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Progress in diagnosis and treatment in elderly patients with tuberculosis obstructive pulmonary disease

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Abstract:

The obstructive pulmonary disease tuberculosis B (tuberculosis obstructive pulmonary called TOPD disease) in elderly patients with tuberculosis is a common and early prevention and treatment, the latter to irreversible persistent airflow limitation and accompanied by chronic airway inflammation, progressive misdiagnosed, TOPD patients are mostly male, 52% for nonsmokers, the incidence characteristics of TOPD has two kinds of disease, TOPD patients than in COPD patients more susceptible to hemoptysis, and its FVC value and lower FEV1/FEV value; and TOPD for the poor response to bronchodilator, airflow limitation in patients with TOPD irreversible airway resistance increased, accompanied by stronger airflow limitation; TOPD patients are not associated with airflow limitation were more susceptible to acute exacerbation. The diagnosis should be based on the history of high risk factors, clinical symptoms and signs, laboratory tests, and other comprehensive analysis and diagnosis of the data. AIDU

Keywords : Ba elderly; Tuberculosis; Obstructive pulmonary disease; Diagnosis; Drug therapy; Combination

Chronic obstructive pulmonary disease (COPD) is a chronic airway inflammatory disease that can be prevented and treated in the early stage and characterized by progressive aggravation with incomplete reversible continuous airflow restriction in the late stage. It is ranking the third in the mortality rate globally. Its high incidence rate and mortality has caused a serious burden on society and families. The risk factors of COPD is heterogeneous. Recent studies showed that in addition to cigarette smoking, tuberculosis is also an important risk factor for COPD, [1]. Tuberculosis (TB) associated obstructive pulmonary disease was proposed as a potential COPD endotypes besides biomass- associated obstructive pulmonary disease, and is worthy of more attention especially in low income and middle income countries [1][2,3.]

Pulmonary TB is a respiratory infectious disease that seriously endangers people's health and is listed as one of the major infectious diseases. As one of the countries with TB high burden, the annual incidence of tuberculosis in China is about 1.3 million, accounting for 14.3% of the global incidence, ranking the second in the world. China has become one of 22 tuberculosis countries in the world and 27 MDR tuberculosis countries in the world [2]. COPD patients are susceptible to Mycobacterium tuberculosis infection. Previous studies have found that pulmonary TB can lead to chronic airflow restriction, especially in developing countries with high incidence of TB. With the increasingly serious aging of society, there are more and more patients with TOPD caused by pulmonary TB, especially elderly pulmonary tuberculosis, resulting in higher and higher disability rate and mortality rate of adults, especially elderly patients, which needs to be paid enough attention to by clinical and society.

1. TOPD risk factor

Chronic airflow obstructive disease after tuberculosis infection may be associated with the following risk factors:

1. smoking: it has been confirmed that smoking is the most important risk factor for COPD. At the same time, smoking more than 10 cigarettes a day will double the incidence of tuberculosis compared with those who do not smoke or quit smoking [2].

2. high incidence of elderly tuberculosis patients: China is a country with high burden of tuberculosis, with a population infection rate of 14% ~ 42%. Elderly tuberculosis patients have decreased immune function and lung function, and are more prone to TOPD. A recent study also confirmed that tuberculosis is strongly correlated with chronic obstructive pulmonary disease and is a risk factor independent of smoking [3].

A study involving 8066 patients showed that 24.2% of patients had previous (inactive) tuberculosis focus on chest radiograph, and the overall prevalence of airflow obstruction was 6.5%, higher than those without previous pulmonary tuberculosis focus, suggesting that previous pulmonary tuberculosis was related to airflow obstruction[4].

A cross-sectional survey conducted by the researchers in the Tibet Autonomous Region of China showed that the average age of 84 patients diagnosed with COPD was 64.7 ($\pm$ 9.1) years. All patients lived at an altitude $\geqslant$ 3000 meters. About 8.3% of the patients were current smokers and 44.0% were former smokers. About 88.1% of the patients reported long-term exposure to indoor biomass fuel. 45.1% of the patients had a history of pulmonary tuberculosis. This suggests that indoor biomass fuel exposure and previous tuberculosis history are both risk factors for COPD at high altitude[5].

In addition, smoking has always been considered as the primary pathogenic factor leading to the high incidence of COPD. The smoking rate in China has always been high, and the prevalence of tuberculosis is also high. If the two are mixed and crossed, it may further increase the incidence of COPD.

3. pollution exposure of biomass fuels: biomass fuels generally refer to agricultural and forestry wastes (such as straw, sawdust, bagasse, rice bran, etc.), which are mainly different from fossil fuels. Biomass pollution is an independent factor in the incidence of tuberculosis [1]. In developing countries, biomass fuel pollution exposure is the most important factor unrelated to smoking. Worldwide, patients exposed to biomass fuel pollution are more likely to cause COPD than smokers [1]. For example, it is typical for Chinese residents to use biofuels to heat or cook food. Some studies in India, Nepal and Brazil have shown that biofuels are an independent risk factor for TB infection [2]. Misra et al. [1] found that the risk of active tuberculosis was 3.56 times higher in people who mainly cooked with biofuels. Especially in countries where biofuels are widely used for cooking or heating.

4. low social and economic status: social and economic status is a composite measure of all indicators, including economic income, education, occupation, housing conditions, living location and population congestion index. Low socio-economic status is a common risk factor for COPD and tuberculosis [2], which will reduce the quality of life and health status of TB infected patients, and easily aggravate the disease to develop into TOPD.

5. vitamin D deficiency: vitamin D not only plays an important role in the body's immune system to resist Mycobacterium tuberculosis through natural immunity and adaptive immunity, but also plays an important role in the incidence, pathology, development, deterioration and skeletal muscle comorbidity of COPD. It is a common risk factor for COPD and tuberculosis [2].

6. complicated with diabetes: the incidence of TOPD in patients with tuberculosis infection complicated with diabetes is more than three times that in patients without tuberculosis infection, and the incidence of TOPD in patients with insulin-dependent diabetes is higher [1]. If the blood glucose of patients with diabetes is not well controlled, they are prone to the failure of anti tuberculosis drug treatment [1].

2. Pathogenesis of stable stage of TOPD

Tuberculosis is caused by the colonization and growth of Mycobacterium tuberculosis in multiple tissues and organs. The incidence rate of COPD after tuberculosis infection is higher than that in the general population, especially in the middle-aged and elderly population. Tuberculosis and COPD can promote each other in the course of disease, and their pathogenic mechanisms are as follows:

1. decreased immunity: Patients with tuberculosis infection, especially middle-aged and elderly patients, often suffer from upper respiratory tract infection due to the decreased body immunity and the obvious decrease in the number of T lymphocytes, resulting in the destruction and adhesion of bronchial ciliary cells. The bronchial mucosa is often in a chronic inflammatory reaction, reducing the cleaning and protection of the respiratory tract and the resistance to various pathogenic microorganisms, Highly susceptible to Mycobacterium tuberculosis → increase the secretion of matrix metalloproteinases → destruction of

extracellular matrix → chronic airway obstruction, tuberculosis related obstructive pulmonary disease [7].

2. chronic inflammation: Patients with chronic bronchitis suffer from chronic inflammation, hyperemia and edema of bronchial mucosa for a long time, resulting in low functions of lymphocytes, monocyte macrophages and lymphatic reticular endothelial system. They are very easy to be infected by Mycobacterium tuberculosis and suffer from bronchoscopic nodules. Further progress of the disease can lead to small airway obstruction [7].

3. long term application of glucocorticoids: because of its good anti-inflammatory effect, glucocorticoids are often used in the treatment of COPD patients, but it also has anti immune effect, which can reduce the immune response of the body and is prone to tuberculosis infection. As above, if COPD patients who have suffered from tuberculosis infection fail to check tuberculosis in time, long-term use of glucocorticoids will aggravate the condition of patients with tuberculosis infection.

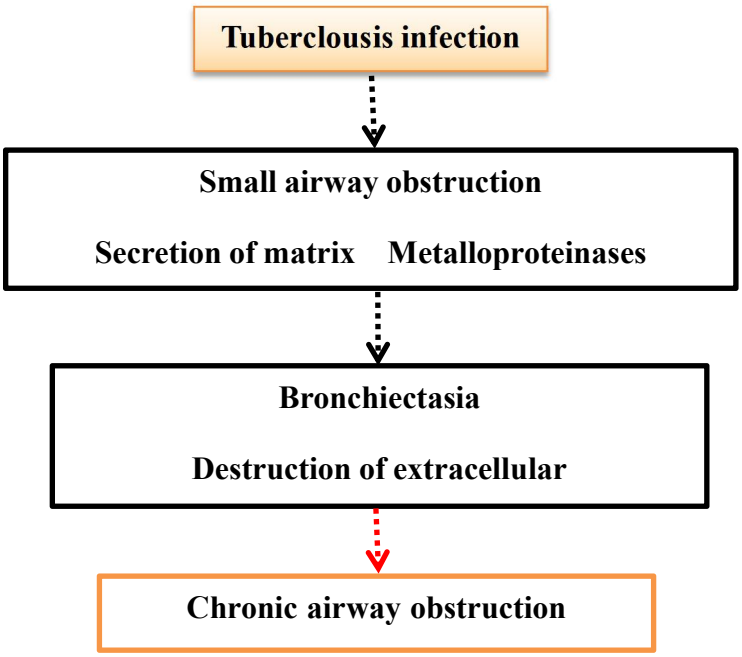
4. patients with previous tuberculosis infection: Patients with a history of tuberculosis in their childhood may be cured at last, but the focus of old tuberculosis may be in a dormant state. With the decline of immunity of individuals, especially elderly patients, and the decline of functions of various organs, the dormant Mycobacterium tuberculosis may recover to form a new infection focus, which may cause tuberculous bronchiectasis and further develop into chronic airway obstruction [7]

5. complicated with other infections: at the initial stage of tuberculosis infection, patients often cough and expectorate, often complicated with other respiratory tract pathogenic bacteria infection, and often similar to the symptoms, signs and imaging diagnosis of patients with tuberculosis infection. Therefore, the initial symptoms of tuberculosis are often confused with other pathogenic bacteria infection, and there is a certain misdiagnosis rate and missed diagnosis rate [6], which leads to the delay of the disease and is very prone to TOPD.

6. lung volume damage: pulmonary tuberculosis is a chronic disease. After the treatment of pulmonary tuberculosis, there is residual pulmonary function and fibrosis in the lung. With the continuous contraction of fibrin secondary to pulmonary tuberculosis, the positive lung volume is easy to be damaged and reduced, resulting in the decline of hemoglobin oxygenation function in the lung. At the same time, the continuous contraction of fibrin will

correspondingly pull the normal lung tissue into pulmonary bullae or abnormal lung tissue, Complicated airway obstruction will further aggravate COPD and further worsen TOPD[8].

Mechanism of COPD secondary to tuberculosis infection:



3. TOPD causes of misdiagnosis and missed diagnosis

1. iatrogenic causes: (1) not paying attention to tuberculosis: doctors in general hospitals do not have enough knowledge of tuberculosis, do not actively carry out relevant examinations, and even repeatedly use broad-spectrum antibiotics or glucocorticoids to some COPD patients before TB infected patients are diagnosed in time, which exacerbates the deterioration of tuberculosis. When clinical symptoms of COPD occur, they often fail to consider the possibility of TOPD; At the same time, TOPD originally had all the clinical symptoms of COPD, and there were no obvious symptoms of systemic tuberculosis poisoning [9], but the causes were different. It was easy for clinicians to ignore the etiological diagnosis, resulting in delayed diagnosis and anti tuberculosis medication. (2) Despise the X-ray examination of tuberculosis: the clinician did not read the film in person or did not have enough experience in reading the film, and made a conclusion easily only based on the diagnosis of radiology department. The chest X-ray findings of TOPD patients are often atypical, which can be tuberculosis of the lower lobe of the lung; CT scan sometimes shows nodular and mass lesions, lobar and segmental shadows, and hilar and mediastinal masses, which are often misdiagnosed

as lung cancer and pneumonia [10-12]. When bronchial tuberculosis or pulmonary tuberculosis leads to TOPD, X-ray film shows congestion, swelling and stenosis of the entire lumen on both sides; However, the inflammatory infiltration caused by simple bronchial tuberculosis or pulmonary tuberculosis has different microscopic manifestations, only local lesions, but this feature has not attracted enough attention of doctors. (3) Improper treatment: before TB infected patients are diagnosed in time, fluoroquinolones or aminoglycosides are used for anti infection treatment. In addition to killing other bacteria, these drugs also have a certain killing or inhibiting effect on Mycobacterium tuberculosis, resulting in the patient's condition alleviating within a certain period of time and mistaking the treatment as effective.

2. the reference value of laboratory examination decreases: 1、 the positive rate of tuberculin test (PPD test) is low: when the body's immunity decreases, especially in middle-aged and elderly patients with pulmonary tuberculosis, the sensitivity to Mycobacterium tuberculosis also decreases, and the test results are mostly negative or weakly positive, so it is difficult to obtain auxiliary diagnostic value. It should be considered that the patient's cellular immune function decreases or the body's immune response is inhibited due to severe infection; 2、 The positive rate of anti tuberculosis antibody is low: it is often seen in some severe pulmonary tuberculosis or complicated with diabetes and other basic diseases and elderly patients with pulmonary tuberculosis [12].

3. Diagnostic methods of TOPD

TOPD itself has the characteristics of two kinds of diseases. It follows the diagnostic principles of two kinds of diseases, but the focus is still on the diagnosis of etiology.

（1）Standardized medical history collection

Ask for detailed medical history, smoking history (including passive smoking history), past history and treatment of tuberculosis, whether there is a history of close contact with patients with tuberculosis, whether there is a history of long-term glucocorticoid use and diabetes. Park et al. [13] believed that most of the patients with TOPD were male, and 52% were non-smokers.

（2）Raise the vigilance of TOPD caused by tuberculosis

Because most respiratory diseases have no obvious characteristics, it is not easy to detect tuberculosis early by clinical symptoms alone. Therefore, for COPD patients with chronic

recurrent cough, phlegm and asthma, especially elderly patients, if they have moderate to high fever, anorexia, hemoptysis, low fever, sweating theft and weight loss, they should actively consider the possibility of TOPD. Moreover, TOPD patients are usually younger, and hemoptysis is more common than COPD, Lee et al. [14] found that TOPD patients were more prone to hemoptysis than general COPD patients; Kim et al. [16] believe that TOPD patients with airflow restriction are more likely to develop into acute exacerbation than general tuberculosis patients without airflow restriction.

（3）Laboratory examination

1）. routine blood test: it is characterized by increased white blood cells, increased erythrocyte sedimentation rate (ESR) and hypoproteinemia.

2）. attach importance to sputum specimen examination: routine acid fast staining examination of sputum smear should be carried out on the basis of anti infection. At least 3 sputum smears and 1 rapid culture of Mycobacterium tuberculosis in sputum should be carried out to assist in diagnosis. Guide patients to correctly leave sputum, especially the elderly patients, try to get deep sputum and submit it for examination in time, not only pay attention to morning sputum samples, but also do timely sputum examination as soon as possible. ① Acid fast staining of sputum smear of Mycobacterium tuberculosis: this method is the most widely used in the diagnosis of tuberculosis and is often used to evaluate the therapeutic effect. However, in the early stage of tuberculosis or when the sputum excretion of patients is low, the total physical examination rate of sputum smear method is not high, so the early diagnosis effect of tuberculosis is not good. ② Mycobacterium tuberculosis culture method: it is the gold standard for the diagnosis of pulmonary tuberculosis. However, this method takes a long time and has a low detection rate, which is easy to lead to missed diagnosis, misdiagnosis or delayed diagnosis and treatment. ③Histopathological examination: usually invasive examination with high risk (pneumothorax, hemorrhage and other complications are easy to occur).

3）. serum immunological diagnostic methods for tuberculosis: ①tuberculin skin test (PPD): Although PPD is the most widely used screening method for tuberculosis, which is simple and cheap, it can not distinguish the post BCG immune response, non tuberculous Mycobacterium infection and new tuberculosis, so it is prone to false positive results. And the experimental

results are easily affected by the immune function of the body. If the body is in the state of immunosuppression or takes some immunosuppressants for a long time, false negative results will appear. ②T-spot.tb: it is a new technique for diagnosing tuberculosis infection. It has high sensitivity and is not affected by BCG vaccination and immune status of the body, but it can not distinguish between active tuberculosis and old tuberculosis. The body regards the invading Mycobacterium tuberculosis as an antigen and activates T lymphocytes through immune reaction to produce γ - Interferon, tested γ - The release of interferon and the number of sensitized T cells indirectly reflect the infection of tuberculosis. ③TB antibody determination (protein chip method): the detection is simple and rapid, with high sensitivity and specificity and low detection cost. It is a new technology widely used in recent years. The combined detection of 5 TB antibodies against Lam (loop mediated isothermal amplification technology) 38 kD, 16 KD, (molecular weight 38K, 16K regulator), CFP10 (culture filtrate protein 10), ESAT-6 (recombinant antigen of Mycobacterium tuberculosis) has high diagnostic value, It is consistent with the "gold standard" diagnosis [15]. ④ Adenosine deaminase (ADA) examination: Ada is a nucleic acid metabolic enzyme related to the cellular immune activity of the body. It widely exists in various tissues of the human body, with the highest content in cecum, mesentery, spleen and thymus. The main isoenzymes are Adal and Ada2. Ada2 increases in tuberculous pleural effusion, while Adal increases in other bacterial empyema. At present, ada>45u / L in pleural effusion is regarded as the limit value for diagnosis of tuberculous in China, but the ratio of ADA in pleural effusion to ADA in serum is of great significance [16]

4. Imaging examination:

1.chest radiography:

Early stage: chest X-ray examination of TOPD patients is helpful to determine the degree of pulmonary hyperinflation, determine pulmonary complications and distinguish them from other diseases (such as pulmonary interstitial fibrosis, tuberculosis, etc.). The chest X-ray findings were complex and varied, showing multiple shapes, segments and foci. Specifically, it can be divided into the following types: ① pneumonia type: flaky shadow, uneven density, unclear boundary, with bronchial air shadow and nodule calcification shadow; ② Mass type:

lumpy shadow, clear boundary, calcification and small cavity in it, satellite focus or fibrous cord around it, and atelectasis of lung lobe; ③ Cavitary type: thick walled or thin-walled, with regular cavities, mostly without liquid level, and a strip-shaped drainage bronchus can be seen inside; ④ Bronchial dissemination type: segment, leaf spot, patch shadow; No significant changes were found in other lung stages. Middle and late stage: ⑤ others: increased lung markings, fibrous cord calcium spot shadow, reticular nodule shadow, honeycomb like changes, etc. There will be non characteristic changes such as increased and disordered lung markings, which are mainly manifested as over inflation of the lung, increased lung volume, increased chest anteroposterior diameter, flattened rib trend, increased lung field transparency, low and flat diaphragm position, long and narrow heart suspension, residual root like pulmonary portal vascular texture, thin and sparse peripheral pulmonary vascular texture, and sometimes the formation of pulmonary bullae. When complicated with pulmonary hypertension and pulmonary heart disease, in addition to the enlargement of the right heart, there are also the enlargement of the pulmonary artery cone, the enlargement of the hilar vascular shadow and the widening of the right lower pulmonary artery [15].

2.active chest CT scan and pay attention to dynamic monitoring: when there are abnormal high-density uneven shadows such as patches, clouds and flocs in atypical parts of tuberculosis, especially with pleural lesions, cavities and calcifications, tuberculosis should be excluded; Enough attention should be paid to the changes of one or both upper lung fields, except tuberculosis; Tuberculosis should be excluded when one or both middle and lower lung fields are affected, especially when the anti infective treatment is not improved; Localized emphysema and bullae, especially those with exudation and hyperplasia around, should be excluded from tuberculosis; Fibrous streak shadow should not be blindly considered as old tuberculosis shadow. If there is no regular chemotherapy or no treatment, we should be alert to the possibility of tuberculosis activity and pay attention to the dynamic monitoring of imaging changes. If there are indications, CT guided percutaneous lung biopsy is feasible. In the differential diagnosis, high-resolution chest CT scanning (HRCT) has high sensitivity and specificity in distinguishing centrilobular or whole lobular emphysema and determining the size and number of pulmonary bullae.

3.Pulmonary function test

The necessary condition for the diagnosis of COPD is the presence of incompletely reversible airflow restriction, and pulmonary function examination is an objective index to judge airflow restriction. It has good repeatability and is of great significance for the diagnosis, severity, disease progression, prognosis and treatment response of COPD. Any patient with dyspnea, chronic cough or expectoration and a history of exposure to risk factors should consider the diagnosis of COPD clinically. (1) Fev1forced expiratory volume in one second and FEV1 / FVC (forced vital capacity): FEV1 / FVC is a sensitive index to detect airflow restriction. The reduction of FEV1 and FEV1 / FVC can determine airflow restriction. After inhaling bronchodilator, fev1/fvc ＜ 70% can confirm the continuous existence of airflow restriction, and the percentage of FEV1 in the predicted value is a good indicator of moderate and severe airflow restriction. It has small variability and is easy to operate. It should be used as a basic item of pulmonary function examination for COPD, and its FVC value and fev1/fev value are lower when TOPD occurs [14], which can be used as a reference indicator of airflow restriction. However, the correlation between PEF (peak expiratory flow) and FEV1 in COPD is not strong enough, and PEF may underestimate the degree of airflow obstruction. (3) Airflow restriction can lead to over inflation of the lungs, increase total lung volume (TLC), functional residual volume (FRC) and residual volume (RV), and decrease vital capacity (VC). The increase of total lung volume was less than that of residual volume, so residual volume / total lung volume increased. (6) The destruction of alveolar septum and the loss of pulmonary capillary bed can damage the diffusion function, reduce the diffusion volume of carbon monoxide (DLCO), and the ratio of DLCO to alveolar ventilation (VA) (DLCO / VA) is more sensitive than DLCO alone. (7) Deep inspiratory volume (IC) is the sum of tidal volume and supplemental inspiratory volume. IC / TLC is an indicator of lung hyperinflation. It has significance in reflecting the degree of dyspnea and even the survival rate of COPD. (6) Bronchodilation test: it can not predict the progress of the disease. The results of bronchodilation test may be different for patients at different times. Even if FEV1 improved less after treatment, the response of patients to treatment could not be reliably predicted. And the response of TOPD to bronchodilators is poor, which indicates that the irreversibility of airway restriction is increased and airway resistance is stronger in patients with TOPD. However, in some patients, such as children with atypical asthma history, cough and wheezing at night, it has certain significance [17].

4.Tracheoscopy

Routine smear examination of acid fast bacilli of tuberculosis in sputum is negative, and tracheoscopy should be actively done. Because TOPD is more common in elderly patients, and the characteristics of bronchoscopic examination of elderly pulmonary tuberculosis are different from those of young adults. Most of them are male than female. Type III pulmonary tuberculosis is mainly found on both sides, with a wide range of lesions and caseous necrosis, often forming bronchial dissemination; Cavities are easy to occur, and the number of cavities is multiple; There are many complications. When caused by bronchial tuberculosis, it is mainly inflammatory infiltration type, accompanied by extensive lumen stenosis [18]

5. Treatment of stable stage of TOPD

1. strengthen understanding and early diagnosis: special attention should be paid to elderly patients with diabetes, history of glucocorticoid or other immunosuppressive agents and malnutrition.

2. Selection of anti tuberculosis drugs: the anti tuberculosis treatment of TOPD patients should still follow the principle of "early, combined, appropriate, regular and whole course". The main drugs include isoniazid, rifampicin, rifapentine, ethambutol, pyrazinamide, etc. Due to the large number of retreated patients, there are also many drug-resistant patients. Attention should be paid to multi drug resistant tuberculosis. Its diagnosis depends on the results of drug sensitivity test (referred to as "drug sensitivity test"). Before the report is issued, the scheduled treatment plan can be selected according to the previous medication history, and then adjusted after the results come out.

3. use of bronchodilators: bronchodilators are the main treatment for controlling COPD symptoms. Short term on-demand application can alleviate symptoms, long-term regular application can prevent and reduce symptoms and increase exercise endurance. Compared with oral administration, inhalants have less adverse reactions and are the first choice of treatment. The main bronchodilators are β 2 receptor agonists, anticholinergic drugs and methylxanthines. A variety of factors can cause acute exacerbation of TOPD. Bronchoconstriction is part of the cause of airflow restriction and is also the fastest reversible factor. Therefore, bronchodilators play an important role in the treatment of acute exacerbation

of TOPD. However, it should be noted that patients with cardiovascular contraindications should be cautious with β Inhaled preparations of receptor agonists. The blood routine and liver and kidney functions of elderly patients should be checked before treatment. During the course of treatment, the changes of liver and kidney functions should be closely observed and tested regularly (once every half a month in the first month, and once every month or every other month thereafter). In case of serious adverse drug reactions, the scheme shall be adjusted in time, relevant drugs shall be stopped, and symptomatic treatment shall be carried out for adverse reactions [21]. In addition, most COPD patients use aminophylline, rifampicin can cause liver enzyme damage and reduce the half-life of theophylline, and fluoroquinolones can increase the plasma concentration of theophylline. Therefore, TOPD patients should pay attention to adjusting theophylline dose to prevent poisoning or reduced efficacy [23-24].

4. anti inflammatory treatment: inflammatory mechanism is the core link of COPD, so anti-inflammatory treatment is the first choice, but the dosage should be strictly controlled and the impact on tuberculosis should be paid attention to. Application of glucocorticoids: if patients with COPD need glucocorticoids, they should mainly use inhaled glucocorticoids. If they really need oral or intravenous use, they should strictly master the indications. The course of treatment should be short (generally within 2 weeks) to avoid the spread of tuberculosis infection [25-26].

5. other symptomatic treatment: symptomatic treatment of antitussive and expectorant drugs, antioxidants, immunomodulators, etc. [19-20]. Active anti infection, bronchodilation, expectorant treatment and oxygen inhalation treatment, at the same time, nutritional support, maintain water and electrolyte balance [21-22], strengthen nutrition, correct anemia and hypoproteinemia, and apply immune enhancers to improve the immune function of the body.

6. correct various complications, such as blood glucose control in patients with diabetes, treatment of heart failure in patients with heart disease, etc.

7. respiratory rehabilitation: respiratory rehabilitation can improve dyspnea, quality of life, and exercise tolerance of patients with stable chronic obstructive pulmonary disease (class a evidence) [27] learn body relaxation techniques, controlled oxygen therapy breathing, functional exercise gymnastics, daily living ability training, respiratory muscle function training (balloon blowing, candle blowing, water bottle blowing, table tennis blowing,

respiratory function exerciser, correct sputum excretion (body position sputum excretion and turning over and clapping back sputum excretion) Ultrasonic concussion expectoration, diaphragm pacemaker, skeletal muscle function exercise (upper limb muscle and lower limb muscle exercise); Correct application of bronchodilators, aerosols, various drugs, glucocorticoids, and noninvasive mechanical ventilation (NIPPV); Scientific assessment of cardiopulmonary motor function, hyperbaric oxygen therapy, music oxygen therapy, spa and psychotherapy.

8. prevent patients from stopping medication by themselves: due to poor pulmonary function, difficult medical treatment, difficult follow-up and long medication time, TOPD patients are easy to stop medication by themselves; In addition, due to the patient's low immunity and long-term malnutrition, it is easy to cause tuberculosis recurrence and sputum bacteria positive conversion [16], Gu should strengthen supervision and follow-up closely.

In conclusion, for the diagnosis and treatment of tuberculosis, we should not only face the problems related to the diagnosis, treatment and management of tuberculosis in the active period, but also study the interaction between other pulmonary diseases related to tuberculosis (such as chronic obstructive pulmonary disease). The diagnosis and treatment of tuberculosis is facing great challenges and needs more attention.

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