Multi-Slice Spiral CT Diagnosis of Septic Pulmonary Embolism Caused by Infective Endocarditis

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Abstract: Objective: To analyze the multi-slice spiral CT manifestations of septic pulmonary embolism caused by infective endocarditis, and improve the understanding and imaging diagnostic ability of this disease. Method: 50 infected SPE patients who visited our hospital from January 2020 to January 2021 were selected. Through detailed analysis of the CT diagnosis results of the patients, the characteristics of SPT under multi-slice spiral CT scanning were understood, the pulmonary artery manifestations of the patients were observed, and the pulmonary display of the patients' primary heart disease and vegetations was determined. Result: There were 19 fungal pulmonary aneurysms in 16 cases, of which 5 were solitary, with 10 cystic, 6 irregular edges, and 4 thickened walls. The filling defects were located in 4 peripheral and 3 distal segments, and 4 were more common in the outer basal segment of the lower lobe and the inner segment of the right middle lobe. There were 2 proximal and 3 middle segments of the pulmonary artery. Three cases showed halo signs around the aneurysm, and four cases had rapid enlargement of the pulmonary artery contour during the acute phase. Among them, three cases shrank and became thinner after anti infection treatment. Before treatment, 5 cases had slightly thickened pulmonary arteries due to embolism. 20 cases of electrocardiographically gated whole chest cardiac large vessel CT angiography were able to clearly display cardiac lesions, with 15 cases showing pulmonary endarteritis, which showed rough and irregular thickening of the pulmonary artery wall, including 10 cases of local swelling. 11 cases showed vegetations. 5 cases underwent chest enhancement scan, showing 5 cases of cardiac lesions and 5 cases of vegetations. All 50 cases had multiple and multiple forms of lesions in both lungs, including patchy infiltrative shadows, wedge-shaped shadows, nodules, and cords. The first three may be accompanied by cavities and airbags, while wedge-shaped shadows and nodules may be accompanied by nutrient vessel signs, mainly distributed around the lungs. Conclusion: For patients with SPE, the use of multi-slice spiral CT for diagnosis is more efficient, and this method is currently the best method for examining the disease.

Keywords: Endocarditis; Bacterial; Pulmonary Embolism; Tomography; Spiral Computer

1. Materials and Methods

1.1 Research subjects

We selected 50 SPE infected patients who visited our hospital from January 2020 to January 2021, including 16 females and 34 males, aged 21-68 years, with an average age of 45.2 years. Admission criteria: the patient was diagnosed with infective endocarditis, which led to the diagnosis of SPE. And the patient needs to undergo a doctor's chest CT examination. Exclusion criteria: After removing SPE, the patient does not have any other serious diseases, such as cardiovascular or cerebrovascular diseases or cancer. Secondly, the clinical data of the patient needs to be completed, and if it is not complete enough and lacks relevant information, the patient cannot participate in the study. Finally, the patient's image has large false images and the display of the lesion status is not clear enough.

1.2 Diagnostic criteria

Main criteria: 1. Positive blood culture; The image of infective endocarditis was positive. Secondary criteria: 1. Risk

factors; 2. Heating; 2. Vascular phenomenon; 4 immune signs; 4 Microbiological evidence. Diagnosis requires meeting 2 main criteria, 1 main criterion+3 secondary criteria, or 5 secondary criteria. SPE diagnosis adopts clinical diagnostic criteria such as Cook, and must simultaneously meet the following four criteria: 1. Focal or multifocal lung infiltration shadows; 2. There are active extrapulmonary infectious foci that can serve as sources of septic emboli; Exclude other diseases that may cause lung infiltration shadows; After reasonable treatment with antibiotics, lung infiltration shadows are absorbed.

1.3 Instruments and Methods

Using Siemens Somatom Definition Flash dual source CT and Canon 640 layer volumetric CT scanner (Aquilion ONE, Toshiba Medical Systems) CT. All patients underwent chest CT plain scan, ranging from the apex to the bottom of the lungs, with a window width of 1200-1500Hu, a window position of -600Hu, a mediastinal window width of 250-350Hu, and a window position of 40-50Hu. Nine patients underwent electrocardiographic gated whole chest CT angiography (dual source CT) of the large blood vessels of the heart. The contrast agent was used, with a dose of 320mgI/ml of iodozolol and dual flow injection. The dosage was 1.0 to 1.5ml/kg at the age of 3 to 14 years, with a flow rate of 1-3 ml/s. The left atrium at the four chamber level was used as the trigger layer, and the trigger threshold was 80 Hu; 14-55 years old, dosage 0.8-1.2ml/kg, flow rate 4-5ml/s, with ascending aortic root layer as triggering layer, triggering threshold of 100Hu, Bolus Tracking triggering, tube voltage of 80-100kV, automatic milliampere second, collimation width of 0.6, pitch of 0.17, reconstruction layer thickness of 1.0mm, reconstruction interval of 0.8mm, matrix 512 × 512。 Ten patients underwent chest enhancement examination (64 slice CT). The contrast agent was iohexol, 350mgI/ml, dosage 1.0~1.2ml/kg, flow rate 3~4ml/s. The ascending aorta layer 2cm below the tracheal carina was used as the trigger layer. The trigger threshold was 100Hu, and Bolus Tracking was used as the trigger.

2. Results

2.1 General Conditions of Patients: The main clinical manifestations of the 25 patients in this group are as follows:

There were 20 cases of fever and 15 cases of hypoproteinemia. There were 9 cases of PDA, 1 case of pulmonary artery foreign body, 2 cases of cardiac congenital malformations or more, 6 cases of interventricular septum defect, 2 cases of aortic sinus rupture into the right atrium, 1 case after cardiac pacemaker replacement, and 2 cases of tricuspid valve vegetations. All 17 cases of cardiac ultrasound detected vegetations, including 14 cases of right heart system vegetations, 3 cases of left and right heart vegetations, and 1 case of PDA with left heart vegetations. Among the 17 cases, 1 case was misdiagnosed as pulmonary sequestration, 2 cases as tuberculosis, 1 case as conventional pulmonary embolism, 1 case as tumor, 1 case as pneumocystis carinii infection, 1 case as missed diagnosis, and the rest were diagnosed as common pneumonia. Eight patients underwent one or more follow-up examinations after 2 days to 8 months. 14 cases were confirmed by surgery, 2 cases received anti infection treatment, 1 case received interventional treatment, and 1 case was discharged automatically. All patients received one or more blood cultures, of which 9 were positive, including 6 cases of Streptococcus, 2 cases of fungi, 1 case of staphylococcus, and 1 case of gram-positive bacteria.

2.2 Pulmonary artery manifestations of SPE

There were 6 cases of MPAA, a total of 9 cases, and 4 cases were positive for blood culture, including 2 cases of Streptococcus, 1 case of Staphylococcus aureus, and 1 case of fungi, among which 2 cases were multiple. The basal segment outside the lower lobe of both lungs and the medial segment of the middle lobe of the right lung are more common, with one common occurrence. There are 5, 4, and 1 pulmonary artery in the proximal, middle, and distal segments, respectively. Two cases and three aneurysms showed peripheral halo sign on plain scan, with 6 showing cystic shape and 6 showing spindle shape, 6 with irregular edges, 4 with thickened tumor wall and attached filling defect, and 2 with interface change at the distal end. The diameter of the aneurysm was about 0.3-2.5cm, with an average of 1.2cm. Three acute pulmonary aneurysms rapidly increased, with 2 cases shrinking and thinning after anti infection treatment, 1 case unchanged, and 1 case increasing

after 8 months; Before treatment, 4 cases had slightly thickened pulmonary arteries due to embolism.

2.3 Display of primary heart diseases and vegetations on SPE

Nine cases of cardiac gated whole chest CT angiography of large blood vessels were able to clearly display cardiac lesions. 5 cases presented with pulmonary endarteritis, including 1 case of pulmonary artery foreign body adjacent to the apex of the pulmonary artery, 4 cases of PDA, and 1 case of complex congenital heart disease with PDA. The pulmonary artery wall in front of the patent ductus arteriosus was rough and irregularly thickened. Distributed on the left upper wall of the main pulmonary artery in 2 cases, anterior upper wall in 1 case, left wall in 1 case, right wall in 1 case, left pulmonary artery inner upper wall in 1 case, and local swelling in 3 cases. 6 cases showed vegetations in the pulmonary artery, 4 cases showed spot, strip and patch filling defects, and 2 cases showed tricuspid valve; Pulmonary valve and tricuspid valve in 1 case showed thickening and partial calcification of the valve. 5 cases underwent chest enhancement scan, and 3 cases showed cardiac lesions. Vegetation was found in 3 cases, located in tricuspid valve in 3 cases, and in pulmonary artery valve and tricuspid valve in 1 case.

2.4 Pulmonary Manifestations of SPE

All 25 cases had multiple and multiple forms of shadows with 2 or more types in both lungs. Patchy infiltrating shadows and blurry edges appeared in 10 locations of 6 cases, with 1 location accompanied by cavities and airbags. In 14 cases, wedge-shaped shadows appeared at 24 locations, with a wide base close to the pleura and a tip pointing towards the hilum of the lungs, without enhancement; 7 cases were accompanied by cavities and airbags, and 5 cases were accompanied by nutrient vessel signs. 151 nodules appeared in 15 cases, mainly distributed around the lung, with a diameter of 0.4-3.6cm; 47 cases were accompanied by cavities and airbags, 45 cases were accompanied by trophoblastic vascular signs, and 12 cases showed subpleural cord strips.

2.5 SPEPulmonary Manifestations of

Among the 10 patients who underwent follow-up, 6 showed partial absorption, partial enlargement, or new lesions, 1 had rapid short-term progression, 2 had no significant changes, and 1 had slight absorption.

3. Discussion

SPE is caused by an extrapulmonary infection that causes a pathogen containing embolus to detach and embolize the pulmonary artery, resulting in pulmonary embolism (or infarction) and focal pulmonary abscess. In addition to the common respiratory symptoms of pulmonary embolism, SPE is often accompanied by fever, pulmonary infiltrates, and primary manifestations. SPE is mostly related to infective endocarditis, thrombophlebitis, infection after central vein catheterization, liver abscess, changes after intravenous drug addicts or immunosuppressive treatment of malignant diseases of the blood system, among which infective endocarditis is most common in the right heart, and a few bacterial emboli of the left heart system can enter the right heart system through cardiac anatomical structure abnormalities, causing SPE. The incidence of 14 cases of right heart infective endocarditis in this group is consistent with that reported in previous studies. The typical CT manifestations of SPE are nodules, subpleural wedge-shaped shadows, with or without cavity formation and nutrient vessel signs, which are important clues for diagnosing SPE, but have no specificity.

References

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