Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Elsevier hereby grants permission to make all its COVID-19-related research that is available on the COVID-19 resource centre - including this research content - immediately available in PubMed Central and other publicly funded repositories, such as the WHO COVID database with rights for unrestricted research re-use and analyses in any form or by any means with acknowledgement of the original source. These permissions are granted for free by Elsevier for as long as the COVID-19 resource centre remains active.
Review

Diagnosis and treatment of novel coronavirus pneumonia based on the theory of traditional Chinese medicine

Shi-xin Wang a, Yan Wang a, Yu-bao Lu b, Jie-yun Li a,c, Yu-jun Song a, Munkhtuya Nyamgerelt a, Xue-xi Wang a,c,*

a School of Basic Medical Sciences, Lanzhou University, Lanzhou 730000, Gansu Province, China
b The Second Clinical Medical College, Lanzhou University, Lanzhou 730000, Gansu Province, China
c Key Laboratory of Evidence-Based Medicine and Knowledge Translation of Gansu Province, Lanzhou 730000, Gansu Province, China

Abstract

Since the outbreak of novel coronavirus pneumonia (coronavirus disease 2019, COVID-19), it has rapidly spread to 187 countries, causing serious harm to the health of people and a huge social burden. However, currently, drugs specifically approved for clinical use are not available, except for vaccines against COVID-19 that are being evaluated. Traditional Chinese medicine (TCM) is capable of performing syndrome differentiation and treatment according to the clinical manifestations of patients, and has a better ability of epidemic prevention and control. The authors comprehensively analyzed the etiology and pathogenesis of COVID-19 based on the theory of TCM, and discussed its syndrome differentiation, treatment and prevention measures so as to provide strategies and reference for the prevention and treatment with TCM.

Please cite this article as: Wang SX, Wang Y, Lu YB, Li JY, Song YJ, Nyamgerelt M, Wang XX. Diagnosis and treatment of novel coronavirus pneumonia based on the theory of traditional Chinese medicine. J Integr Med. 2020; 18(4): 275–283.

© 2020 Shanghai Changhai Hospital. Published by Elsevier B.V. All rights reserved.
1. Introduction

Since the novel coronavirus pneumonia (coronavirus disease 2019, COVID-19) outbreak in the world and has now infected a total of 348,678 people in 187 countries (March 21, 2020) [1]. China has listed COVID-19 as a class B infectious disease and has undertaken preventive and control measures according to class A infectious diseases [2]. With the spread of the epidemic, presently, patients infected with the novel coronavirus, as well as those with asymptomatic infection, are the main sources of infection; thus, COVID-19 is an infectious disease with a medium to slightly high contagious capacity [3]. The incubation period of the disease is generally 7 days, and the longest is 14 days; however, some cases have reported an incubation period of 24 days as well [4]. Common clinical manifestations include fever, dry cough and fatigue. Computerized tomography of the chest can show multiple ground glass shadows of the pulmonary lobes, indicative of conditions such as respiratory distress syndrome, shock and sepsis, which can even lead to death [5]. Thus far, although China has announced six trials and strategies for the diagnosis and treatment of the disease, the focus remains mainly on symptomatic treatment, new drugs specifically approved for the infection are not available. Clinical trials for new drugs such as remdesivir and cidofovir are underway; however, the clinical promotion and short-term use of these drugs is unlikely. Therefore, given the particularities of this disease, it is of critical clinical value to formulate a set of treatment plans using integrated traditional Chinese medicine (TCM) and Western medicine, based on the concept of prevention and treatment. To utilize the advantages of integrated traditional Chinese and Western medicine in the prevention and treatment of COVID-19, this paper discussed the etiology and pathogenesis of COVID-19 from the viewpoint of integrated TCM and Western medicine, the treatment measures for different susceptible groups, and the effect along with matters needing attention, so as to provide a reference for the prevention and treatment of COVID-19.

2. Etiology

Coronavirus is a type of a ribonucleic acid virus with an envelope structure, characterized by rod-like protuberances on the surface and can infect multiple host species, causing a variety of diseases [6]. The COVID-19 pathogen is a novel coronavirus (2019-nCoV), which can infect humans and is significantly clustered with the bat-like severe acute respiratory syndrome coronavirus (SARS-CoV) sequence isolated in 2015, with a nucleotide similarity of 88%. Based on these results, it can be concluded that 2019-nCoV is similar to SARS-CoV and Middle East respiratory syndrome coronavirus (MERS-CoV) [7]. It is a zoonotic pathogen that can cause severe respiratory diseases in humans and can be transmitted from person to person [8]. Therefore, the International Committee on Taxonomy of Viruses announced that the official classification of the novel coronavirus is SARS-CoV-2.

There is no virus theory in TCM, and according to the clinical characteristics of COVID-19, the disease belongs to the category of "plague" [9]. As the General Treatise on the Etiology and Symptomology says [10], "if a person feels grumpy and gets sick, he will be easily infected by evil Qi, which may even exterminate the family, and extend to outsiders." The common symptoms in the early stage of COVID-19 in mildly infected patients include fever, fatigue and dry cough, which could be easily confused with other common exogenous diseases. However, according to Wu You-ke's The Treatise on Epidemic Febrile Diseases [11], which mentions "the febrile disease is non-wind, non-cold, non-heat and non-damp; it is a different feeling between heaven and earth," the cause of this disease is very clear, differing from the other six exotic evils, and presenting characteristics of a strong and contagious epidemic virus.

Wuhan, the center of the outbreak pathogen in China, is located in the east of Jianghan Plain of China. The vertical and horizontal water areas of the city's rivers account for one-fourth of the total city area, demonstrating the natural environmental basis of "damp evil" [12]. At the initial stage of this epidemic, most patients presented symptoms of fever; however, there were also patients with no fever or low fever, and some patients presented gastrointestinal symptoms, such as indigestion and loose stool, as well as chest tightness and fatigue, coinciding with the characteristics of "damp evil" in TCM. Hence, this disease is an epidemic, with the primary nature of "damp" and "toxic," and thus can be termed "damp toxin disease." Furthermore, in 2019, Wuhan experienced a warm winter climate, with incoming heat instead of cold. From the perspective of TCM, this kind of climate change is prone to generate damp-heat in the human body, which persists and is difficult to eliminate from Sanjiang (one of the six fu-organs in TCM theory). Some patients have a recurrent fever, bitter mouth, insomnia, upset, chest tightness and shortness of breath, fatigue, yellow or greasy tongue coating, and slippery pulse, which are manifestations of the evil underlying Shaoyang meridian according to the six-meridian syndrome differentiation theory [13]. Notably, the most severe cases developed dyspnea one week later, which even progressed to acute respiratory distress syndrome, septic shock, intractable metabolic acidosis, and coagulation dysfunction, leading to death [14]. According to TCM, the toxins from these patients not only hurt the Qi but also injure the nutrient blood and result in blood stasis; the pericardium transmission channel is also reversed, resulting in mental changes. Dampness stagnates for a prolonged period and turns into heat; heat toxin accumulates for a long time, resulting in stasis; stasis and heat combine mutually and then generate syncope, which consumes Qi and Yin and leads to a deficiency. According to the principle of "three factors and measures," there exist various etiological characteristics in different regions, as well as climatic factors. Fan et al. [15] observed and analyzed the TCM pathological characteristics of "dryness" in Hunan cases, and concluded that dryness and dampness are mainly due to "child disease to mother" in the course of the disease. In the theory of TCM, dryness evil can easily injure the lung. Lung and spleen belong to "gold" and "soil" in the five-element theory of TCM. Dryness turns into dampness. Dampness easily traps spleen. Wet soil is the mother of dryness "gold." Furthermore, excessive lung dryness injures the spleen "soil"; hence, both lung dryness and spleen dampness are significant. In contrast, Yu et al. [16] summed up the data and concluded that the diseases in Guangdong Province and Gansu Province were caused by warm-heat toxin or epidemic toxin, which was closely related to their regional environment. Guangdong Province is hot and humid all year round, and the epidemic Qi can easily mix with evils of damp and heat to attack the lung; however, the overall 2019 winter temperature in Gansu Province was higher than that experienced in previous years. Additionally, Gansu is located in the northwest region of China, which is mostly dry and warm, and susceptible to the evil of dryness that can cause lung disease. TCM runs through the whole idea of disease differentiation all the time, and the unified relationship between man and nature has been called “correspondence between man and nature” in ancient books, which presents considerable advantage in the treatment of COVID-19 in different populations and regions.

3. Pathogenesis

Compared with other diseases, the evil Qi of the “damp toxin epidemic” is relatively fixed, and hence, the etiology and pathogen-
that "the plague toxin burns its blood inside, and if the epidemic toxin enters the blood, the dampness toxin is heavy and viscous, blocking the Qi mechanism and causing chest tightness, body heat, and muscle soreness. "Damp evil" traps the spleen, easily injuring Yang Qi. The spleen dominates and regulates Qi; if they experience the external evil, the disease is often characterized by severe illness, rapid progression, and rapid transmission, resulting in critical illness and even death. Pregnant women have a special physiological state, with a relative deficiency of Yin-blood and relative hyperactivity of Yang Qi. The growth of the fetus blocks the rise and fall mechanism of the Qi in pregnant women, which may lead to poor operation of Qi and blood. Therefore, the elderly, the infirm, children and pregnant women require close monitoring.

4. Treatment

Currently, there are no drugs specifically approved for COVID-19. In the treatment plan announced by the National Health Commission of the People’s Republic of China [21], Western medicine offers mainly symptomatic treatment support, including early oxygen therapy and the use of corticosteroids. The treatment plan comprises antiviral therapies, including interferon-α, ritonavir and ribavirin; however, the curative effect remains unsatisfactory.

Referring to the experience of TCM in the treatment of patients with SARS in 2003, Chinese medicine is now fully involved in the treatment of COVID-19 patients [21–39], utilizing the advantages of TCM syndrome differentiation and treatment, improving the cure rate, and reducing mortality (Table 1).

4.1. Treatment of patients with the disease

Currently, according to published data, COVID-19 clinically manifests as different stages of disease progression. TCM treatment requires syndrome differentiation and treatment based on the stages, which are defined as initial stage (mild), progressive stage (severe), extreme stage (extremely severe) and recovery stage (convalescent stage). The medicines’ sources and names in Chinese, Latin and English are presented in Table 2.

4.1.1. Initial stage

The damp toxin in the Shangjiao membrane should be treated for “damp-heat clearance to cure the lung,” including separating and dissipating the damp-heat, paying critical attention to the smooth release of lung Qi. Furthermore, it is crucial to closely monitor the potential of the toxin to enter the blood in order to resolve the dampness, eliminate the filth, promote the Qi mechanism, resolve blood stasis, and relieve the blood vessel networks, thereby following the principles of the Huopu Xialing Decoction and Sanren Decoction [14]. The combination prescription includes Guanghuxiang, Peilian, Banxia and Doukou for aromatizing, drying and regulating Qi; Xingren for promoting lung Qi; Fuling, Zexie, Huashi, Tongcao, Danzhu and Qiyin for relieving and removing dampness, or allowing the removal of dampness; and Mudanpi and Chishao for resolving blood stasis. The combination of these herbs can smoothen the Sanjiao Qi mechanism, dissipate and dissolve the dampness, resolve blood stasis, and dredge collaterals.

4.1.2. Progressive stage

Toxins causing dampness can increase the heat in the body; this dampness and heat can lead to infection of the lung and negatively affect the functioning of the lung. Hence, the treatment methods include elimination of dampness, transportation of aromatics to the lung, removal of Ying heat and subsequent cooling of the blood, and detoxification. This treatment strategy utilizes Lei’s aromatic turbid-resolving method and the Jiedu Huoxue Decoction combined with Shengjiang Powder [29], in which Guanghuxiang, Peilian and Banxia are fragrant and are used for removing dampness and invigorating the stomach and spleen; Chenpi is used for promoting Qi circulation; Dafupi and Houpu are combined to promote...
Table 1
Specific measures of syndrome differentiation and treatment by disease stages.

| Stage       | Symptoms and signs                              | Therapeutic principle                                                                 | Prescription                                                                 | Reference       |
|-------------|-------------------------------------------------|----------------------------------------------------------------------------------------|------------------------------------------------------------------------------|-----------------|
| Initial stage | Fever is the main symptom of the disease, with most hiding fever not accompanied by a cold. Other symptoms include sleepiness and discomfort, dry cough and less phlegm, thirst without the desire to drink, chest tightness and palpitation, occasional muscle aches, nasal congestion and runny nose, and loose stools. No sweat, no sthenic heat or irritable heat sensation, and no sore throat. The tongue is dark red, or its edge is red, the mottl is thin and white, and the pulse has no fixed point. | Eliminating the filth with aromatics, promoting Qi mechanism, separating and dissipating damp-heat, removing blood stasis, and freeing the network vessels | Modified Huopu Xialing Decoction and Sanren Decoction | [13,19,39] |
| Progressive stage | Include high fever, asthma and shortness of breath, difficulty in movement, aggravation of fatigue and tiredness, aggravation of cough, persistent dry cough or less phlegm, white or yellow, sticky cough, thirst without the desire to drink, cyanosis of lips and nails, or with delirium, increased palpitation, dizziness, indigestion, abdominal distention, loose stools or constipation, difficult urination, dark red tongue, greasy fur, and smooth pulse. | Eliminating dampness and dispersing the lung with aromatics, clearing Ying heat, cooling blood, and detoxifying | Lei’s aromatic turbid-resolving method and jiuedu Huoxue Decoction combined with Shengjiang Powder | [29,31–33,35,39] |
| Extreme stage | In the advanced stage, without proper treatment, the disease is further aggravated, with high fever, dyspnea, cyanosis of lips, dark complexion, extreme fatigue, restlessness, syncope, hot hands and feet or cold hands and feet, oliguria, dark red tongue, turbid or yellow greasy fur, and rapid and thinning pulse. It should be noted that some patients during this period may have a moderate or low fever or even no obvious fever. | Dispersing Qi of the lung, healing the body’s essence Qi and blood, detoxifying, and rescuing the inverse | Shenfu Sini Decoction, Angong Niuhuang Pill, Zhibao Dan, Zixue Dan, and Suhe Xiang Pill | [22–25, 28,39] |
| Recovery stage | The recovery period is mainly characterized by high fever that has subsided, mental improvement, low fever, fatigue, poor appetite, sticky stool, and other symptoms. Computed tomography shows absorption or fibrosis. The disease pathogenesis demonstrates that the damp toxin is eliminated, but the residual evil is still present, with deficient lung and spleen Qi. | Clearing the residual evil, promoting lung circulation, activating spleen and strengthening healthy Qi | Modified Xue’s Wuye Luogen Decoction | [14,16,20,21] |

4.1.3. Extreme stage

During the progressive stage, if the disease is not properly treated, the heat and dampness cause the lung to close, with the possibility of internal closure and external prolapse appearing. It is necessary to discuss treatment from the point of Qi and Yin, and treatment should be based on dispersing the Qi of the lung and fixing the body’s essence Qi, improving blood flow, enabling detoxification, and rescuing the inverse. Based on these principles, the Shensu Sini Decoction and three treasures (Angong Niuhuang Pill, Zhibao Dan, and Zixue Dan) or the Suhe Xiang Pill can be utilized [22]. In the Shensu Sini Decoction, Fuzi warms and strengthens the kidney Yang; Gancao can replenish the spleen and stomach to disperse cold, and help Yang to dredge the blood vessels; Suxhe can promote Qi, remove phlegm, and open the orifices to awaken the mind; and Longnian can also awaken the mind. Anxiixiang is capable of circulating the Qi and blood and removing the filth; Xiangfu is used to soothe the liver, regulate Qi, and relieve depression; Muxiang soothes Sanjiao; Tanxiang relieves Qi stagnation in the stomach; Chensheng can warm the middle energizer and descend Qi, and warm the kidney to control Qi; Ruxiang can improve blood circulation; Dingxiang and Bibo can warm the spleen and stomach, promoting Qi and reducing cold symptoms; Baihuo invigorates the spleen and transports dampness, and it can be used together with various aromatic herbs to remove dampness and turbidity of Sanjiao; Hezi is used to relieve pain, with its astrigency preventing all kinds of heat from consuming Qi; Zhusha can enhance heart detoxification and calm the mind; and Shuiniujiang can purify fire and remove toxins. Lastly, Angong Niuhuang Pill or Zixue Dan can be utilized when the heat is removed, and the Suhe Xiang Pill when Yin is closed.

4.1.4. Convalescent stage

This period is dominated by asthenia, with many changes necessitating individual syndrome differentiation and treatment. Some studies have emphasized that Xue’s Wuye Luogen Decoction can be used as reference to clear the residual evil and promote lung circulation, activate the spleen, and strengthen healthy Qi [14]. The five leaves in the formula float and bring the evil to the surface. Among them, Huoxiang leaf, Bohe, fresh lotus leaf and Peilan leaf are all fragrant and good at invigorating the spleen. Luogen and Dongguazi can be used for infiltration. The formula is light and nimble and can be used for dispersing, purging, and infiltration.

Additionally, it is necessary to pay attention to the following points. (1) Focus on removing dampness. The process of dampness removal is considered during diagnosis and treatment of the dis-
| Chinese name (pin yin) | Medicine source | Latin name | English name (common name) |
|------------------------|-----------------|------------|---------------------------|
| Anxixiang              | Styrax tonkinensis (Pierre) Crab ex Hart. | Benzoinum | Benzoin |
| Baishao                | Paeonia lactiflora Pall. | Paeoniae Radix Alba | White paeony root |
| Baizhu                 | Atractylodes macrocephala Koidz | Atractylodis Macrocephalae Rhizoma | Bighead atractylodes rhizome |
| Banxia                 | Pinellia ternata (Thunb.) Breit | Pinelliae Rhizoma | Pinellia ternata |
| Bibo                   | Piperis longi Fructus | Menthae Haplocalycis Herba | Wild mint herb |
| Bohe                   | Mentha haplocalyx Briq. | Atractylodis Rhizoma | Rhizoma atractylodes |
| Cangzhu                | Atractylodes lancea (Thunb.) DC. | Bupleuri Radix | Chinese throrowax root |
| Chaitui                | Bupleurum Chinese DC. | Cidacae Periostracum | Cidacae slough |
| Chao                   | Cryptoporpupa pustulata Fabricius | Cidacae Periostracum | Cidacae slough |
| Changqi                | Citrus reticulata Blanco | Tangerine peel | Tangerine peel |
| Chenshan               | Aquilaria sinensis (Lour.) Gilg. | Aquilariae Lignum Resinatum | Rosewood heart wood |
| Chishao                | Paeonia lactiflora Pall. | Paonae Radix Rubra | Red paeony root |
| Daofu                  | Arera catechu L. | Arecae Pericarpium | Shell of areca nut |
| Dahuang               | Rheum palmatum L. | Rhei Radix Et Rhizoma | Rhubarb root and rhizome |
| Daihuai               | Eacnsmccy imbricata | Bibo | |
| Danggui               | Angelica sinensis (Oliv.) Diels | Angelicae Sinensis Radix | Chinese angelica |
| Danshen               | Salviae miltiorrhiza Bge. | Salviae Miltiorrhizae Radix Et Rhizoma | Red sage root |
| Danzhuye              | Lophatherum gracile Brong. | Lophatheri Herba | Lophatherum gracile |
| Dazao                 | Zeiziphus jujubis Mill. | Jujubae Fructus | Chinese date |
| Dingxiang             | Egevlea caryophyllata Thunb. | Caryophylli Flos | Clove |
| Doudou                 | Amomum kravanth Pierre ex Gagnep. | Amomi Fructus Rotundus | Round cardamon |
| Dongguica             | Benincasa hispida (Thunb.) Cogn. | Benincasa hispida | Seed of Chinese waxgourd |
| Fangfeng               | Saposinikoviae divaricata (Turcz.) Schischk. | Saposinikoviae divaricata | Saposinikoviae divaricata |
| Fuling                | Poria cocos (Schw.) Wolf | Poria | Poria mushroom filament |
| Fuzi                   | Aconitum carmaichae Delb. | Aconiati Lateralis Radix Praeparativa | Monkshood |
| Gancao                | Glycyrrhiza uralesis Fisch. | Glycyrrhizae Radix Et Rhizoma | Liquorice root |
| Ganjiang              | Zingiber officinale Rose. | Zingiberis Rhizoma | Dried ginger |
| Gegen                 | Pueraria lobata (Wild.) Ohwi | Puerariae Lobatae Radix | Lobed kudzuvine root |
| Guizhi                | Pogostemon cablin (Blanco.) Benth | Pogostemonis Herba | Cablin potshkher herb |
| Hanhsuhsi             | Cinnamoan cassia Presl. | Cinnamomum cassia | Cinnamomum cassia |
| Heye                  | Nelumbo nuclera Gaertn. | Nelumbinis Folium | Lotus leaf |
| Hei                  | Terminalia chebula Retz. | Chebulacae Fructus | Medicine termalaia |
| Honghua               | Carthusus rootcariusius L. | Carthami Flos | Safflower carthamus |
| Houpo                 | Magnolia officinalis Rehd. et Wils. | Magnoliae Officinalis Cortex | Bark of magnolia |
| Hupo                  | Fossil resin | Sussicnic | Amber |
| Huanglian             | Coptis chinensis Franch. | Coptidis Rhizoma | Chinese goldthread |
| Huangqi              | Astragalus membranaceus (Fisch.) Bge. var. mongolicus (Bge.) Hsiao | Astragalai Radix | Milkvetch root |
| Huashi              | Magnesian minerals | Talcum | Talc |
| Jiangcan               | Bombyx mori Linnaeus. | Bombyx Batryticas | Stiff silkworm |
| Jianghuang            | Curcumae Longae Rhizoma | Curcumae Longae Rhizoma | Turmeric |
| Jinyinhua             | Aurum | Aurum | Aurum |
| Jinzhong              | Loniceria japonica Thunb. | Loniceriae Japonicae Flos | Wild honeysuckle flower |
| Lianqiao              | Glechoma longita (Nakai) Kupr. | Forsythiae Fructus | Weeping forsythia |
| Lingyangjiao          | Saiga tatarica Linneae | Saiga Tataricae Cornu | Antelope horn |
| Longnag               | Cinnamomun camphora (L.) Presl | Bornedourn | Synthetic borneod |
| Longli                | Phrhagmites communis Trin. | Phrhagmites Rhizoma | Reed root |
| Mangxiang             | Glauert's salt of family sulfates | Natrii Sulis | Mirabilite |
| Maidong               | Ophiopogon japonicus (L.) Ker-Gawl. | Ophiopogonis Radix | Dwarf lilputter tuber |
| Mudanpi               | Paeonia suffraticosa Andr. | Paeoniae Radix | Tree peony bark |
| Muxiang              | Aucklandiae Lappa Decne. | Aucklandiae Radix | Aucklandia lappa |
| Niuhuang              | Bos taxus domesticae Gmelin | Calculus Bovis | Bezmar |
| Peilang               | Eupatorium fortunei Turcz. | Eupatorii Herba | Eupatorii fortunei |
| Pipaie                | Eriothrya japonica (Thunb.) Lindl. | Eriothryae Folium | Loquat leaf |
| Rensheng              | Panax ginseng C. A. Mey. | Ginseng | Ginseng |
| Ruxiang               | Booswella carteri Birdw | Olibanum | Frankencense |
| Sangbqih              | Morus alba L. | Morus Foli | White mulberry root-bark |
| Sangye                | Morus alba L. | Morus Foli | Mulberry leaf |
| Sharen                 | Amomum villosum Lour. | Amomi Fructus | Villous amomum fruit |
| Shengdihuang           | Rehmannia glutinosa Lobisco. | Rehmanniae Radix | Rehmannia glutinoso |
| Shengjian             | Zingiber officinale Rosc. | Zingibers Rhizoma | Ginger |
| Shengma               | Cimicifuga heraclefolia Korn. | Cimicifugae Rhizoma | Larignostolious bugbane |
| Shexiang              | Moschus berezovski Flerov | Moschus | Forest musk abelnosk |
| Shigao                 | Gypsum | Gypsum | Gypsum |
| Shiniujiqo             | Bubulus bobilis Linnaeu | Bubuli Cornu | Buffalo horn |
| Shuexiand              | Liquidambar orientalis Mill | Styx | Styx |
| Tanxiang               | Santalum album L | Santalii Albi Lignum | Sandalwood |
| Taoren               | Prumus persica (L.) Barsch | Semeni Persica | Peach seed |
| Tongcao               | Tetrapanacis pappyer (Hook.) K. Koch | Tetrapanacis Medulla | Rice paper plant pith |
| Wuweizi               | Acanthopanax grclairlystus W. W. Smith | Schisandae Chenensis Fructus | Chinese magnolacaine fruit |

(continued on next page)
ease. Although the epidemic toxin is mainly characterized by toxic heat, dampness and turbidity, it is difficult to separate the heat and dampness characteristics from the initial stages of the infection to the end. It is also difficult to only get rid of heat without removal of dampness as well. Dampness is Yin evil, and it is unsuitable to use cold and cool drugs during the early stage; warm and tonic herbs in the later stage should also be used cautiously. Furthermore, it is permissible to use a combination of drugs to resolve dampness, dry dampness, and drain dampness during different stages. (2) Promoting blood circulation and resolving blood stasis. The patients should be treated with drugs for promoting blood circulation and resolving blood stasis immediately after the appearance of lung shadow. During COVID-19, the patients present high fever, sputum mixed with blood, dark purple-colored tongue, and consolidation or ground glass shadows in early lung images. Pathological reports indicated diffuse alveolar damage, hyperemia, hemorrhage, edema, and pulmonary interstitial inflammation, which are all manifestations of blood stasis. Therefore, during the different stages of treatment, it is necessary to combine products promoting blood circulation and eliminating blood stasis, dredging blood vessels, removing blood stasis, reducing alveolar damage, preventing pulmonary interstitial fibrosis, and reducing sequelae, which is conducive to the comprehensive rehabilitation of patients. Additionally, there are no specific Chinese medicine prescriptions for the elderly, pregnant women, children, and patients with underlying diseases. Hence, it is essential to study the signs and symptoms of COVID-19 cases to provide effective treatment.

4.2. Prevention of disease

TCM focuses on the idea of “prevention of disease,” advocating prevention before the disease occurs and prevention of change after disease. Therefore, those who have a history of exposure or have been in close contact with epidemic areas should be prioritized with the treatment principles, including stabilizing Qi and strengthening the exterior, removing heat, and detoxifying the body according to the composition of the prescription and climatic factors in different regions, to practice prevention before disease occurrence. In the cases of patients with chronic illness or those susceptible to infection, emphasis should be given to strengthening the vital energy, improving immunity, and using Yupingfeng Powder to invigorate Qi and solidify the exterior [26]. Individuals with underlying diseases can be treated regionally according to their diseases. According to TCM, after conception, the whole body's Yin-blood is gathered in Chong Meridian, Ren Meridian, and the uterus, placing the pregnant women in a special physiological state of a relative deficiency of Yin-blood and relative hyperactivity of Yang Qi. The growing fetus will block the rise and fall of Qi and blood, resulting in poor operation of Qi and blood. “It should be cool before pregnancy and warm after birth” is the general principle of regulation and stabilization in TCM before and after pregnancy. This can be adjusted and treated in advance to prevent the occurrence of disease, and the method of nourishing Yin and clearing heat, regulating the Qi mechanism, and calming the fetus is adopted. Young children are not full of Qi; their Yin and Yang are immature, and their viscera are delicate, especially, the lung, spleen, and kidney [26]. Hence, it is recommended to protect the Qi of the spleen and stomach in advance to nourish other organs, strengthen their physique, and resist the evil of epidemic disease, utilizing Sijunzi Decoction or Yupingfeng Powder to invigorate the Qi for consolidating superﬁcies [26]. According to TCM, different people have different physical characteristics, and hence, different treatment principles and medication plans should be generated based on their physical characteristics (Table 3). Based on the existing treatment schemes, the prescription composition and dosage recommended for prevention and treatment of COVID-19 during different stages are introduced in Table 4.

4.3. Evaluation of the curative effect

According to the description of discharge criteria in the Diagnosis and Treatment Protocol for COVID-19 (Trial Version 7) [40], the evaluation of COVID-19 should be based on body temperature (more than 3 days after returning to normal), obvious improvement of respiratory symptoms, and pulmonary imaging (obvious alleviation of inﬂammation). If the above symptoms and signs are relieved and the respiratory pathogen nucleic acid test is negative for two consecutive times (the sampling interval is at least 24 hours), patient can be considered to be cured.

However, we believe that the quantification of lung imaging related to the above efficacy evaluation index is insufficient. Hence, we suggest that the lung imaging of patients with COVID-19 should be comprehensively evaluated, based on the definition of the lung segment and the density criteria of high, medium and low grades, to better evaluate the treatment efficacy.

5. Prospect

The use of TCM adopts the holistic concept, combined with symptoms, signs and other corresponding manifestations, to examine the syndromes and seek the causes, to support the selection of drugs based on syndrome differentiation. Syndrome differentiation and treatment, as one of the characteristics and advantages of TCM, is very important in diagnosis and treatment. For example, in the treatment of COVID-19, the syndrome types differ among individuals in different regions, under different cli-
motic conditions, and for relatively different physiques. Syndrome differentiation should be clearly defined in combination with different factors and clinical syndrome characteristics. Prescriptions are mainly used to improve immunity, balance human Qi, blood, Yin and Yang, and recover organ function. According to the study of COVID-19 treatment herbs [41,42], Chinese herbal medicines with a higher probability to directly inhibit SARS-CoV-2 have been selected, including Lianqiao, Gancao, Sangbaipi, Jinyinhua, Sangye, Pipaye, and other herbs, commonly used to treat viral pneumonia. Drugs should be selected and utilized according to the corresponding syndrome types. Furthermore, with disease development, the drugs should be given the flexibility to deal with different syndrome types, and the whole process should be adjusted according to the principle of “three factors and measures,” undertaking multi-target treatment. TCM also plays a leading role during the recovery period and post-discharge convalescence. Currently, although some patients present a negative nucleic acid test accompanied by alleviated pneumonia and recovered body temperature, they may still demonstrate symptoms, including fatigue, shortness of breath, loss of appetite, and anxiety. Some patients may present pulmonary fibrosis due to poor absorption of pulmonary inflammation, which may affect the quality of life; additionally, some patients may suffer adverse reactions during drug therapy. It is crucial to resolve such related issues when TCM is involved. However, we do not advocate taking medicine without incident, and the preventive prescription is only a corresponding choice for people with an imbalance of Qi, blood, and Yin and Yang. When selecting the prescription, attention should be paid to the syndrome and symptoms, especially in special groups, such as children, pregnant women, and the elderly. Moreover, any special physique should be closely monitored when using medicines, and the improper use of interventions is not recommended; the overdose of cold or hot drugs should be avoided. Current research on Qingfei Paidu Decotion, a combination of prescriptions from the Treatise on Febrile and Miscellaneous Diseases written by Zhang Zhongjing in the Han Dynasty, has made progress in the special project documented by the National Administration of Traditional Chinese Medicine of China on screening effective prescriptions for the prevention and treatment of the novel coronavirus pneumonia [43]. As of February 5, four pilot provinces have used the Qingfei Paidu Decotion to

### Table 3

| Crowd type                  | Features                              | Therapeutic principle                                                                 | Prescription                      |
|-----------------------------|---------------------------------------|---------------------------------------------------------------------------------------|-----------------------------------|
| Contacts                    | Close contacts or healthy people returning from the epidemic area | Invigorate Qi for consolidating the exterior of the body, remove heat, and detoxify. | Yupingfeng Powder                |
| Children People with underlyinng diseases | Under 14 years of age High blood sugar High blood pressure | Invigorate Qi for consolidating superfiicies, and remove heat and detoxify. Remove heat and promote fluid retention in the body, and enrich Yin and consolidate superfiicies. Remove heat and nourish Yin, and calm the liver and consolidate superfiicies. Remove heat, detoxify blood, and promote blood circulation to alleviate blood stasis. | Yupingfeng Powder or Sijunzi Decotion Shengmai Drink |
| Coronary heart disease and cardio cerebrovascular diseases | | | |
| Women during pregnancy      | Pregnant women                        | Nourish Yin and remove heat, regulate Qi flow for soothing the fetus, and strengthen healthy Qi for consolidating superfiicies. | Yupingfeng Powder                |
| Normal adults               | Uninfected adults                     | Regulate Ying and Wei, invigorate Qi for consolidating superfiicies, invigorate Qi and nourish Yin, strengthen healthy Qi, remove heat and detoxify, and resolve dampness and exterior symptoms. | Guizhi Decotion, Yupingfeng Powder, Shenzhu Powder, or Huangqi Guizhi Wuwu Decotion |

### Table 4

| Stage                      | Prescription                          | Composition                                                                                     |
|----------------------------|---------------------------------------|-------------------------------------------------------------------------------------------------|
| Prevention                 | Yupingfeng Powder                     | Fangfeng 30 g, Huangqi 60 g, Baizhu 60 g                                                      |
|                            | Shengmai Drink                        | Renshen 9 g, Baizhu 9 g, Fuling 9 g, Gancao 6 g                                                |
|                            | Guizhi Decotion                       | Guizhi 9 g, Shengjiang 9 g, Dazao 9 g, honey-fried Gancao 6 g                                 |
|                            | Shenzhu Powder                        | Cangzhu 1000 g, Chenpi 1000 g, Houpi 1000 g, honey-fried Gancao 360 g, Guanghuoxiang 250 g, Sharen 120 g |
| Initial stage              | Huangqi Guizhi Wuwu Decotion          | Huangqi 15 g, Guizhi 12 g, Baishao 12 g, Shengjiang 25 g, Dazao 4 g                          |
|                            | Huo Pu Xiling Decotion and Sanren Decoction | Guanghuoxiang 6 g, Peilan 6 g, Banxia 9 g, Doukou 6 g, Xingren 9 g, Fuling 9 g, Zexie 6 g, Huashi 18 g, Tongcao 6 g, Danzhuyi 6 g, Yyiiren 12 g, Mudanpi 6 g, Chishao 6 g |
| Progressive stage          | Let’s aromatic turbid-resolving method | Guanghuoxiang 3 g, Peilan 3 g, Chenpi 6 g, Banxia 6 g, Dafu 3 g, Houpo 3 g, Heiye 9 g        |
| Extreme stage              | Jiedu Huoxue Decotion combined with Shengjiang Powder | Lianqiao 6 g, Gegen 6 g, Chaihu 9 g, Danggui 6 g, Shengdihuang 15 g, Chishao 9 g, Taoren 24 g, Honghua 15 g, Zhqiao 3 g, Gancao 6 g, Jiangcan (wine fried) 6 g, Chantui 3 g, Jianghuang 9 g, Dahuang (raw) 12 g |
|                            | Shenfu Sini Decoction                 | Honey-fried Gancao 12 g, Fuzi 10 g, Ganjiang 6 g, Renshen 15 g                              |
|                            | Angong Niu huang Pill                 | Niuhuang 30 g, Yujin 30 g, Shuninuijiao 30 g, Huangqi 30 g, Huanglian 30 g, Xionghuang 30 g, Zhizi 30 g, Zhusha 30 g, Longnua 7.5 g, Shexiang 7.5 g, Zhenzhu 15 g |
|                            | Zhibao Dan                            | Shuninuijiao 30 g, Danmao (raw scute) 30 g, Huo 30 g, Zhusha 30 g, Xionghuang 30 g, Niu huang 0.3 g, Longnua 0.3 g, She xiang 0.3 g, Anxiang 4.5 g, Jinyo 50 layers, Yituo 50 layers |
|                            | Zixue Dan                             | Shiqiao 1500 g, Hanshuishi 1500 g, Huashi 1500 g, Shuninuijiao 500 g, Lingyangle jiao crumbs 500 g, Muxiang 500 g, Chenxiang 500 g, Xuan shen 500 g, Shengma 500 g, Gancao 240 g, Mangxiao 5000 g, Xiaohui 930 g, She xiang 38 g, Zhusha 90 g, Jin bu 3000 g, Dingxiang 30 g |
| Recovery stage             | Xue’s Wuye Lu gen Decoction           | Suhe Xiang Pill Suhexiang 60 g, Baizhu 60 g, Muxiang 60 g, Shuninuijiao 60 g, Xiangfu 60 g, Zhusha 60 g, Hozhi 60 g, Tan xiang 60 g, Anxiang 60 g, Chenxiang 60 g, She xiang 60 g, Dingxiang 60 g, Bibo 60 g, Longnua 60 g, Ruxiang 60 g, Huoxiang leaf 6 g, Bohe leaf 1.8 g, fresh lotus leaf 3 g, Pipaye 15 g, Peilan leaf 4.5 g, Lugen 30 g, Dongguazi 15 g |
treat 214 confirmed cases, with a treatment course of 3 days, demonstrating a total efficacy rate exceeding 90%, among which over 60% of the patients showed significant improvement in symptoms and imaging manifestations, and 30% patients demonstrated stabilized symptoms without aggravation. Concurrently, Lianhua Qingwen Granule [44] is used in clinical treatment based on the principle of clearing away epidemic toxin, dispersing the lung, and expelling heat. Reportedly, it has been confirmed to significantly improve fever, cough, expectoration, and shortness of breath in confirmed cases of COVID-19. According to the feedback of clinical data, the efficacy of TCM in the clinical treatment of COVID-19 is great, and it still needs to be adjusted and improved with the clinical accumulation. In brief, the combination of Chinese and Western medicine can complement each other’s advantages, which can improve the comprehension of the core of the disease, and cooperate actively and effectively in clinical settings to enhance overall efficacy.

**Funding**

The study was not supported by any funding.

**Authors’ contributions**

WSX and LYB wrote the article; WY revised part of the article and made grammatical corrections; WXX provided research ideas; LJY reviewed the article and provided guidance; NM and SYJ collated the data.

**Conflicts of interest**

The authors declare that they have no conflict of interest.

**References**

[1] Tracking coronavirus: map, data and timeline. (2020-03-23) [2020-03-23]. https://nbc.ly/dx/m?ncsbh5/view= pneumonia [Chinese].

[2] Zhao RS, Yang YH, Yang L, Li ZJ, Liu F, Ren ZY, et al. Expert consensus on Holshue ML, DeBolt C, Lindquist S, Lofy KH, Wiesman J, Bruce H, et al. First case of 2019 novel coronavirus in the United States. N Engl J Med 2020;382(21):2014–23.

[3] Chao XQ, Liu Y, Wang Y, Song BY. Discussion on the application of febrile disease theory to the diagnosis and treatment of COVID-19. Zhong Yi Yi Zhi 2020;54(3):5–8 [Chinese with abstract in English].

[4] National Health Commission of the People’s Republic of China. Notice on issuing the diagnosis and treatment plan for pneumonia infected by novel coronavirus (trial four edition). (2020-01-29) [2020-02-01]. http://www.gov.cn/zhengce/zhengceku/2020-01/28/content_5472673.htm [Chinese].

[5] Beijin Municipal Administration of Traditional Chinese Medicine. Notice of Beijing Administration of Traditional Chinese Medicine on issuing the prevention and treatment plan for pneumonia infected by novel coronavirus in Beijing (trial second edition). (2020-01-24) [2020-02-02]. http://zyj.beijing.gov.cn/sy/tzgg/202001/nz2000130_16216103.html [Chinese].

[6] Tianjin Municipal Health Commission. Notice of Municipal Health Commission on issuing traditional Chinese medicine prevention and treatment plan for pneumonia infected by novel coronavirus in Tianjin (for trial implementation). (2020-01-29) [2020-02-02]. http://www.tjtm.gov.cn/www/system/2020/01/29/ 2020012910.shtml [Chinese].

[7] Guangdong Provincial Bureau of Traditional Chinese Medicine. Notice on issuing the traditional Chinese medicine treatment plan for pneumonia infected by novel coronavirus in Guangdong Province (trial first edition). (2020-01-25) [2020-02-01]. http://www.gdratcm.gov.cn/gdzcglw/content/post_2879085.html [Chinese].

[8] Hebei Provincial Health Commission. Notice on printing and issuing the diagnosis and treatment plan for pneumonia infected by novel coronavirus in Hebei Province (trial second edition). (2020-02-01) [2020-02-01]. http://www.hebwsj.gov.cn/index.do?templet=content&id=39623423&cid=43 [Chinese].

[9] Hunan Provincial Administration of Traditional Chinese Medicine. Notice on issuing the diagnosis and treatment plan of traditional Chinese medicine for pneumonia infected by novel coronavirus in Hunan Province (trial second edition). (2020-01-26) [2020-02-01]. http://tcm.hunan.gov.cn/tcm/jxqg/202001/r20200126_11164462.html [Chinese].

[10] Guanzhou Shuangzhong Autonomous Region Health Commission. Circular of the Autonomous Regional Bureau of Traditional Chinese Medicine on issuing the traditional Chinese medicine treatment plan for pneumonia infected by novel coronavirus in Guangdong Province (trial first edition). (2020-01-27) [2020-01-29]. 0125/037953ca2534d382b7a4e8125469.htm [Chinese].

[11] Zhong Guo Xun Zheng Yi Xue Za Zhi 2020;20(3):359–64 [Chinese with abstract in English].
for the prevention and treatment of pneumonia infected by novel coronavirus.
Zhong Yi Za Zhi 2020;61(4):277–80 [Chinese with abstract in English].

[40] General Office of the National Health Commission of the People's Republic of China. Diagnosis and treatment protocol for COVID-19 (trial version 7). (2020-03-03) [2020-03-23]. http://www.nhc.gov.cn/yzwj/s7653p/202003/46c9294a7dfe4cefb0dc7f5912eb1989.shtml [Chinese].

[41] Zhang DH, Wu KL, Zhang X, Deng SQ, Peng B. In silico screening of Chinese herbal medicines with the potential to directly inhibit 2019 novel coronavirus. J Integr Med 2020;18(2):152–8.

[42] Ling CQ. Traditional Chinese medicine is a resource for drug discovery against 2019 novel coronavirus (SARS-CoV-2). J Integr Med 2020;18(2):87–8.

[43] Wang RQ, Yang SJ, Xue CG, Shen QL, Li MQ, Lei X, et al. Clinical observation of Qingfeipaidu Decoction in the treatment of novel coronavirus pneumonia. Zhong Yao Yao Li Yu Lin Chuang 2020;36(1):13–8 [Chinese with abstract in English].

[44] Yao KT, Liu MY, Li X, Huang JH, Cai HB. Retrospective clinical analysis on treatment of coronavirus disease 2019 with traditional Chinese medicine Lianhua Qingwen. Zhongguo Shi Yan Fang Ji Xue Za Zhi 2020;26(11):8–12 [Chinese with abstract in English].