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The CT Findings of Pneumonia-Type Mucinous Adenocarcinoma

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Abstract: Objective To explore the CT characteristics of pneumonia-type mucinous adenocarcinoma (PTMA) to improve the diagnosis of the disease. Methods Thirty PTMA pathologically confirmed by surgery or lung puncture biopsy were retrospectively analyzed, and all patients underwent plain CT scan, including 16 enhanced scans. CT characteristics in lesion distribution, morphology, density, marginal border, air bronchial signs, vacuolus or cavity signs, enhancement patterns, angiography signs, and pulmonary metastasis were analyzed. Results 30 PTMA showed focal and diffuse mixed ground glass shadow and air cavity consolidation, Of these, 20 were multiple lung lobes involvement, Twenty cases of polished glass shadow with clear surrounding boundaries, Nineteen patients, associated with multiple nodules in both lungs, Dynamic observation of ground glass and nodule lesions fusion, increase, consolidation and dissemination to the two lungs; In 23 cases, smooth and straight edges with right Angle features; Interlobular fissure and swelling existed in 13 cases; "Dry branch-like" air bronchial signs were present in 17 lesions, There were multiple vacuoles or vacuoles in the 19 consolidation cases; Low flat sweep density (average 24.5 ±8.4), After enhancement, mostly uneven mild enhancement (average 41.1 ± 16.6) with angiography; In two cases, the pleural fluid appeared, Pleural and mediastinal lymph node metastases were seen in two cases. Conclusion The characteristic CT manifestations of PTMA are branch-like bronchial, CT angiography, multiple vacuoles or vities, straight edges with right Angle, interlobular fissures swelling and lumen dissemination. Radiologists should be familiar with several characteristic imaging findings of the disease in order to make an early non-invasive diagnosis.

1. Introduction

Pulmonary invasive mucinous adenocarcinoma (PIMA) is a less common subtype of lung adenocarcinoma, accounting for about 5% of all lung adenocarcinoma [1], and its incidence has increased significantly in recent years. The 2011 International Society for Lung Cancer / American Chest Society / European Respiratory Society for Lung adenocarcinoma has classified separately from lung adenocarcinoma [2], replacing mucinous bronchioloalveolar carcinoma in the original lung cancer classification. On imaging, it is divided into nodular mass type and pneumonia type [3,4], among which pneumonic-type mucinous adenocarcinoma (PTMA) usually shows diffuse consolidation without proximal bronchial obstruction, similar to pulmonary infectious lesions such

as lobar pneumonia and caseous pneumonia, which is prone to misdiagnosis and delay in the early stage in many clinical practices. This paper analyzes the CT manifestations of PTMA to improve the awareness of the disease and provide help in early diagnosis and treatment.

2. Materials and Methods

2.1. Data

Thirty PTMA patients from January 2016 to December 2021 were collected retrospectively through the hospital information system. Inclusion criteria: ⑴ was confirmed by surgical or puncture pathology results; ⑵ CT images and clinicopathological data were complete, and scanning was performed within 2 weeks before surgery; ⑶ without any antitumor treatment. Exclusion criteria: ⑴ had a history of other malignancy; ⑵ CT images. Patients were 41 to 83 years old (mean age 62.6 ±12.7 years), including 13 males and 17 females. There was no history of any occupational exposure associated with lung disease. Twenty-two patients came to the hospital with clinical symptoms, 15 had repeated cough, 13 had heavy white foam or water sputum, 7 had sputum, 12 patients had dyspnea and shortness of breath after activity, 2 had intermittent fever, 6 had weight loss, and 2 patients had smoked for more than 20 years and 20 cigarettes / day. Eight cases were found in the physical examination. In 17 patients with first diagnosed pneumonia, the conventional anti-inflammatory treatment was ineffective, and the symptoms persisted with progressive aggravation. The median interval from the onset of symptoms to the clinical diagnosis was 3 months (1 to 24 months). Cases of 15 patients tumor markers (embryo antigen, sugar antigen 125, sugar antigen 199, neuron specific enolase, cytokeratin 19 fragment) 1 or more positive, blood routine (leukocytes, procalcitonin, C reactive protein, hypersensitive C reactive protein quantification, serum amyloid A and interleukin-6) mostly normal, individual patients only 1-2.

2.2. Scan Strategies

Patient supine position, arm lift, advanced head, using Canon Aquilion one 640-layer spiral CT or Siemens Definition 128 layer spiral CT, scanning range from lung tip to lung bottom, scanning conditions: tube voltage 120kV, automatic tube current setting, visual field 320mm x320mm, matrix 512x512, scanning layer thickness 5 mm, lung algorithm and standard algorithm reconstruction, recombinant layer thickness 1mm, layer spacing 1mm.A high pressure syringe was injected with nonionic iodine contrast iodixanol (320mg I / ml) through the median cubital vein, with a flow rate of 3.0~3.5 ml / s and a total amount of 75~100ml. Intelligent tracking trigger technology was used in the arterial period, and the scan was delayed by 60s, the image was transmitted to the PACS system. All patients underwent plain CT scan, with 16 underwent CT enhancement. Then we use the MPR reconstruction function to observe the lesions in multiple ways.

2.3. Imaging Findings

Two experienced chest imaging physicians independently observed the CT images through the lung window (1500~1700HU, 600~ 5050 HU) on the PACS system. When the agreement was reached, the third senior physician participated in the final consultation. To evaluate the number, morphology, distribution, boundary, and marginal features; the morphology of the air bronchus in the lesion; vacuoles and void; plain scan CT and enhancement, angiography; ground glass density and nodules; interlobular swelling; pleural metastasis; enlarged pulmonary and mediastinal lymph nodes. For CT measurement, avoid blood vessels, calcification and normal lung tissue, and averaged them three times. Enhancement <20HU was mild, >20 HU <40HU was intermediate

and >40HU was marked.

3. Results

The lesions were distributed in 20 cases (Figure 1), 11 involving whole lobe and 9 with 3 lobe; 10 with single lobe and single lobe. Nine patients were located in the peripheral subpleural area, two patients were in the central lung region, and the remaining 19 patients involved the peripheral and central lung areas. The morphology includes sheet, patchy and nodular, lobar and segmental consolidation accounts for the majority, and the density changes from ground glass shadow to consolidation (Figure 1).In 20 cases, multiple ground glass density shadows appeared around the consolidation or in the distant lung field (Figure 2).Nineteen cases of pulmonary consolidation with multiple small nodules were distributed along the location of the lobular center or bronchial center, with nodules of varying size, irregular morphology, and clear edges or with ground glass shadow. The boundary between the lesion and the normal lung tissue was clear in 25 cases, of which 23 cases had straight local edges (Figures 3A, 3B).CT values 14 to 36 HU (24.5 ± 8.4) (Figure 4A), and CT values 20 to 63 HU (41.1 ± 16.6) (Figure 4B), including 11 with mild enhancement, 5 with moderate enhancement, and branch angiography (Figure 4B)."Dry branches" of air bronchial signs were seen in 17 solid lungs (Figure 1,5), manifested by varying degrees of bronchial stenosis, stiffness, uneven thickness, distal bronchiolar occlusion with reduced branches, and 4 cases of bronchial arc curvature (Figure 5).The 13 cases had occupancy effect, which by lobe lobe shift (Figure 6).The 19 cases saw vacuoles or holes in the ground glass shadow or consolidation area, with multiple cystic changes, with circular cavity, smooth inner wall and size range from 3mm to 25mm (Figure 7, Figure 8A-C).Two cases had pleural effusion and pleural thickening; 2 cases had mediastinal and hilar lymph node enlargement. In 13 cases of follow-up review, multifocal plaque ground glass shadow was enlarged and merged into large consolidation, and multiple nodules were added in the two lungs, and some airbags could be new, partially expanded or disappeared (Figure 8A-C).

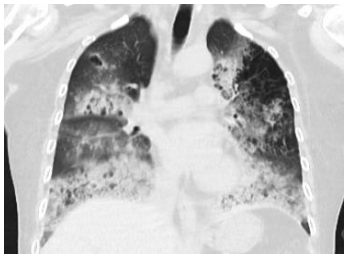

Figure 1: The lesions showed multiple morphology and multiple densities, Multilobular and multifocal distribution

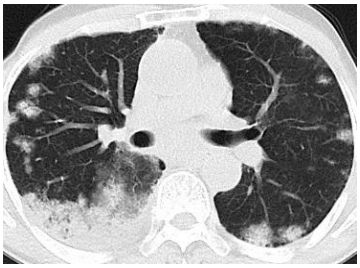

Figure 2: Diffuse distribution of double lung ground glass pattern

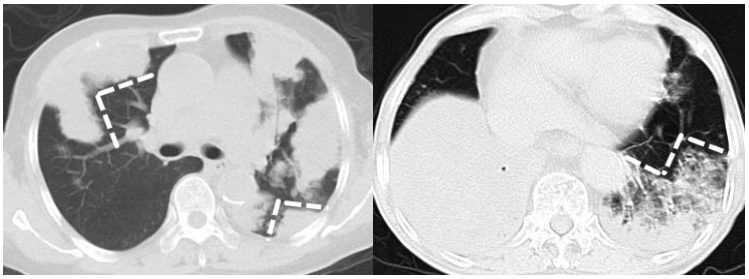

Figure 3A Figure 3B

Figure 3A-B: Lesion edge straight with right Angle sign (white dotted line)

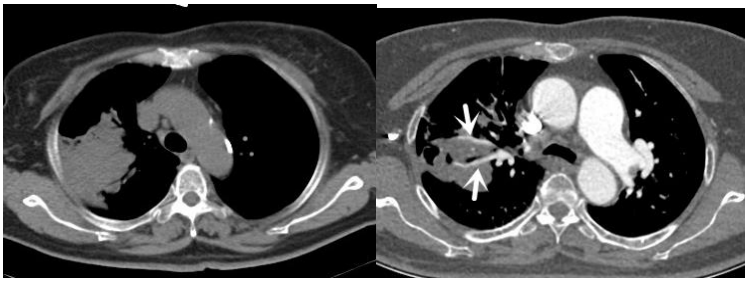

Figure 4A Figure 4B

Figure 4A-B: Flat sweep of lesions showed low density (CT value about 20-25HU), Mild enhanced scan enhancement (CT ~ 30-42HU), See the angiography sign (white arrow)

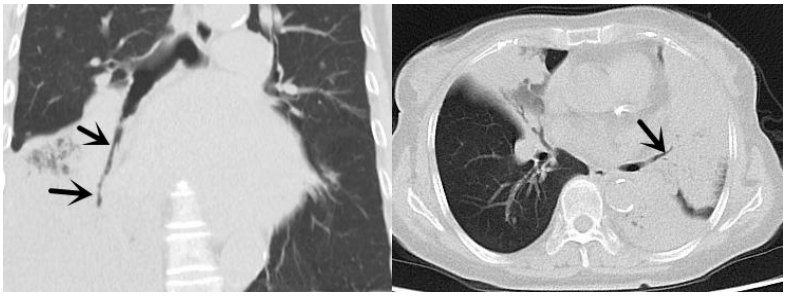

Figure 5A Figure 5B

Figure 5A-B: Black arrow shows the "dead branch" air bronchial sign, Distal branch reduction, uneven lumen thickness

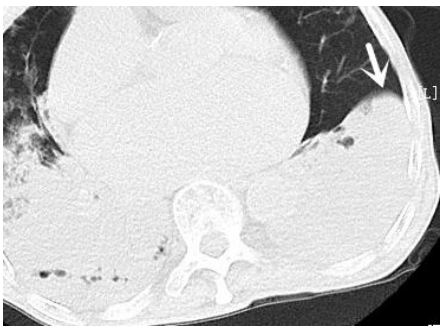

Figure 6: White arrow shows interlobular fissure swelling

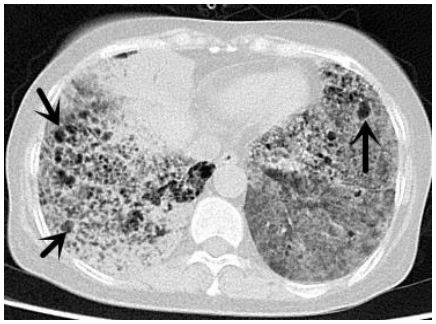

Figure 7: Black arrow shows scattered inside the distribution of empty bubbles

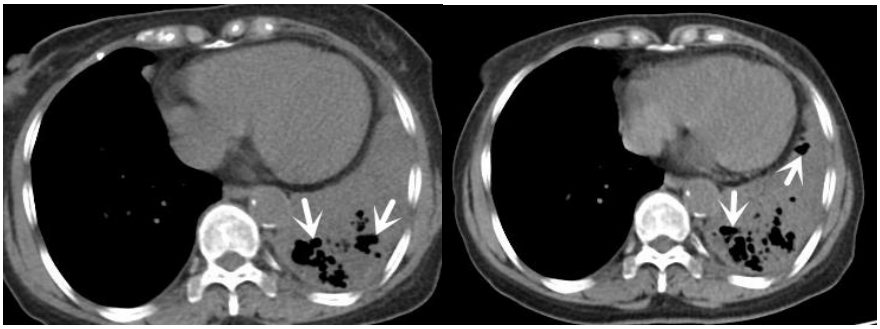

Figure 8A Figure 8B

Figure 8A (2020.10.25), 8B (2021.1.1): Follow-up review shows partial disappearance, new onset or enlargement of the cystic cavity in the left lung

4. Discussion

PTMA was more common in middle-aged and elderly people, with no significant difference between men and women, and no significant association with smoking. The mean age of the patients in this group was 62.6 ± 12.7 years, the male: female ratio was 1:1.3, and only 2 smokers. Early clinical symptoms are not specific, manifested as cough, sputum, chest pain, etc. With the progress of the disease, chest tightness and obvious after activity; middle and late cough of a large number of white foam mucus or water sputum, with certain characteristic[5], some patients with blood in the sputum. Most of the patients have no fever symptoms, anti-infection treatment is ineffective, not absorbed in the short term, but aggravated. It was not uncommon for physical examination. 8 cases in this group were found through physical examination. Laboratory examination can be accompanied by multiple tumor markers elevated, while the blood routine is normal.

PTMA is characterized by multilobular and subpleural peripheral areas, with rare single lung lobe and central distribution. 20 cases in this group, which is consistent with previous literature[6].Lesions involve the peripheral pulmonary subpleura more frequently, and are associated with metaplasia of PIMA derived from the bronchiolar epithelium. Clear boundary in 25 cases, with the lung lobular interval block and alveolar epithelial tumor cells for proliferative lesions[7,8], 23 cases of edge straight with right Angle sign, the author thinks the sign for the characteristics of PTMA, literature[8] reported lesions and normal lung tissue boundary mostly clear, straight line, and right Angle sign rarely mentioned, remains to be further observation in the future. Lesions are mainly spots, large sheet consolidation or ground glass, dynamic observation can increase and increase, often accompanied by ground glass density shadow or multiple nodules, located around the consolidation or / and the lung field away from the main lesion, histology research believes that these nodules and ground glass are lung metastasis [5,9,10] caused by PTMA through air cavity

dissemination (spread through air spaces, STAS).Another scholar[11] identified KRAS, NKX2-1, TP53 or ARID1A mutations in all multifocal PIMA as genetic evidence for the occurrence of metastasis in the lung. The incidence of PTMA pulmonary metastasis can reach 50.0% to 72.3%[12], and 19 patients in this group are consistent with the literature, while lymph node metastasis and distant metastases are rare. STAS can be used as a predictor of poor overall survival in PTMA patients[13].

The real part density of PTMA is low, less than the same level of soft tissue density, which is related to the large accumulation of mucus secreted by tumor cells in cells and alveolar cavity [14].This group flat sweep CT value of 24.5 ± 8.4,25 cases of light and moderate uneven enhancement, see angiography, as in the low degree of lung consolidation of high density of blood vessels, has certain characteristics and significance, pathological basis for the alveolar cavity filled of mucus, and the characteristics of tumor scale growth retain blood vessels, which are apparent on contrasted-enhanced images [14].A large amount of mucus accumulates in the lung lobe, which can also cause lobe consolidation expansion and swelling between the lung lobe. The 13 cases in this group have this sign, which has a certain effect on the disease [15].Air bronchial signs are also common, showing reduced peripheral bronchiolar branches, stiff and curved bronchial walking on the side of the near pulmonary hilus, uneven lumen thickness, and the inner wall is not only whole, like "dead branches", which is consistent with the previous report[15,16]. vacuolus and / or cavity signs were common than other types of adenocarcinoma [17] . In our study, 19 patients in our study showed multiple lesions of different size, smooth inner wall, and multiple septations in larger lesions. Pathologically, the invasive growth of tumor cells along the tube wall forms a live valve-like obstruction, and the gas into the alveolar cavity is easy but difficult to discharge, making the alveolar cavity overinflated [18].Dynamic follow-up observation of vacuoles and cavity can have large changes, some are new, some can disappear or capsule expansion, which is related to mucus filling the air cavity and discharge through cough, the patient showed the symptoms of coughing a large amount of white foam sputum or water-like sputum.

In most cases, PTMA is easily misdiagnosed as pneumonia, here we mainly discuss the differentiation with pulmonary infectious lesions. Infected patients are clinically urgent, showing fever, cough, sputum and other symptoms, and increased blood image in laboratory examination. Anti-inflammatory treatment effect is good, short-term review lesions are quickly absorbed, the general course of the disease is short. Infection is mainly inflammatory exudate filling alveolar cavity, edge is often fuzzy, generally does not cause the bronchial shape and changes, air bronchial signs for wall light, lumen, natural, from thick to fine to the pleural, part of the pulmonary side bronchial mucus plug formation cause atelectasis, is different from PTMA bronchial "branches" like change. Infectious lesions have more cell components, high CT value of plain sweep. In addition, obvious inflammatory solid congestion and capillary dilation, and large amount of mucus in PTMA, resulting in low flat sweep density and less enhancement. he infected nodules are located around the main lesion, manifested as indistinct lobular central nodules (acinar nodules), partially with tree bud signs, related to inflammation along the bronchial dissemination or proximal bronchial occlusion, different from the transairway pulmonary metastatic nodules of PTMA can be distributed in the whole lung field. Cavities with air-fluid planes are more common in infectious lesions.

5. Conclusion

CT signs of PTMA include segmental or lobar consolidation of a multifocal distribution, with multiple nodules in the lung, low lesion density, increased dynamic observation range, increased fusion, from ground glass samples to partial consolidation or consolidation density. Characteristic features are internal "dead tree-like" air bronchography, CT angiography, multiple vacuoles or

hollow features, straight edges with right-angle features, interlobular fissure swelling, and air lumen dissemination. If the radiologist is familiar with several characteristic imaging manifestations of the disease, PIMA should be included in the differential diagnosis of pneumonia, and should be included in the differential diagnosis to prevent delayed diagnosis and treatment.

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