Journal of Clinical and Nursing Research

Research Article

Diagnostic Value of Spiral CT Chest Enhanced Scan in Adult with Active Pulmonary Tuberculosis

Ruishu Wang

The Affiliated Hospital of Chifeng College, Chifeng City 024005, Inner Mongolia, China

Abstract: ***Aim:*** To explore the diagnostic value of spiral CT chest enhanced scan for adults with active pulmonary tuberculosis. ***Methods:*** The clinical data of 60 adult patients with active pulmonary tuberculosis who were treated in our hospital from January 2018 to November 2019 were retrospectively analyzed. All patients underwent conventional chest radiography and spiral CT chest enhanced scan. The number of tuberculosis diagnosis, the detection rate of special site lesions, and the detection rate of active pulmonary tuberculosis signs by the two methods were compared. ***Results:*** In 60 patients, the pathological results confirmed the existence of 75 tuberculosis lesions. The detection rate of spiral CT was 98.67%, which was not statistically significant compared with the detection rate of 92.00% (P>0.05) in the conventional chest X-ray. The detection rate of spiral CT enhanced scans for tuberculosis lesions in special sites was 100.00%, which was significantly higher than that of conventional chest X-ray of 7.69%, and the accuracy rate of active pulmonary tuberculosis signs was 98.85% higher than that of conventional chest X-ray of 79.31%. P<0.05). The difference was statistically significant (P<0.05). ***Conclusion:*** Spiral CT chest enhanced scan can not only find special tuberculosis lesions that cannot be detected by conventional chest radiography, but also accurately determine active pulmonary tuberculosis in adults, which is of high diagnostic value.

Keywords: Active pulmonary tuberculosis; Adult; Spiral CT; Enhanced scan; Signs of active pulmonary tuberculosis

Publication date: May, 2020

Publication online: 31 March, 2020

***Corresponding author:** Ruishu Wang, wrs26121939@163.com

Pulmonary tuberculosis is a serious respiratory disease caused by pulmonary infection with tuberculosis bacteria, and has a high infectivity and mortality[1]. Pulmonary tuberculosis can be asymptomatic in the early stages, or show symptoms such as cough, sputum, low fever, and fatigue, which can easily be misdiagnosed as other respiratory diseases, so the best treatment time is missed, causing respiratory disorders and endanger patients' lives[2-3]. In addition, patients with pulmonary tuberculosis have an incubation period after infection with tuberculosis bacteria, and it will develop into tuberculosis when the allergy increases or the immunity decreases. Therefore, early diagnosis is of great significance for improving the prognosis. Pathological examination is the gold standard for the diagnosis of tuberculosis, but its operation is complicated and takes a long time, which is not suitable for widespread promotion. Chest X-ray has the advantage of being fast, economical, and convenient, but its detection rate of tuberculosis is low. Spiral CT is widely used in the diagnosis of lung diseases due to its simple operation, high resolution and safety[4]. In order to find an effective diagnostic method for active pulmonary tuberculosis, this study investigated the value of spiral CT enhanced scan in adult patients with active pulmonary tuberculosis.

1 Information and methods

1.1 General information

The clinical data of 60 adult patients with active pulmonary tuberculosis who were treated in our hospital from January 2018 to November 2019 were retrospectively analyzed. All patients underwent conventional chest X-ray scan and spiral CT chest enhanced scan. There were 34 males and 26 females;

the age was 24-72 with the average age of (46.25 3.62). There were 9 asymptomatic cases, 42 cases of sputum and cough, 9 cases of night sweats and low fever. All patients were diagnosed with active pulmonary tuberculosis by pathological findings.

1.2 Inclusion criteria

(1) Inclusion criteria: patients who were diagnosed with active pulmonary tuberculosis by X-ray, spiral CT, sputum culture, and tuberculin test; complete patient data; complete CT image preservation. (2) Exclusion criteria: Mental disorders; patients with lung malignancies; communication disorders; patients with other organ.

1.3 Method

1.3.1 Spiral CT chest enhanced scan

The instrument used is Brilliance 64-row spiral CT (Philips), the standard tube current is 178 mAs, the tube voltage is 12OKV, and the collimated acquisition channel parameter is 0.625 × 64. The patient took a supine position and was informed the breathing training method in advance. The patient inhaled and held his breath to completed the CT scan, which was carried out from the thoracic orifice to the bottom of the lung. The thickness of the scan layer was 5mm, and the scan was 6-8s. Then, the enhanced scan was performed to reconstruct the 10mm interval and 10mm layer thickness, and the partial thin layer was reconstructed with the interval and thickness of 2 mm. All images had no artifacts caused by breathing, and were confirmed by 2 senior radiologists.

1.3.2 Conventional chest X-ray scan

The detection instrument was D6000DR radiograph machine (GE, the United States) to conduct the frontal and lateral chest radiography examination with current 320 mA, voltage 120 kV. The chest X-ray ranged from the upper edge of the bilateral acromion to 3 cm below the bilateral costal angle. The diagnosis was confirmed by 2 senior radiologists.

1.4 Evaluation Index

The final pathological results were used as the gold standard. Compare conventional chest X-ray and spiral CT enhanced scan for tuberculosis lesions in the left and right lungs, number of tuberculosis lesions in specific sites (pleural tuberculoma, endobronchial tuberculosis, hilus pulmonis and mediastinal lymphadenopathy), and detection rate of active tuberculosis signs (cavitation, infiltration shadow, endobronchial lesions, bronchial disseminated lesions).

1.5 Statistical methods

SPSS 22.0 software was used for data processing. Counting data were expressed as percentages and χ^2 test was used. P <0.05 was considered statistically significant.

2 Result

2.1 Detected number of tuberculosis lesions

Pathological findings confirmed the presence of 75 tuberculosis lesions of the 60 patients, with a conventional chest X-ray detection rate of 92.00%(69/75) and a spiral CT detection rate of 98.67%(74/75). The difference between the two detection rates was not statistically significant (χ^2=2.398, P = 0.122). See Table 1.

Table 1. Comparison of the number of tuberculosis lesions detected by conventional chest X-ray and spiral CT

diagnostic method	left lung			right lung			total number
	upper lobe	middle lobe	inferior lobe	upper lobe	middle lobe	inferior lobe	
conventional chest X-ray	25	0	3	29	5	7	69
spiral CT	25	1	4	29	6	9	74
pathological findings	25	1	4	29	7	9	75

2.2 Detected number of lesions in special site

The detection rate of spiral CT enhanced scans for tuberculosis lesions in special site was 100.00% (13/13), which was significantly higher than that of 7.69% (1/13) of conventional chest X-ray. The difference was statistically significant (χ^2= 22.286, P = 0.000). See Table 2.

Table 2. Comparison of the number of tuberculosis lesions in special sites detected by conventional chest X-ray and spiral CT

diagnostic method	pleural tuberculomas	endobronchial tuberculosis	hilus pulmonis and mediastinal lymphadenopathy	total number
conventional chest X-ray	0	0	1	1
spiral CT	3	4	6	13
pathological findings	3	4	6	13

2.3 Detected number of active tuberculosis signs

The accuracy rate of signs of active pulmonary tuberculosis detected by spiral CT enhanced scan was 98.85% (86/87) higher than that of conventional chest X-ray scan of 79.31% (69/87), and the difference was statistically significant ($\chi^2 = 17.075$), $P = 0.000$). See Table 3.

Table 3. Comparison of the number of active pulmonary tuberculosis signs detected by conventional chest X-ray and spiral CT

diagnostic method	cavitation	infiltration shadow	endobronchial lesions	bronchial disseminated lesions	total number of the sign
conventional chest X-ray	2	62	0	5	69
spiral CT	11	62	4	9	86
pathological findings	11	62	4	10	87

3 Discussion

The occurrence of pulmonary tuberculosis is related to the infection of tuberculosis bacteria. Active pulmonary tuberculosis, that is, active pulmonary tuberculosis patients, has a positive sputum smear and congestion or infiltrated disseminated lesion on lung examination[5-6]. The degree of tuberculosis is related to the virulence and quantity of mycobacterium tuberculosis, as well as the body's allergic reaction and immunity to the disease. When the patient is infected with mycobacterium tuberculosis for the first time, due to the lack of immunity, the lesions can easily spread to the whole body with blood vessels and lymphatic vessels, causing military tuberculosis or hilus pulmonis and mediastinal lymphadenopathy. But the cavitation, liquescence and putrescence of the lung are rare. However, with the presence of infection and disease deterioration, the body's immunity to mycobacterium tuberculosis and allergic reaction of the tissue are gradually increasing, leading to the lesion putrescence. And the cavitation, military tuberculosis and hilus pulmonis and mediastinal lymphadenopathy are rare. Humans have a period of incubation after being infected with mycobacterium tuberculosis, so tuberculosis will be formed when cell-mediated allergies increase or immunity decreases. Therefore, early diagnosis and treatment are necessary. This study explores the diagnostic value of conventional chest X-ray and spiral CT chest enhanced scans in adult patients with active pulmonary tuberculosis.

The results of this study showed that pathological results confirmed the presence of 75 tuberculosis lesions in 60 patients, and the detection rate of spiral CT was not significantly different from that of conventional chest X-ray; However, the detection rate of spiral CT enhanced scan for tuberculosis lesions in specific sites and the accuracy rate of active tuberculosis signs are higher than those of conventional chest X-ray, indicating that spiral CT chest enhanced scan can not only find special tuberculosis lesions that cannot be detected by conventional chest X-ray, but also accurately determine active tuberculosis in adults, which has higher diagnostic value. The reason is that multi-layer spiral CT has the advantages of fast scanning and high resolution. It can scan the lung lesions hierarchically, and has powerful post-processing technology which can find small lesions, and has a high diagnostic accuracy for active tuberculosis[7-8]. Compared with X-ray, spiral CT enhanced scan has the advantages of no radiation, high density resolution, and high imaging speed, and is widely used in the diagnosis of tuberculosis.

The CT diagnosis of pulmonary tuberculosis is mainly manifested as multi-forms (nodular, cord-like, cavity, miliary), multi-lesions (fine nodular and cord-like shadow mainly in upper lobe), and less mass (increased value≥80HU), more calcification, and less

nodule accumulation. Compared with conventional chest X-ray, spiral CT chest enhanced scan has the advantage that it can find lung lesions hidden in the heart and mediastinum, clearly show mediastinal emphysema that cannot be displayed on X-ray images, and have a high density resolution above the chest X-ray, which can find the very small calcification points. Therefore, spiral CT can be used for patients with suspected pulmonary tuberculosis who cannot be diagnosed with X-ray.

The CT features of patients with active pulmonary tuberculosis are mainly cavitation shadows, infiltration shadows, tree-in-bud signs, etc. Among them, thick-walled cavities (thickness of the wall>3 mm) are mainly signs of cheese-sign cavitation and lesions excluded of the lung through the bronchus. It is the activity of tuberculosis lesion. If the thick-walled cavity changes to thin-walled cavity after treatment in active pulmonary tuberculosis patients, it indicates that the patient is gradually getting better[9]. The emergence of the tree-in-bud sign indicates that the bronchioles have been affected by active pulmonary tuberculosis lesions, and the cause is related to the obstruction of bronchioles by inflammatory secretions[10]. In the spiral CT enhanced scan, when the diameter of lobular branchlike shadow and central nodule shadow is about 3mm, it can be judged as active tuberculosis. In addition, the detection of hilus pulmonis and mediastinal lymphadenopathy also indicates that tuberculosis bacteria have invaded the lymph nodes and pleura. Hilus pulmonis and mediastinal lymphadenopathy also exists in some patients with active pulmonary tuberculosis.

In summary, the spiral CT chest enhanced scan can find special tuberculosis lesions that cannot be detected by conventional chest X-ray, accurately determine active pulmonary tuberculosis in adults, and have higher diagnostic value.

References

[1] Shang GF, Wu ZB, Xia WG. Analysis of clinical value of multi-slice spiral CT in detecting tuberculosis and silicosis[J]. Journal of Medical Imaging, 2017, 27(9): 1714-1717.

[2] Xu YH, Li SJ, Wu MC, et al. Application analysis of 16-slice spiral CT chest low-dose scan in diagnosis of tuberculosis[J]. China Primary Medicine, 2019, 26 (12): 1415-1418.

[3] Zhang YX, Zhang H, Xin YZ, et al. Application value of spiral CT low-dose scanning for monitoring of tuberculosis[J]. China Radiation Health, 2019, 28 (1): 95-97.

[4] Zhang L, Zhou YH. Value analysis of 64-slice spiral CT low-dose chest scan in the diagnosis of tuberculosis[J]. China Primary Medicine, 2017, 24(12): 1798-1801.

[5] Xue SJ, Ren L. Clinical value of multi-slice spiral CT in the differential diagnosis of tuberculosis and lung cancer[J]. Journal of Oncology, 2017, 23 (5): 442-444.

[6] Liu Y, Gong SB, Chen Y, et al. CT imaging characteristics of primary active pulmonary tuberculosis in middle-aged people[J]. Journal of Clinical Pulmonary Medicine, 2017, 22 (7): 1184-1187.

[7] Li F, He W, Zhou XH, et al. Analysis of the similarities and differences of high-resolution CT manifestations of non-tuberculous mycobacterial lung disease and active pulmonary tuberculosis [J]. Chinese Journal of National Defense, 2018, 40 (5): 499 -505.

[8] Tang XZ, Liu CP. The value of multislice spiral CT in the diagnosis of senile pulmonary tuberculosis with lung cancer [J]. Chinese Medicine and Clinic, 2019, 19(20): 3503-3504.

[9] Zhang QJ, Zhang XM. CT Signs of Active and Inactive Tuberculosis in Differential Diagnosis of Different Types of Tuberculosis [J]. Chinese Journal of CT and MRI, 2017, 15 (1): 67-69.

[10] Zhang N. Exploration of the application value of MSCT plain scan before and after clinical treatment of active tuberculosis[J]. Chinese Journal of CT and MRI, 2019, 17 (6): 56-58.