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Original Article

A comparative study of the differences in the imaging characteristics of pulmonary tuberculosis patients with different ages and courses

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Abstract: Objective: To explore the differences in the imaging characteristics of pulmonary tuberculosis (PTB) patients with different ages and courses of the disease. Methods: A total of 90 PTB patients diagnosed in our hospital were recruited as the study cohort and were examined using x-rays and CT scans respectively. Based on the differences in their ages and courses of the disease, the subjects were grouped into the elderly group (n = 40), the young group (n = 50), the simple PTB group (n = 60), and the other disease complications group (n = 30). The differences in the lesion sites, the lesion ranges, the lesion types, and the imaging characteristics were compared among the different groups of PTB patients. Results: Compared with the young group, the elderly group had a wider range of lesions and more types of lesions ($P < 0.05$). The ratio of lesions involving two or more lobes in the other disease complications group was significantly higher than it was in the simple PTB group, and the disease severity was more significant ($P < 0.05$). Conclusion: Compared with the patients in the young group, the PTB patients in the elderly group had a wider range of lesions, generally had lesions occurring in the bilateral lungs, and were more likely to develop cavitary pulmonary tuberculosis (CPTB). Compared with the simple PTB patients, the PTB patients suffering from other diseases were more prone to nodular, caseous, and cavitary lesions and had a wider range of lesions involved, larger diameters of cavities and nodules, a higher occurrence of pleural effusion, and a higher probability of contracting bronchiectasis.

Keywords: Different ages, disease course, pulmonary tuberculosis, imaging characteristics, difference

Introduction

Pulmonary tuberculosis (PTB) is a chronic infectious disease caused by the invasion of *Mycobacterium tuberculosis* in the body. *Mycobacterium tuberculosis* can invade other organs and cause dysfunction of the body. The typical clinical symptoms of PTB are low fever, night sweats, emaciation, fatigue, chest pain, and hemoptysis. Some patients with advanced pulmonary tuberculosis (APTB) may also exhibit the collapse of pleura or mediastinal displacement due to pulmonary fibrosis. According to epidemiological statistics, there were about 9 million PTB patients worldwide in 2013, of which about 1.5 million PTB patients died. In 2013, there were about 1 million PTB patients in China, of which about 40,000 PTB patients were died. Additionally, the number of deaths in China ranked second in the world, and PTB and PTB deaths ranked the top three in the incidence and the number of deaths of Class A and B infectious diseases respectively in China [1-3].

Early diagnosis and timely treatment significantly improve the prognoses of PTB patients. If early detection and timely and appropriate treatment are performed, most PTB patients can be cured clinically. Currently, imaging examinations, including x-rays and CT scans, are commonly used in the clinical diagnosis and differentiation of PTB. Some empirical studies suggest that there are certain differences in the imaging characteristics of PTB patients with different ages and courses of the disease [4, 5]. A survey of 100 PTB patients showed that compared with PTB patients under

60 years old, PTB patients over 60 years old were more likely to have extensive involvement in their bilateral lungs, experience multiple signs appearing at the same time, and reveal complex and diverse manifestations that can be easily confused with other diseases, indicating that differentiation should be carefully carried out during the diagnosis and treatment [6]. Some studies found that the lesion segments of elderly PTB patients are evenly distributed, with a high incidence of patchy shadows, which suggests that the targeted regimen should be formulated accordingly [7]. The objective of this study was to explore and analyze the differences in the imaging characteristics of PTB patients with different ages and courses, so as to provide a clinical basis for the treatment of PTB patients.

Materials and methods

General data

A total of 90 PTB patients diagnosed in our hospital from January 2019 to January 2020 were recruited as the study cohort and were examined using x-rays and CT scans. Based on the differences in their ages and the courses of the disease, the subjects were placed into the elderly group (n = 40), the young group (n = 50), the simple PTB group (n = 60), or the other disease complications group (n = 30).

Inclusion criteria: (1) Patients who met the criteria for combined diseases referred to in *Diagnostic Criteria for Tuberculosis* [8] and who showed the corresponding clinical symptoms [6], (2) Patients who had a clear consciousness and could cooperate with the investigation, (3) Patients with an education level of primary school or above, (4) Patients and their families who had a clear understanding of the investigation process, methods, and principles, and who signed the informed consent form. The investigation was approved by the Ethics Committee of the Second Affiliated Hospital of Hainan Medical University.

Exclusion criteria: (1) Patients also suffering from mental disorders, (2) Patients with complications from other organic diseases, such as coronary heart disease and renal failure, (3) Patients with complications from consciousness disorders, (4) Patients with complications from autoimmune diseases, and (5) Patients who recently received hormone drugs or immunosuppressants.

Intervention methods

The enrolled patients were examined using CT plain scans. The instrument selected was a Philips Brilliance 64-slice spiral CT machine. The scanning parameters were set, namely, voltage: 120 KV, current: 250 mAs, pitch: 1.0, layer thickness: 0.8 mm and reconstruction layer thickness: 5 mm. After we did a conventional plain scan, an enhanced scan was performed. Iohexol was selected as the enhancer drug, and it was injected intravenously from the back of the patient's hand or via an elbow vein, with an injection dosage of 80 ml and an injection speed of 2.5 ml/s. The enhancement degree of the lesions was observed about 60 s after the injection and recorded. All the subjects were examined by the same physician.

Observation indices and assessment criteria

The subjects' lesion sites, lesion ranges, lesion types, and lesion morphologies were observed. When comparisons were performed between groups, 90 of the PTB patients enrolled in the study were placed into an elderly group (≥ 60 years old, 40 cases) or a young group (< 60 years old, 50 cases) according to their age. The imaging characteristics of the PTB patients of different ages were compared. Next, the 90 PTB patients were divided into a simple PTB group (60 cases) and a group with complications from other diseases (complications from AIDS, diabetes, etc., 30 cases) based on whether they only had PTB or not, and the imaging characteristics of the PTB patients with different disease courses were compared.

Statistical methods

The data collected were input into SPSS 20.0 for the statistical analysis. The measurement data were expressed as ($\bar{x} \pm s$), and the differences between groups were determined using Student's t tests. The enumeration data were expressed as [n (%)], and the differences between groups were expressed using Chi-square tests. $P < 0.05$ indicated a statistically significant difference [9].

Results

Comparison of the general clinical data of the patients in the different groups

The differences in the general clinical data of the patients in the different groups, such as gender, mean weight, education level, and marital status, had no statistical significance ($P > 0.05$), so the groups were comparable (**Table 1**).

Analysis of the lesion sites and the lesion ranges of the PTB patients of different ages

The ratio (75.00%) of lesions involving two or more lobes in the elderly group was significantly higher than it was (6.00%) in the young group ($P < 0.05$). The ratio (70.00%) of lesions involving the posterior tip of the upper lobe and the posterior segment of the lower lobe in the elderly group was markedly higher than it was (16.00%) in the young group ($P < 0.05$). The ratio (37.50%) of lesions involving the anterior and lingual segments in the elderly group was notably higher than it was (6.00%) in the young group ($P < 0.05$) (**Table 2**).

Analysis of the differences in the lesion types of the PTB patients of different ages

The occurrence rate (25.00%) of cavitary lesions in the elderly group was significantly higher than it was (0.00%) in the young group ($P < 0.05$), and the ratio (12.50%) of high-density shadows of consistency on one side in the elderly group was markedly higher than it was (0.00%) in the young group ($P < 0.05$) (**Figure 1**; **Table 3**).

Comparison of the lesion morphologies of the PTB patients of different ages

The ratio (56.00%) of the plaques in the lesion morphologies in the elderly group was remarkably higher than it was (20.00%) in the young group ($P < 0.05$). The ratio (17.50%) of cavity walls ≥ 3 cm in the elderly group was significantly higher than it was (0.00%) in the young group ($P < 0.05$). The ratio (48.00%) of multiple enlargement of the mediastinal lymph nodes in the elderly group was markedly higher than it was (10.00%) in the young group ($P < 0.05$). However, the ratio (80.00%) of cords in the elderly group was lower than it was (90.00%) in the young group ($P < 0.05$). The ratio (8.00%) of mediastinal lymph nodes without enlargement in the elderly group was remarkably lower than it was (42.00%) in the young group ($P < 0.05$) (**Table 4**).

Comparison of the lesion sites and lesion ranges of the PTB patients with different disease courses

The ratio (76.67%) of the lesion ranges involving two or more lobes of the PTB patients with complications from other diseases in the other disease complications group was much higher than it was (16.67%) in the simple PTB group ($P < 0.05$). There was no significant difference in the lesion ranges involving others between the simple PTB group and the other disease complications group ($P > 0.05$) (**Table 5**).

Comparison of differences in the lesion types of the PTB patients with different disease courses

The occurrence rate (13.33%) of nodular shadows in the other disease complications group was remarkably higher than it was (0.00%) in the simple PTB group ($P < 0.05$). The occurrence rate (33.33%) of cavities in the other disease complications group was significantly higher than it was (3.33%) in the simple PTB group ($P < 0.05$). The incidence rate (13.33%) of fluid planes in the cavities in the other disease complications group was notably higher than it was (1.67%) in the simple PTB group ($P < 0.05$). The incidence rate (23.22%) of pleural effusion in the other disease complications group was higher than it was (8.33%) in the simple PTB group ($P < 0.05$). The ratio (13.33%) of high-density shadows of consistency on one side in the other disease complications group was higher than it was (1.67%) in the simple PTB group ($P < 0.05$) (**Figure 2**; **Table 6**).

Lesion morphologies of the PTB patients with different disease courses

The ratio (26.67%) of caseous lesions in the other disease complications group was remarkably higher than it was (5.55%) in the simple PTB group ($P < 0.05$). The incidence rate (50.00%) of consolidation in the other disease complications group was significantly higher than it was (16.67%) in the simple PTB group ($P < 0.05$). The ratio (23.33%) of the nodules

Table 1. Comparison of the general clinical data of the patients in the different groups ($\bar{x} \pm s$)/[n (%)]

General clinical data		Elderly group (n = 40)	Young group (n = 50)	t/X^2	P	Simple PTB group (n = 60)	Group of complication by other diseases (n = 30)	t/X^2	P
Gender	M	20	24	0.036	0.85	30	14	0.089	0.766
	F	20	26			30	16		
Mean weight (kg)		60.29±2.32	59.98±2.45	0.611	0.543	60.12±2.21	60.21±2.22	0.182	0.856
Mean BMI (kg/m^2)		20.39±1.20	19.98±2.21	1.055	0.294	20.11±1.22	20.21±1.31	0.358	0.721
Degree of education	Illiteracy	2	6	0.334	0.781	9	2	0.267	0.981
	Primary school	10	9			11	5		
	Junior high school	15	23			25	13		
	High school and above	13	12			15	10		
Marital status	Married	35	43	0.043	0.835	50	28	1.731	0.188
	Not married	5	7			10	2		
Hypertension	Yes	8	5	0.827	0.363	7	6	1.124	0.289
	No	32	35			53	24		
Diabetes	Yes	4	5	0.125	0.723	6	4	0.225	0.635
	No	36	35			54	26		
Working environment	With dust	4	4	0.0	1.0	7	1	1.715	0.19
	Without dust	36	36			53	29		

Table 2. Analysis of the lesion sites and lesion ranges of the PTB patients of different ages [n (%)]

Group	n	Two or more lobes	Posterior tip of upper lobe and posterior segment of lower lobe	Middle lobe	Basal segment of lower lobe	Anterior and lingual segments
Elderly group	40	30 (75.00)	28 (70.00)	11 (27.5)	7 (17.5)	15 (37.5)
Young group	50	3 (6.00)	8 (16.00)	20 (40.00)	21 (42.00)	3 (6.00)
X^2	-	45.56	27.00	1.538	6.224	13.781
P	-	< 0.001	< 0.001	0.215	0.013	< 0.001

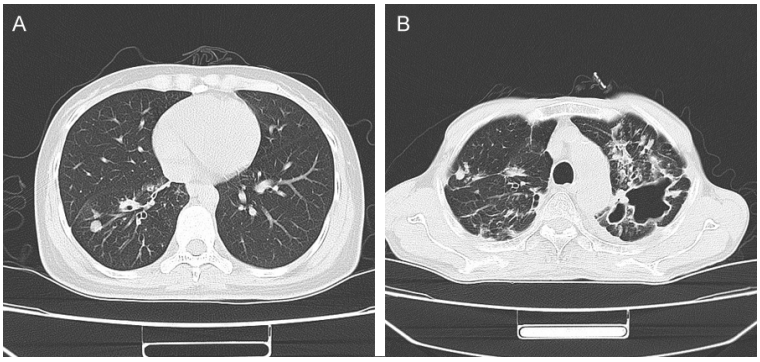

Figure 1. Comparison of the imaging characteristics of PTB patients of different ages. A. In the young group, the cavities, the high-density shadows of consistency on one side, and the liquid plane in the cavity are not significant. B. In the elderly group, the cavities, the high-density shadows of consistency on one side, and the liquid plane in the cavity are remarkable.

with a diameter > 3 cm in the other disease complications group was significantly higher than it was (3.33%) in the simple PTB group (*P* < 0.05). The ratio (23.33%) of cavity walls ≥ 3 cm in the other disease complications group was remarkably higher than it was (0.00%) in the simple PTB group (P < 0.05). The ratio (76.67%) of bronchiectasis in the other disease complications group was notably higher than it was (51.67%) in the simple PTB group (*P* < 0.05). The incidence rate (30.00%) of pleural effusion in the other disease complications group was markedly higher than it was (5.00%) in the simple PTB group (*P* < 0.05). The ratio of mediastinal lymph nodes without enlargement in the other disease complications group was higher than it was in the simple PTB group (*P* < 0.05) (**Table 7**).

Discussion

PTB is a chronic infectious disease mainly transmitted through the respiratory tract due to *Mycobacterium tuberculosis* infection, and it is one of the major infectious diseases seriously threatening human health. There are about 2 billion people infected with tuberculosis globally, with 15 million active tuberculosis patients and 10 million new tuberculosis patients every year, and about 1.8 million people die of tuberculosis every year [10, 11]. Currently, China is one of the 22 countries with the highest tuberculosis burdens globally, and it is also one of the 27 countries with the highest burden of multidrug-resistant tuberculosis (MDR-TB) globally. An epidemiological study showed that there were about one million PTB patients in China in 2013, accounting for 14% of the PTB patients worldwide and ranking second globally in the number of PTB patients. In recent years, although the number of PTB patients is generally declining in China, the proportion of MDR-TB infections and concurrent tuberculosis infections has been on the rise, seriously affecting the normal life of Chinese residents and becoming a public health concern and the focus of social concern [12-14].

There are multiple clinical diagnostic options for PTB. The option can be selected according to the etiology, clinical manifestations, laboratory and imaging examinations. With the continuous development and improvement of radiation technologies over the years, imaging technology plays an increasingly prominent role in the diagnosis and treatment of PTB [15, 16]. Compared with laboratory examinations, imaging examinations have a higher sensitivity and a stronger repeatability and reveal more prominent signs of PTB infection, with the results less affected by individual factors. These factors have made great contributions to the extensive implementation of imaging in clinical diagnosis [17, 18]. According to the results of an imaging test carried out on 89 PTB patients, it is easy to misdiagnose PTB only based on the clinical symptoms, as PTB is similar to the

Table 3. Analysis of the differences in the lesion types of PTB patients of different ages [n (%)]

Imaging signs	Elderly group (n = 40)		Young group (n = 50)		X^2	*P*
	n	Ratio	n	Ratio		
Cloud flocculent shadow	16	40.00	26	52.00	0.911	0.34
Nodular shadow	3	7.50	1	2.00	1.583	0.208
Spherical or lumpy shadow	1	2.50	0	0.00	1.264	0.261
Cavity	10	25.00	3	6.00	6.492	0.011
Cord-like and stellate shadows	4	10.00	2	4.00	1.286	0.257
Enlargement of mediastinal lymph nodes	1	2.50	3	6.00	0.641	0.423
Liquid planes in cavities	4	10.00	1	2.00	2.711	0.1
Pleural effusion	8	20.00	4	8.00	2.769	0.096
High-density shadows of consistency on one side	5	12.50	0	0.00	6.618	0.01

Table 4. Comparison of the lesion morphologies of the PTB patients of different ages

Site		Elderly group (n = 40)		Young group (n = 50)		X^2	*P*
		n	Ratio	n	Ratio		
Caseous		4	10.00	7	14.00	0.331	0.565
Consolidation		10	20.00	15	30.00	0.277	0.599
Patch		28	56.00	10	20.00	22.773	< 0.001
Nodule	Diameter > 3 cm	3	6.00	6	12.00	0.5	0.48
	Diameter ≤ 3 cm	36	72.00	41	82.00	1.151	0.283
Cavity	Cavity wall < 3 cm	2	5.00	2	4.00	0.052	0.819
	Cavity wall ≥ 3 cm	7	17.50	0	0.00	9.488	0.002
	Nodule of wall	1	2.50	1	2.00	0.026	0.873
Cord		40	80.00	45	90.00	4.235	0.04
calcification		33	66.00	40	80.00	0.091	0.763
Bronchiectasis		24	48.00	30	60.00	0.0	1.0
Pleural thickening	Significant thickening	18	45.00	15	30.00	2.153	0.142
	Slight thickening	22	55.00	35	70.00	2.153	0.142
hydrothorax		8	16.00	4	8.00	2.769	0.096
Mediastinal lymph nodes	Unilateral enlargement	12	24.00	24	48.00	3.0	0.083
	Multiple enlargement	24	48.00	5	10.00	25.438	< 0.001
	Without enlargement	4	8.00	21	42.00	11.343	0.001

symptoms of chronic pulmonary lesions. The positive rate of bacteriological examination of sputum for treatment of PTB, especially for the retreatment of PTB, is as low as 20%-55%. Therefore, the imaging test is crucial in the diagnosis of PTB [19]. Some studies have suggested that multi-slice spiral CT plays an irreplaceable role in revealing the subtle characteristics of secondary PTB, and can guide clinical treatment by monitoring patients' lesion sites [20].

With the extensive promotion and implementation of imaging techniques, more and more studies have indicated that age, course and other factors have certain impacts on the imaging characteristics of PTB patients, and may even affect physicians' judgment of the conditions. This is obviously not conducive to the clinical treatment of PTB patients. In fact, there are a plethora of studies on interference factors in clinics. A comparative analysis of the x-ray characteristics of 100 elderly PTB patients and 100 young and middle-aged PTB patients shows that the cumulative range of lesions in elderly PTB patients is wider than it is in young PTB patients, and the ratio of bronchial spread in elderly PTB patients is greater than it is in young PTB patients. Meanwhile, a comparison of lesion properties indicates that the

Table 5. Comparison of the lesion sites and lesion ranges of the PTB patients with different courses [n (%)]

Group	n	Two and more lobes	Posterior tip of upper lobe and posterior segment of lower lobe	Middle lobe	Basal segment of lower lobe	Anterior and lingual segments
Simple PTB group	60	10 (16.67)	20 (33.33)	20 (33.33)	20 (33.33)	10 (16.67)
Group of complication by other diseases	30	23 (76.67)	13 (43.33)	11 (36.67)	8 (26.67)	8 (26.67)
X^2	-	34.598	0.861	0.098	0.415	1.25
P	-	< 0.001	0.353	0.754	0.52	0.264

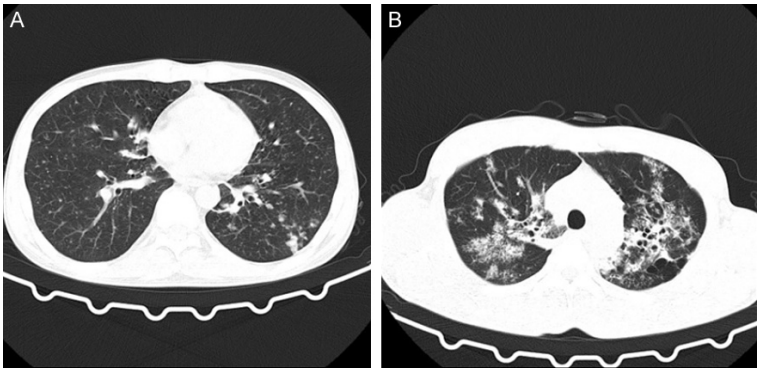

Figure 2. Comparison of the imaging characteristics of PTB patients with different disease courses. A. Simple PTB patients have no prominent cavity, nodular shadow, or high-density shadows of consistency on one side. B. PTB patients also suffering from other diseases have significant nodular shadows, more prominent cavities, liquid in the cavities, and notable high-density shadows of consistency on one side.

lesions of elderly PTB patients mainly have exudative, caseous and cavitary lesions, but those of young and middle-aged patients primarily have fiber proliferation and mixed lesions. Elderly PTB patients often experience complications, such as pneumonia and emphysema, while the young and middle-aged PTB patients are less likely to experience these complications [21]. The results of an investigation on the imaging characteristics of 89 PTB patients also suffering from diabetes showed that most lesions are distributed in the multiple lobe segments (60.67%) and pulmonary segments (95.51%). Most lesion morphologies occur predominately in large patches (64.04%), with cavities occupying 65.17% and the tree-in-bud pattern accounting for 31.46%. This study found that there are significant differences in the imaging manifestations of multiple lobe segments and cavities between PTB patients complicated by diabetes aged > 60 years and < 60 years [22]. The aforementioned studies suggest that different ages and courses have remarkable effects on the imaging characteristics of PTB. This is a significant theoretical basis for this study.

In this study, a total of 90 PTB patients were grouped and compared according to age and course of disease. The differences in the imaging characteristics of the PTB patients with different ages and courses were compared and investigated. The comparison of the imaging characteristics of the PTB patients with different ages showed that the lesion site and lesion ranges in elderly group were significantly greater than those in the young group, and the occurrence rate of cavities and the ratio of high-density shadows of consistency on one side in the elderly group were markedly higher than they were in the young group. The ratios of plaque, cavity walls ≥ 3 cm and multiple enlargements of the mediastinal lymph nodes in the elderly group were notably higher than they were in the young patients. This indicates that the elderly PTB patients had a wider range of lesions, more diverse lesion morphologies, and more significant organic lung injuries. The results of a comparison of the performance characteristics of 159 elderly PTB patients and 255 young and middle-aged patients PTB revealed that the lesions in the elderly group are more extensively distributed. The lesions are mostly distributed in the middle and lower lung fields. Meanwhile, large solid shadows are observed and cavities are more common in the lesions, and the ratio of large solid shadows and cavities can be up to 24.53%. Elderly PTB patients are prone to infection symptoms, gas-liquid planes in cavities, frequent pleural thickening, nodular shadows, spherical shadows of PTB, and high-

Table 6. Differences in the lesion types of the PTB patients with different courses [n (%)]

Imaging signs	Simple PTB group (n = 60)		Group of complication by other diseases (n = 30)		X^2	*P*
	n	Ratio	n	Ratio		
Cloud flocculent shadow	32	53.33	10	33.33	3.214	0.073
Nodular shadow	0	0.00	4	13.33	8.372	0.004
Spherical or lumpy shadow	0	0.00	1	3.33	2.022	0.155
Cavity	3	5.55	10	33.33	12.992	< 0.001
Cord-like and stellate shadows	2	3.33	4	13.33	3.214	0.073
Enlargement of mediastinal lymph nodes	2	3.33	2	6.67	0.523	0.469
Liquid planes in cavities	1	1.67	4	13.33	5.188	0.023
Pleural effusion	5	8.33	7	23.22	3.894	0.048
High-density shadows of consistency on one side	1	1.67	4	13.33	5.188	0.023

Table 7. Lesion morphologies of the PTB patients with different disease courses

Site		Simple PTB group (n = 60)		Group of complication by other diseases (n = 30)		X^2	*P*
		n	Ratio	n	Ratio		
Caseous		3	5.55	8	26.67	8.751	0.003
Consolidation		10	16.67	15	50.00	11.077	0.001
Patch		20	33.33	14	46.67	1.513	0.219
Nodule	Diameter > 3 cm	2	3.33	7	23.33	8.889	0.003
	Diameter ≤ 3 cm	50	83.33	22	73.33	1.25	0.264
Cavity	Cavity wall < 3 cm	2	3.33	2	6.67	0.523	0.469
	Cavity wall ≥ 3 cm	0	0.00	7	23.33	15.181	< 0.001
	Nodule of wall	1	1.67	1	3.33	0.256	0.613
Cord		60	100.00	25	83.33	10.588	0.001
calcification		46	76.67	27	90.00	2.321	0.128
Bronchiectasis		31	51.67	23	76.67	5.208	0.022
Pleural thickening	Significant thickening	18	30.00	15	50.00	3.445	0.063
	Slight thickening	42	70.00	15	50.00	3.445	0.063
hydrothorax		3	5.00	9	30.00	10.817	0.001
Mediastinal lymph nodes	Unilateral enlargement	12	20.00	24	80.00	30.0	< 0.001
	Multiple enlargement	24	40.00	5	16.67	4.986	0.026
	Without enlargement	4	6.67	21	70.00	39.988	< 0.001

density shadows consistent with those on one side are more commonly observed. However, the imaging manifestations of young and middle-aged PTB patients are relatively simple. The lesions are mostly concentrated in the two upper lobes and are predominately cloud flocculent shadows (40.78%). Young and middle-aged PTB patients are more prone to multiple pleural effusions (26.27%). There was little difference in mediastinal lymph node enlargement, calcification shadows, or stellate shadows between the two groups in this study [23].

In this study, the authors believe that, on the one hand, compared with the young and middle-aged PTB patients, the elderly PTB patients had a lower immunity, and reveal decreasing T cell and B cell function. After the elderly PTB patients are infected by *Mycobacterium tuberculosis*, their immune cells cannot quickly kill the pathogenic bacteria, making *Mycobacterium tuberculosis* difficult to be confined locally and easily causing diffusion and extensive infiltration. On the other hand, the proliferation of *Mycobacterium tuberculosis* in the body leads

to the production of bacterial protein, resulting in caseous necrosis of the tuberculosis lesions. The effluent easily infects the bronchus and causes inflammation, and the infection of the opposite lung leads to the onset of bilateral lung diseases [24]. Additionally, the comparison shows that the differences in the cavities and the liquid planes in the cavities between the two groups may be related to a poor recovery ability, long-term unhealed cavities, and the proliferation of fibrous tissue in the cavity walls of elderly PTB patients.

In this study, the imaging characteristics of the PTB patients with different disease courses were compared. The results showed that the ratio (76.67%) of lesion ranges involving two lobes in the other disease complications group was significantly higher than it was (16.67%) in the simple PTB group. Meanwhile, the occurrence rates of nodular shadows, cavities, fluid planes in cavities, and pleural effusion in the other disease complications group were remarkably higher than they were in the simple PTB group. A further comparison showed that the incidence rates of caseous lesions, consolidation, and pleural effusion, and the ratios of nodules with a diameter > 3 cm and bronchiectasis in the other disease complications group were higher than they were in the simple PTB group. The results of a study on the imaging signs of PTB patients also suffering from AIDS revealed that the incidence rates of the cavities and the enlargement of the mediastinal lymph nodes of PTB patients also suffering from AIDS were markedly higher than those of simple PTB patients (79.8% vs 29.8%, 65.3% vs 14.3%) [25]. In addition, the results of a comparative study of the imaging of PTB patients also suffering from diabetes indicate that the PTB patients also suffering from diabetes had a wider cumulative range of lesions, demonstrate bilateral lung involvement, and experience diseases in two or more lobes. Additionally, their lesions were mostly distributed in the anterior segments of the lung, and could involve multiple adjacent lung segments. The lesions were mainly lung consolidation, multiple cavities, and bronchial disseminated lesions with a massive fusion of the plaque lesions. These findings are similar to the results of this study. According to the authors' analysis, compared with simple PTB patients, PTB patients also suffering from other diseases, such as AIDS and diabetes, experience certain issues in their energy metabolism, immune function, liver and kidney function, etc. This leads to a decrease in their antibody levels and in the body's immunity. Therefore, PTB patients who also have other diseases have a special imaging performance [26]. The results of a case study of diabetes found that PTB patients who also have diabetes often have higher *Mycobacterium tuberculosis activity*, a higher incidence rate of cavities as a result of caseous necrosis lesions, and the likely occurrence of tree-in bud signs due to bronchial dissemination. Meanwhile, due to the weak constitution of PTB patients who also have diabetes, they are usually placed in a supine flat position, and the anterior lung segment (upper tip segment, middle lobe segment, lingual segment, etc.) is mostly in in a state of hypoxia. This facilitates the invasion of *Mycobacterium tuberculosis*.

The results of this study show that, compared with those in the young group, the PTB patients in elderly group had a wider range of lesions, and mostly had lesions occurring in the bilateral lungs and were more likely to develop cavitary pulmonary tuberculosis (CPTB). Compared with simple PTB patients, PTB patients also suffering from other diseases were more prone to nodular, caseous, and cavitary lesions, and had a wider range of lesions involved, larger diameters of cavities and nodules, a higher occurrence of pleural effusion, and a higher probability of bronchiectasis. The innovation of this study lies in its comparison of the imaging characteristics of pulmonary tuberculosis patients of different ages and courses. The results of this study can summarize the clinical characteristics of different groups of patients with tuberculosis and provide theoretical support for their clinical diagnosis and treatment. However, the shortcomings of this study are as follows: (1) The small sample size leads to a lack of comprehensiveness in the results and insufficient clinical data. (2) The patients were followed up only for a short period, and there was no dynamic assessment. In view of the aforementioned shortcomings, we plan to carry out clinical studies with a longer follow-up period and a larger sample size, so as to provide a more detailed theoretical basis for the treatment of PTB patients.

Disclosure of conflict of interest

None.

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