which is worthy of clinical promotion. This paper reviews the pathogenesis, diagnostic criteria, and treatment means of the disease from the perspectives of Western medicine and Dai medicine, with a view to providing ideas for clinical treatment of the disease.

2 Progress in Western medicine treatment

2.1 Etiology and pathogenesis Gout is a polygenic disease that is associated with gene polymorphisms and environmental factors. It is the result of the interaction between gout susceptibility genes and environmental factors[3]. The precise etiology and pathogenesis of gout, which is a severe but self-resolving condition, remains uncertain. Studies have shown that the onset of gout is related to the patient's metabolism, inflammation and immunity[4]. The final product of purine metabolism is uric acid, and elevated blood uric acid levels are considered to be the underlying cause of gout attacks. More than 80% of uric acid present in the human body originates from endogenous purine metabolism, and inborn enzyme defects represent the primary reason for the increase in primary blood uric acid production. A reduction in glomerular filtration and tubular secretion, accompanied by an increase in reabsorption and the deposition of urate crystals, especially the reduction of tubular secretion, can result in impaired uric acid excretion and the development of hyperuricaemia[5]. Mutations in the urate anion exchanger (URAT) gene and abnormal expression of the urate transporter (HUAT) also result in decreased uric acid filtration and increased reabsorption[5]. The fundamental aspect of the inflammatory response in gout is the deposition of monosodium urate on bone, joints, kidneys and subcutaneous tissues, which results in tissue damage and inflammation. The development of inflammation is contingent upon the quantity of protein on the surface of monosodium urate crystals[6]. Recurrent inflammation depends on the intrinsic immune response elicited by monosodium urate (MSU) crystal mediation[7]. Long-term, repeated urate deposition results in the infiltration of monocytes, epithelial cells, and giant cells, ultimately leading to the formation of gouty stones[8].

In addition, it has been shown that the inflammatory response subsequent to deposition is intimately associated with the participation of neutrophil-mediated, monocyte-macrophage differentiation, IgG-MSU complexes, and inflammatory complexes[9]. Furthermore, it has also been demonstrated that gut microbes[10], abnormal proliferation and activation of Th17 in peripheral blood $CD4^+$ T lymphocyte subsets[11] and other factors are associated with the onset and progression of GA.

2.2 Diagnostic standards The gold standard for the diagnosis of gout is the identification of birefringent needle-like urate crystals in the patient's joint fluid or gout stones under polarized light microscopy. An elevated blood uric acid level is regarded as a primary factor in the onset of gout. A clinical diagnosis of gout may be made when a patient exhibits a blood uric acid level exceeding 420 μmol/L and presents with distinctive arthritis, urinary stones, or episodes of renal colic. Nevertheless, the majority of patients with hyperuricaemia do not develop gout. Conversely, some patients with gout have their serum uric acid levels within the normal range at the onset of the disease, and some patients with gout who have gout stones do not experience a gouty attack or have gout stones prior to the onset of gout, which may lead to clinical misdi-

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agnosis and misdiagnosis[12]. Therefore, in patients presenting with clinical challenges in diagnosing acute gouty arthritis, diagnostic colchicine treatment is typically employed to elucidate the diagnosis.

2.3 Status of treatment

2.3.1 Medication. Acute GA attacks are a common occurrence and therefore require prompt medical intervention, with the administration of drugs commencing within 24 h. The initial drug selected should be appropriate for the severity of symptoms and the number of joints involved. Therapeutic drugs that are commonly used in clinical practice include non-steroidal anti-inflammatory drugs (NSAIDs), systemic corticosteroids and colchicine[13]. In addition to the patient's medical history, the potential for drug-drug interactions, the presence of comorbidities, the patient's degree of adaptation to a particular treatment regimen, and the patient's own constitution must also be considered. Patients presenting with first-onset severe pain, multiple joints, or multiple large joints are typically treated with a combination of drugs[14].

2.3.2 Surgical treatment. (i) Microneedle therapy. Small-needle knife therapy is a novel approach to medical treatment that combines the techniques of modern medicine and traditional Chinese medicine, with the characteristics of modern medicine surgery and the role of acupoint stimulation in Chinese medicine[15]. Zhao *et al.* [16] found that the direct discharge of blood containing analgesic substances through local skin incisions using a small needle knife can enhance blood circulation, accelerate the subsidence and absorption of inflammation, facilitate accelerated tissue repair, and reduce inflammatory stimuli, thereby achieving the purpose of analgesia. The most commonly employed combinations include colchicine in conjunction with NSAIDs, colchicine with oral corticosteroids, and intra-articular steroid injections with NSAIDs and oral colchicine or corticosteroids. However, the concurrent administration of NSAIDs and oral corticosteroids is not recommended due to the potential for enhanced toxicity, exemplified by gastrointestinal bleeding[17]. In this study, the use of a small needle knife to incise the local skin of acute gouty arthritis and discharge the pathological products has been demonstrated to promote uric acid excretion and inhibit the secretion of inflammatory mediators, so as to achieve the purpose of analgesia and delay the symptoms in a relatively short period of time.

(ii) Minimally invasive needle knife mirror therapy. The minimally invasive needle knife mirror represents a novel approach to minimally invasive diagnostic and therapeutic technology. It is guided by the theory of Chinese medicine and based on the surgical operations of Western medicine. This technology integrates the traditional medicine's small needle technology, modern medicine's minimally invasive surgical technology and endoscopic equipment. It is able to deal with the lesions of the body's microscopic tissues and structures without destroying the overall structure in the diagnostic and therapeutic process. This represents a new technology that can not be replaced by the traditional needle and knife therapy and ordinary open surgery. A minimally invasive needle knife mirror has the potential to loosen the tissue adhesion within the joint, while simultaneously facilitating repeated irrigation of the joint cavity, thereby facilitating the removal of urate crystals[18-19].

3 Progress of Dai Medicine treatment

3.1 Causes and mechanisms of Dai medicine The "Four Pagodas and Five Aggregates" represents the foundational tenet of Dai medicine. It is employed to elucidate the physiological processes and pathological changes of the human body, as well as to direct the clinical identification of diseases and the administration of medication. The Four Pagodas comprise the Wind Pagoda, the Fire Pagoda, the Water Pagoda and the Earth Pagoda. The Wind Pagoda is capable of fostering the growth of all things, the Fire Pagoda of the maturation of all things, the Water Pagoda of the intake of all things and the nourishment of all things, and the Earth Pagoda of the retention of all things and the conveyance of all things. The Four Pagodas exhibit a mutually supportive relationship, maintaining a relatively dynamic equilibrium between the internal and external environments. The Five Aggregates specifically refer to the colour aggregate, knowledge aggregate, receptivity aggregate, thought aggregate, and action aggregate. These are the five internal, spiritual elements that are embedded in the human body. The Four Pagodas serve as the material basis for the Five Aggregates, which in turn represent the functional manifestations of the Four Pagodas. The malfunction of the Four Pagodas and the Five Aggregates represents a significant internal factor contributing to the development of disease. Dai medicine posits that gout belongs to the category of "longmengshahou", which is caused by dysfunction in the body's four pagodas, resulting in impaired transportation of water and dampness, leading to the accumulation of heat in the body. This, in turn, causes the wind and cold to evoke a negative response, resulting in the congestion and stagnation of the disease's symptoms. Alternatively, dietary preferences may contribute to the accumulation of heat within the body, leading to the perception of wind and heat as poisonous evils. This, in turn, may result in the damage of the pagoda of water, wind and fire bias, and the stagnation of the limbs and joints[20].

In accordance with the clinical manifestations of gouty arthritis, the Dai medical tradition categorizes it as "longmengshahou"[21]. The absence of wind does not give rise to evil, nor does evil become ill. Similarly, the absence of wind disease does not change or spread. This suggests that longmengshahou is caused by a variety of diseases, but its primary causative factor is wind. The wind exerts a multifaceted influence on the development of disease. It can act independently to cause disease or in conjunction with other factors to cause disease. Longmengshahou, a disease that manifests in its early stages, is primarily caused by an overconsumption of foods with high fat content, such as barbecue and frying, alcohol, wine, and other foods with a thick, sweet, and fatty texture. These foods contribute to the body's accumulation of excessive nutrients, which can not be converted into the

normal water, earth, fire, and wind pagodas. Instead, they accumulate within the body, leading to the emergence of the water, dampness, heat, and the subsequent loss of balance in the body's four pagodas. Alternatively, these factors may act as new disease-causing agents, influencing the joints and causing local mobility disorders, redness, swelling, and other symptoms. Ultimately, this can lead to the development of gouty arthritis[22].

3.2 Dai Medicine treatment

3.2.1 Internal remedy (Medicine). Longshatalinglinruan (Tu-ta dysfunction type) is a TCM practice that aims to tonify the earth and benefit water, remove wind and relieve pain. The commonly used formula is: Menggun (Renzhi Shu) 30 g, Hahaman (Paixu San) 20 g, Gaihei (Tongxue Xiang) 30 g, Guanding (Trifolium Craneflorum) 25 g, Hengzhang (Dagou Rongling) 30 g, Heigaiguan (Pouring Heart Shielded Winged Garland Vine) 30 g. The solution is typically prepared by combining the formula with 20 g of water and 20 g of Yannuomiao (Kidney Tea) to a volume of 150 mL, and consumed three times a day for 12 weeks. The treatment is designed to tonify the earth and promote water flow, as well as to remove wind and relieve pain[21].

3.2.2 External treatment (Medicine). (i) External application. It can be divided into fresh Dai medicine for external application and dried Dai medicine for external application, which is particularly suited to the prevailing winds, fires, and poisons. Fresh Dai medicines are commonly used in sealing packs: Heikeluo (Green Ox Gallbladder), Huanjiu (Dry Lotus Grass), Haomin (Turmeric), Baiduanheng (Big Leaf Fire Tree Leaves); Haomin (Turmeric), Bulei (Purple Ginger), Heikeluo (Green Ox Gallbladder), Zhuzhalin (Wide Tendon Vine), Yanshaban (Wind-Expelling Grass); Heikeluo (Green Ox Gallbladder), Zhuzhalin (Broad Tendon Vine), Yanshaban (Wind-Expelling Grass); Heikeluo (Green Ox Gallbladder), Zhuzhalin (Wide Tendon Vine), Yanshaban (Wind-Expelling Grass). Dai medicines in fresh form are used for external compresses and dried ones for external compresses. The following herbs are excluded: wind grass, Heikeluo (green ox gall), Haomin (turmeric), closed-sheath ginger, *etc.* The appropriate amount should be combined with a small amount of "nanmo" (rice-water) and "manmu" (lard) as a guide; Xingailian (red and white-flowered stinking peony), Maidanbieshupi (bark of duck's foot), Guolingashupi (bark of thousand sheets of paper) should be fried in rice vinegar and then wrapped around the affected area after it gets cold. The most commonly used formula for a dried Dai medicine sealing package is as follows: Hataoxiu (big green vine root), Yapapin (small copper hammer), Haomin (turmeric), Mahuxinmeilang (big red and yellow foam), Bibihao (white flower Dan), rhubarb, *Angelica dahurica*, *etc.* These ingredients are combined with cold water and applied to the affected area[23].

(ii) Fumigation. This is applicable to the type of Tu Ta disorder, and it concerns the commonly used Dai medicines: Heikeluo (green ox gall), Zhuzhalin (broad-leafed vine), Guandi (three-leafed creeping thorn), Yanshaba (wind-removing grass), Huangjiu (dry lotus herb), Yansaigai (green vine)[20].

(iii) Antibiotic. It is suitable for the type of wind, fire and poisonous evil, and commonly used Dai medicines include: Heikeluo (green ox gall), Zhuzhalin (broad vine), Guandi (three-leafed creeper), Yanshaba (wind remover), Huangjiu (dry lotus herb), Yansaigai (green vine), Wenshahai (hundred kinds of solution), *etc.*, which are prepared in the form of decoction of soup and cold soak[20].

4 Discussion

At present, the specific pathogenesis of GA remains unclear, and the treatment is based on the etiology of the disease and symptomatic treatment as the main therapeutic measures. The dearth of efficacious therapeutic drugs and the adverse reactions of drugs commonly employed in the treatment of GA present significant challenges to the Western medical treatment of GA. According to the principles of Dai medicine, GA is believed to result from an imbalance of the Four Pagodas. Clinically, the treatment principle of "solving the problem first and then treating it later, solving the problem together and treating it at the same time" is usually applied. Modern research has shown that Dai medicine treatment for GA can reduce the release of inflammatory factors by lowering uric acid levels, thus playing a role in the treatment of GA[24]. However, the majority of research on GA in Dai medicine is based on pharmacodynamic experiments. However, the current research on GA in Dai medicine is mainly based on pharmacodynamic experiments, with the research on its mechanism still in its infancy. These experiments are conducted on a single target and single animal, and thus can not provide a comprehensive understanding of the mechanism and treatment of GA. In light of the aforementioned issues, the subsequent phase of research should focus on elucidating the precise mechanism of action of Dai medicine in the treatment of GA. This can be achieved by conducting a detailed analysis of the proteomic, genomic, and metabolomic profiles of select Dai medicines and formulations that have demonstrated efficacy in the management of GA. This approach will not only advance our understanding of the mechanisms and principles underlying the therapeutic effects of Dai medicine in GA but also facilitate the further advancement of Dai medicine in combating GA.

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(From page 113)

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