

Key to Treating COVID-19: Removing Phlegm from Small Airways

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Abstract

According to autopsy reports, patients who died from COVID-19 had a lot of mucus in the lung that obstructed the airways, reduced the effect of mechanical ventilation, and even led to pulmonary failure. Traditional Chinese medicine literature mentions that “Inability to remove phlegm impairs the lung, which leads to death.” Hence one of the most urgent problems to be solved is to remove phlegm from the small airways. This article elaborates ten methods to remove phlegm for clinical reference.

Keywords: Autopsy, COVID-19, methods to remove phlegm, traditional Chinese medicine (TCM)

AUTOPSY REPORTS: A LOT OF MUCUS IN THE LUNG

According to a report in the *Journal of Forensic Medicine* [Figure 1], a research team led by Liu Liang pointed out in *Gross Observation Report of Autopsy of Patients Dead from COVID-19* that “There were obvious lung injuries in the body. The lung looked patchy to the naked eyes, with pale foci and dark red bleeding. The plane of section showed a large amount of thick secretion overflowing from the alveoli since there was a lot of mucus in the lung, which caused inability of oxygen to enter the alveoli for air exchange and failure of oxygen therapy, ultimately leading to suffocation. It indicates that the novel coronavirus causes mainly inflammatory reactions characterized by damage to deep airways and alveoli” [Figures 2 and 3].^[1] Academician Zhong Nanshan also said that by comparing the pathological biopsy results of patients with SARS and those with COVID-19, the most significant difference was that there was a large amount of sticky mucus in bronchioles and alveoli of patients with COVID-19, which obstructed the airways. He believed that “The mucus may be one of the causes of death in critical patients. The mucus present in alveoli and bronchioles is very sticky and reduces the effect of mechanical ventilation. How to remove the mucus from small airways is a problem to be solved urgently.”

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SU WEN “PING RE BING LUN PIAN” (《素问·热病论篇》“DISCOURSE DELIBERATING UPON HEAT DISEASE”): INABILITY TO REMOVE PHEGGM CAUSES LUNG INJURY, WHICH LEADS TO DEATH

As regards “Laofeng disease (common cold due to overstrain),” it was discussed in *Basic Questions* “Discourse Deliberating upon Heat Disease” that “The patients may cough up bluish and yellowish sputum like pus and the size of a marble from the mouth or nose. If it is not coughed up, it impairs the lung. If the lung is impaired, the patients will die (咳出青黄涕，其



Figure 1: The report published in *Journal of Forensic Medicine*

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状如脓，大如弹丸，从口中若鼻中出，不出则伤肺，伤肺则死也。”^[2] It suggests that in pulmonary diseases, failure to remove phlegm timely may obstruct the airways and lead to suffocation and even death. It indicates that phlegm should be treated by making the best use of the disease condition, that is, giving the pathogens a way out, lest qi of the zang organs be damaged. In *Du Yi Sui Bi* (《读医随笔》 *Informal Essay about Medicine*) by Zhou Xuehai (周学海) in the Qing Dynasty, it was described that “In treatment of disease, it is better to give the pathogens a way out. For pathogens to leave the body through evacuation of the bowels, purgation methods should be used; for those to leave the body from the body surface, dispersion methods should be used.”^[3] In the treatment of COVID-19 with traditional Chinese medicine (TCM), removal of phlegm from the respiratory tract to give the pathogen a way out is an important link in improvement of unobstructed respiratory tract and repair of pulmonary injury and a key to therapeutic effect.

TEN METHODS TO REMOVE PHEGM IN TRADITIONAL CHINESE MEDICINE

Phlegm is a substance secreted by the stimulated respiratory tract and is composed of mucus, foreign matter, pathogenic microorganism, various inflammatory cells, and necrotic and exfoliated epithelial cells, etc. It is a product of inflammatory reactions in COVID-19, and how to remove it from the airways is a major problem to be solved quickly in treatment of the disease. According to TCM, “Phlegm is generated in the spleen, stored in the lung and rooted in the kidneys.” It was warned in *Jing Yue Quan Shu* (《景岳全书》 *Complete Works of Jingyue*) [Figure 4] that “Do not be hasty to treat phlegm the moment it is observed (见痰休治痰).”^[4] It does not mean that phlegm needs no treatment in phlegm diseases, but the source of phlegm should be identified before treatment so that “phlegm is generated no more” or all possible means

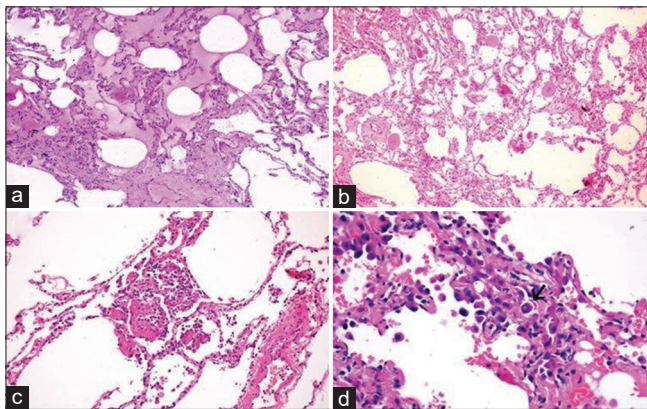


Figure 2: Pathological sections of the lungs of COVID-19 patients. Source: <https://www.meipian.cn/2vvhmvr1>. (a) The alveoli have a thick layer of gelatinous mucus. (b) The alveoli have a thick layer of gelatinous mucus. (c) After viral infection, there are congestion, edema of lung interstitium and inflammatory cell infiltration. (d) In severe condition of COVID-19, there is alveolar hemorrhage

should be tried to remove phlegm – the pathological product that has already been formed so that the respiratory tract is unobstructed again. The methods to remove phlegm are introduced as follows.

Ventilating the lung and resolving phlegm

The lung dominates qi and governs ascent and dispersion, purification and descent. In case of an attack of the lung by external pathogens, the lung qi fails to ascend, leading to clinical manifestations including cough, asthma, copious phlegm, chest tightness, and thin and white tongue coating. The method of ventilating the lung and resolving phlegm should be used for treatment. Recipes such as San Ao Decoction (三拗汤) and Tong Xuan Li Fei Pill (通宣理肺丸) can be used. Herbs including Ma Huang (麻黄 *Herba Ephedra*), Bei Xing Ren (北杏仁 *Armeniaca Semen Sctentrionale*), Jie Geng (桔梗 *Radix Platycodonis*), Zi Su (紫苏 *Caulis Perillae*), and Jin Fei Cao (金沸草 *Herba Inulae*) can be selected to diffuse the lung qi, together with Xiang Bei Mu (象贝母 *Fritillariae Verticillatae Bulbus*), processed Ban Xia (半夏 *Rhizoma Pinelliae*), and Qian Hu (前胡 *Radix Peucedani*) that resolve phlegm and relieve cough used as adjuvants. In *Yi Men Fa Lü* “Ke Sou” (《医门法律·咳嗽》 *Precepts for Physicians* “Cough”), it was written that “To treat cough due to exuberant pathogens, astringent drugs that stop coughing are forbidden and they can only be used for prolonged and weak coughing.”^[5]

Clearing the lung and resolving phlegm

When pathogenic heat invades the lung or high fever lasts for several days after pathogenic wind or cold attacks the lung, fluids are consumed, leading to yellow sticky phlegm.

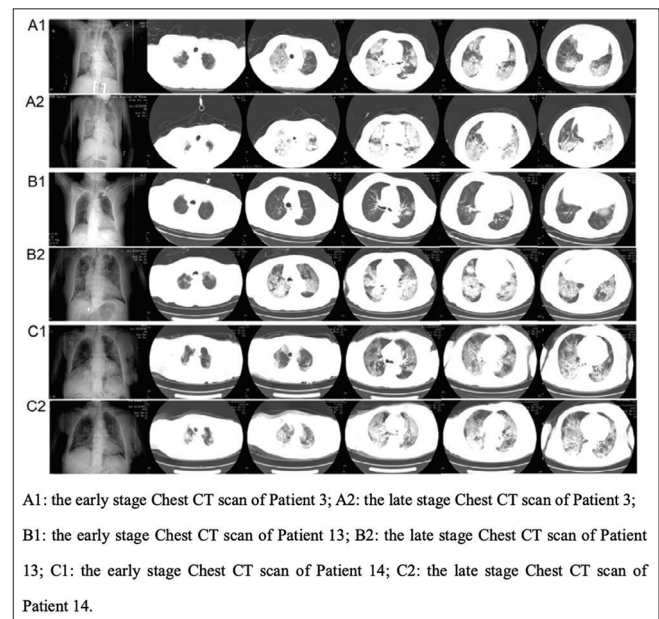


Figure 3: Chest computed tomography scans. Zuojiogong *et al.* Clinical characteristics of 25 death cases infected with COVID-19 pneumonia: a retrospective review of medical records in a single medical center, Wuhan, China. Available from: <https://www.sciencedirect.com/science/article/pii/S1201971220301867>

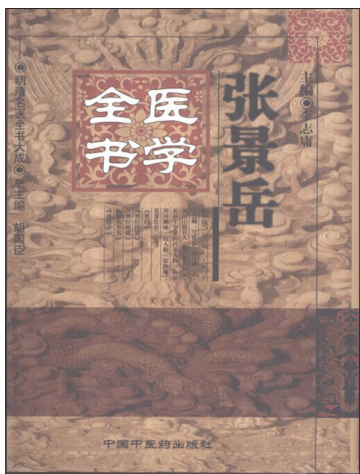


Figure 4: *Zhang Jingyue Yi Xue Quan Shu* 《张景岳医学全书》 *Zhang Jingyue's Complete Medical Book*

The patients complain of fear of heat and liking for cool drinks, with the symptoms of red tongue, slimy yellow tongue coating, and surging and forceful pulse. Herbs such as Huang Qin (黄芩 *Radix Scutellariae*), Yu Xing Cao (鱼腥草 *Herba Houttuyniae*), Kai Jin Suo (开金锁 *Fagopyri Cymosi Radix et Rhizoma*), Shan Zhi (山梔 *Gardeniae Fructus*), Sheng Shi Gao (生石膏 *Gypsum Crudum*), Xing Ren (杏仁 *Armeniacae Semen*), She Gan (射干 *Rhizoma Belamcandae*), Chuan Bei Mu (川贝母 *Bulbus Fritillariae Cirrhosae*), and Zhu Ru (竹茹 *Caulis Bambusae in Taenia*) can be selected. Bamboo sap can be used by nasal feeding or gavage. In *Yi Xue Ru Men* “Ke Sou” (《医学入门·咳嗽》 *Introduction to Medicine* “Cough”), it was written that “External contraction for a long time leads to depressed heat and prolonged internal damages lead to flaming fire. The treatment is to open depression and moisten dryness.”^[6]

Warming and resolving cold-phlegm

As pathogenic cold invades the lung, fluids in the lung coagulate into phlegm that is white and thin, and the tongue coating is thin white or slimy white. In *Jin Gui Yao Lue* “Tan Yin Pian” (《金匱要略·痰饮篇》 *Synopsis of the Golden Chamber* “Phlegm-Fluid Retention”), it was suggested that “For patients with phlegm-fluid retention, drugs warm in property can be used for harmonization (病痰饮者，当以温药和之).”^[7] In *Yi Bian* (《医编》 *Stepping Stone to Medicine*), it was written that “Cold-phlegm is ascribed to the kidney, and shows the symptoms of sunken pulse, dark complexion, cold feet, fear and flusteredness, glomus blockage, bone impediment and inability to move the limbs. Jiang Gui Pill (姜桂丸) and Ju Fang Hu Jiao Li Zhong Pill (局方胡椒理中丸) can be used for treatment. Gan Jiang (干姜 *Zingiberis Rhizoma Exsiccatum*) is indispensable, and Gui (桂 *Cinnamomi*), Ma Huang (麻黄 *Herba Ephedrae*) and Xi Xin (细辛 *Herba Asari*) are added for serious disease. Phlegm originates from water that is rooted in the kidney.”^[8] Modified Xiao Qing Long Decoction (小青龙汤) can be used. Herbal drugs such as Ma Huang (麻黄 *Herba Ephedrae*), Gui Zhi (桂枝 *Ramulus Cinnamomi*),

processed Ban Xia (半夏 *Rhizoma Pinelliae*), Gan Jiang (干姜 *Zingiberis Rhizoma Exsiccatum*), Xi Xin (细辛 *Herba Asari*), Xing Ren (杏仁 *Armeniacae Semen*), and Bai Jie Zi (白芥子 *Semen Sinapis Albae*) can be used with ginger juice for better effect.

Moistening the lung and resolving phlegm

As pathogenic dryness invades the lung or lung heat transforms into dryness, phlegm is thick and hard to cough up, often accompanied by hemoptysis. The patient complains of dry mouth, nose, and throat and shows thin yellow tongue coating. Then, Qing Zao Jiu Fei Decoction (清燥救肺汤) and Wu Zhi Decoction (五汁饮) can be used. Herbal drugs such as Xi Yang Shen (西洋参 *Radix Panacis Quinquefolii*), Nan Sha Shen (南沙参 *Radix Adenophorae*) or Bei Sha Shen (北沙参 *Radix Glehniae*), Tian Dong (天冬 *Radix Asparagi*), Mai Dong (麦冬 *Radix Ophiopogonis*), Bai He (百合 *Bulbus Lilii*), stir-fried Pi Pa Ye (枇杷叶 *Folium Eriobotryae*), Tian Hua Fen (天花粉 *Radix Trichosanthis*), Lu Gen (芦根 *Rhizoma Phragmitis*), Sheng Di (生地 *Radix Rehmanniae Recens*), Xian Shi Hu (鲜石斛 *Dendrobii Caulis Recens*), Chuan Bei (川贝 *Bulbus Fritillariae Cirrhosae*) powder, and Yu Zhu (玉竹 *Rhizoma Polygonati Odorati*) can be used with fresh fruit juice for good effect.

Softening hardness and dispersing phlegm

Lingering pathogens in the lung cause glue phlegm-qi, with the manifestations of thick phlegm that leads to difficulty to cough up, dry mouth, and tongue with scanty fluid. This is frequently observed in patients suffering from senile chronic bronchitis with lung and kidney deficiency. In *Su Wen* “Zang Qi Fa Shi Lun” (《素问·脏气法时论》 *Basic Questions* “Discourse on How the Qi in the Depots Follow the Pattern of the Seasons”), it was stated that “Since the heart needs to be softened, the treatment of heart disease requires immediate use of salty flavor to soften it (心欲软，急食咸以软之).”^[2] Drugs such as Zhe Bei Mu (浙贝母 *Bulbus Fritillariae Thunbergii*), Hai Zao (海藻 *Sargassum*), Kun Bu (昆布 *Thallus Laminariae*), Mu Li (牡蛎 *Concha Ostreae*), Hai Fu Shi (海浮石 *Pumex*), vinegar-soaked Bie Jia (鳖甲 *Carapax Trionycis*), Qing Meng Shi (青礞石 *Lapsi Chloriti*), and Sang Bai Pi (桑白皮 *Cortex Mori*) can be selected against that. Drugs salty in taste can soften hardness and resolve old and stubborn phlegm. Tian Hua Fen (天花粉 *Radix Trichosanthis*), Lu Gen (芦根 *Rhizoma Phragmitis*), Xian Shi Hu (鲜石斛 *Dendrobii Caulis Recens*), and Bai He (百合 *Bulbus Lilii*) that engender fluid can be used as adjuvant drugs to liquefy old phlegm and help expel phlegm.

Disinhibiting qi and resolving phlegm

Phlegm is tangible turbid matter and its movement is promoted by qi. According to TCM, “Phlegm must be resolved before cough can be treated and qi must be disinhibited before phlegm can be resolved (治咳先治痰，治痰先利气).” In *Yi Xue Zheng Zhuan* “Ke Sou” (《医学正传·咳嗽》 *Orthodox Lineage of Medicine* “Cough”), it was written that “To treat cough, phlegm should be resolved first, and to resolve phlegm, disinhibition of qi is held essential. Therefore, Nan Xing (南星 *Pinelliae Massa*)

Fermentata) and Ban Xia (半夏 *Rhizoma Pinelliae*) resolve phlegm and cough clears up of its own accord; Zhi Qiao (枳壳 *Fructus Aurantii*) and Ju Hong (橘红 *Citri Exocarpium Rubrum*) disinhibit qi and phlegm moves down by itself.^[9] Pang Anchang (庞安常), a medical scholar in Northern Song Dynasty said that “There should be no phlegm moving up in the human body as no water runs upward in nature. So, doctors good at resolving phlegm treat qi instead of phlegm. Once qi is disinhibited, fluids in the body can move smoothly in pace with qi. Half amount of drugs in Perilla Fruit Qi-Descending Decoction and of those in Phlegm-Abducting Decoction is decocted together. Or, Xiao Ban Xia Fu Ling Decoction (小半夏茯苓汤) Plus Zhi Shi (枳实 *Fructus Aurantii Immaturus*) and Mu Xiang (木香 *Radix Aucklandiae*) can be used.”^[10] Drugs such as processed Ban Xia (半夏 *Rhizoma Pinelliae*), Hua Ju Hong (化橘红 *Exocarpium Citri Grandis*), and Xiang Bei Mu (象贝母 *Fritillariae Verticillatae Bulbus*) can be selected, and drugs including Su Zi (苏子 *Fructus Perillae*), Lai Fu Zi (莱菔子 *Semen Raphani*), Hou Po (厚朴 *Cortex Magnoliae Officinalis*), Zhi Qiao (枳壳 *Fructus Aurantii*), and Mu Xiang (木香 *Radix Aucklandiae*) can be added accordingly.

Dispelling wind and clearing up phlegm

As pathogenic wind invades the lung, the patient coughs with thin white sputum, which then becomes yellowish thick phlegm, and shows fear of wind, as well as white at the beginning and then thin yellowish tongue coating. Modified Xing Su Decoction (杏苏饮加减) can be used. Drugs such as Xing Ren (杏仁 *Armeniaca Semen*), Su Ye (苏叶 *Folium Perillae*), Jing Jie (荆芥 *Herba Schizonepetae*), Qian Hu (前胡 *Radix Peucedani*), Jie Geng (桔梗 *Radix Platycodonis*), and Bai Qian (白前 *Rhizoma Cynanchi Stauntonii*) can be selected. As regards deepgoing and stubborn pathogens, it was described in *Stepping Stone to Medicine* that “Wind phlegm is ascribed to the liver and has the manifestations of string-like pulse, bluish complexion, stuffy pain and numbness of the limbs, constipation, depressed anger in the heart, or even paralysis, convulsion and vertigo.”^[8] Drugs such as processed Nan Xing (南星 *Pinelliae Massa Fermentata*), processed Ban Xia (半夏 *Rhizoma Pinelliae*), Tian Ma (天麻 *Rhizoma Gastrodiae*), Tian Zhu Huang (天竺黄 *Concretio Silicea Bambusae*), Ya Zao (牙皂 *Gleditsiae Fructus Parvus*), Jiang Can (僵蚕 *Bombyx Batryticatus*), and Qin Jiao (秦艽 *Radix Gentianae Macrophyllae*) can be selected, together with the adjuvants including Wu Yao (乌药 *Radix Linderae*), Zhi Qiao (枳壳 *Fructus Aurantii*), and Jiang Zhi (姜汁 *Zingiberis Rhizomatis Succus*).

Clearing intestines and draining phlegm

There is an interior–exterior relationship between the lung and large intestine. The lung govern ascent and dispersion, purification and descent. Qi of the Fu organs runs smoothly because of purification and descent of lung qi. Phlegm-heat brewing internally leads to failure of lung qi to descend, resulting in deteriorated syndromes. Xuan Bai Cheng Qi Decoction (宣白承气汤) in *Wen Bing Tiao Bian* (《温病条辨》 *Systematized Identification of Warm Diseases*) can be

used. Drugs such as raw Shi Gao (生石膏 *Gypsum Crudum*), raw Da Huang (大黄 *Radix et Rhizoma Rhei*), Xing Ren (杏仁 *Armeniaca Semen*), and skin of Gua Lou (瓜蒌 *Fructus Trichosanthis*) can be selected, added with Huang Qin (黄芩 *Radix Scutellariae*), Sang Bai Pi (桑白皮 *Cortex Mori*), Hou Po (厚朴 *Cortex Magnoliae Officinalis*), Zhi Shi (枳实 *Fructus Aurantii Immaturus*), Ma Ren (麻仁 *Cannabis Semen*), Xiang Bei Mu (象贝母 *Fritillariae Verticillatae Bulbus*), and so on to clear the lung and arrest panting, relieve constipation, and purge phlegm-heat. It was reported that in Shanghai, varied Qi-Infusing Decoction for enema was used to treat COVID-19 patients with heat binding in Yangming and good efficacy has been obtained.

Invigorating the spleen and moving phlegm

Invasion of the lung and spleen by pathogenic dampness or improper diet that causes irregular transportation and transformation leads to internal generation of phlegm dampness. The manifestations include white watery sputum, which is copious and easy to cough up, as well as body heaviness, fatigue or loose stool, and thin white or slimy white tongue coating. It was written in *Stepping Stone to Medicine* that “Damp phlegm is ascribed to the spleen, and the manifestations include slow pulse, sallow complexion, limb heaviness, fatigue, weakness, somnolence, abdominal distension, indigestion, diarrhea, or lumps and numbness. White Atractylodes Pill can be used. Drugs like Bai Zhu (白术 *Rhizoma Atractylodis Macrocephalae*), Cang Zhu (苍术 *Rhizoma Atractylodes Rhizome*), Nan Xing (南星 *Pinelliae Massa Fermentata*), Ban Xia (半夏 *Rhizoma Pinelliae*), Fu Ling (茯苓 *Poria*) and Ze Xie (泽泻 *Rhizoma Alismatis*) can be selected.”^[8] Er Chen Decoction (二陈汤) and Ping Wei Powder (平胃散) can be taken. Herbal drugs such as Dang Shen (党参 *Radix Codonopsis*), Cang Zhu (苍术 *Rhizoma Atractylodes Rhizome*), Bai Zhu (白术 *Rhizoma Atractylodis Macrocephalae*), Ban Xia (半夏 *Rhizoma Pinelliae*), Ju Pi (橘皮 *Citri Exocarpium*), Fu Ling (茯苓 *Poria*), Yi Yi Ren (薏苡仁 *Semen Coicis*), and honey-fried Gan Cao (蜜制甘草 *Radix Glycyrrhizae*) can be selected.

Tonifying qi and dispelling phlegm

The lung governs qi and has the functions of ascent and dispersion, purification and descent. Phlegm is a product of inflammation when the lung is attacked by pathogenic qi. Qi is invisible and phlegm is visible. That phlegm can be coughed up is depended on ascent and dispersion, purification and descent of lung qi, and when lung qi is weak, phlegm is difficult to be removed. Patients with chronic obstructive pulmonary disease and old patients with COVID-19 are commonly seen clinically and they have root (ben 本) deficiency and branch (biao 表) excess. Therapeutic effect is poor when phlegm is resolved only for treatment and qi must be tonified simultaneously. Herbs such as Tai Zi Shen (太子参 *Radix Pseudostellariae*), Dang Shen (党参 *Radix Codonopsis*), Huang Qi (黄芪 *Radix Astragali seu Hedysari*), Fu Ling (茯苓 *Poria*), and Gan Cao (甘草 *Radix Glycyrrhizae*) can be used, and Chen Pi (陈皮 *Pericarpium Citri Reticulatae*), Ban Xia (半夏 *Rhizoma Pinelliae*), Bei Mu (贝母 *Bulbus Fritillariae*), and processed Nan Xing (南星 *Pinelliae Massa Fermentata*) can be used

to resolve phlegm. Many years ago, I treated a patient with senile chronic bronchitis, who was short of breath the moment he moved and could not cough up phlegm. Both Chinese and Western medicines were used with poor efficacy. Then, 6 g of powder of sundried Shen (参 *Ginseng Radix*) and 6 g of powder of Chuan Bei Mu (川贝母 *Bulbus Fritillariae Cirrhosae*) were taken by the patient with warm water. Three days later, there was no difficulty to remove phlegm and no shortness of breath was observed. The method of banking up earth to generate metal was used for rehabilitation.

In addition, for patients with difficulty to remove phlegm, back-patting can be performed to help dispel phlegm. The patient lies prone like a frog, the caregiver or paramedic pats gently on his/her back bottom-up, then the patient coughs, and phlegm is often easy to be removed. The patient is instructed to drink a lot of water so that thick secretion is diluted and coughed up, which is helpful for relieving cough and dispelling phlegm, and throat is moisturized and physically treated, which promotes resolution of local inflammation. Besides, the steam method can also be used. Boiling water is poured into a jar with a big opening or a teacup, and the patient turns his or her nose and mouth toward the rising steam and absorbs it so that phlegm is thinned and easy to be coughed up, congestion and edema of tracheal and bronchial mucosa can thus be relieved, and cough can be reduced.

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There are no conflicts of interest.

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