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Pulmonary Sclerosing Pneumocytoma - A Comprehensive Exploration of Clinical, Radiological, and Surgical Dimensions

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Abstract:-

- ***Objectives:***

The study findings have important Clinical implications, especially in the preoperative evaluation of Lung Nodules and aid in the radiological diagnosis based on CT features.

Pulmonary Sclerosing pneumocytoma is a Benign, rare tumor of the lung that represents a diagnostic challenge due to the Non-specific CT findings. The Aim of this study was to present a 10-year experience with sclerosing pneumocytoma of a large center of CHINA for the diagnosis and treatment of pulmonary diseases, and to emphasize differential diagnostic dilemmas as a potential source of errors.

- ***Material and Methods:***

This represents a retrospective study of 31 patients diagnosed and treated with sclerosing pneumocytoma in the 10-year period. The study analyzed various Variables, including Gender, Age, Smoking history, Reason for CT, Nodule location, Nodule shape, Clinical symptoms, Calcifications, and Surgical Resections.

- ***Results:***

Sclerosing pneumocytoma was more frequently diagnosed in females (93.5%). The patients ranged in age from 28 to 68. Most of the patients (77.4%) were asymptomatic. 30 patients had no history of smoking (96.8%). Mean Nodule size was 14.4mm. Most nodules have Round, oval and smooth margin, with majority of Nodules have location in the lower lobes of both lungs. Most nodules were peripherally situated (54.83%). VATS with lobectomy performed in 25 (80.64%) patients while VATS with wedge resection performed in 6(19.64%) patients, without post-surgical complications and Normal follow up.

I. INTRODUCTION

Pulmonary Sclerosing Pneumocytoma (PSP), is a rare Benign tumor with malignant potential (1).IT was described by Liebow and hubbell in the years 1956(2). Earlier it was believed to be arised from vascular endothelia cell, latter was proved to be arised from respiratory epithelium, especially type -2 pneumocytes(3). Although it is regarded as the benign tumor, it represents diagnostic challenge due to unknown etiology and tumor behavior, as well as the variety of the pathohistological findings. This tumor was frequently seen in middle aged female, especially in the fifth decade(3), It could have been brought about by progesterone receptors (1). The World Health Organization (WHO) suggested in 2004 that PSH is classified histologically differently from other benign tumors, making it an intermediate tumor with the potential to become malignant(4). Primary PSH was formally renamed as PSP and categorized as a pulmonary adenoma by the WHO in 2021(5). Treatment for this type of benign tumor is still up for debate. The primary treatment for pulmonary sclerosing pneumocytoma was surgery. Sublobectomy, including mainly segmentectomy and wedge resection, tended to be preferred for peripheral small-sized tumor(6), while lobectomy could stop the possibility of metastasis and recurrence, which would worsen the prognosis in the long run(7).

The objective of this study was to provide a comprehensive analysis of a 10-year period involving sclerosing pneumocytoma at a prominent medical facility specializing in the diagnosis and treatment of pulmonary disorders. Herein, we retrospectively reviewed pulmonary sclerosing pneumocytoma patients admitted to our center from 2013 to 2023, aiming to investigate demographic characteristics, clinical characteristics, CT characteristics and treatment for patients with pulmonary sclerosing pneumocytoma.

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II. MATERIALS AND METHODS

PSP, treated at the Shanghai Pulmonary Hospital, Tongji University School of Medicine, are the key subjects of this study. Retrospective Data between 2013 September to December 2023 gathered for this study includes all data from history to medical records. The total number of patients who participated in this study was 31.A diagnosis of PSP was confirmed in all patients via surgical resection.

Demographic Characteristic, Clinical Characteristics and CT characteristics, including Gender, Age, Smoking history, Reason for CT, Nodule location, Nodule shape, Clinical symptoms, Calcifications, Surgical Resections and Immuno-histochemistry was gathered from the patient's medical records.

➢ *Inclusion Criteria:*

- Presence of a Solid Pulmonary Nodule.
- Histological Confirmation: Requires the acquisition of a verified histological diagnosis through biopsy or surgical resection.
- The presence of high-quality CT imaging is required .
- Patient Demographics and Clinical Information: Inclusion criteria encompass instances that possess accessible Demographic Data (Age, Gender) and pertinent clinical information, such as Symptoms and Smoking history.

➢ *Exclusion Criteria:*

- Non-Solid or Sub solid Nodules.
- Exclusion of Cases without Histopathological Confirmation.
- Exclusion of Cases with Inadequate CT Imaging Quality.

➢ *CT Protocols*

Somatom definition AS (Siemens Medical Solutions, Forchheim, Germany) and Brilliance-64 (Phillips Medical Systems, the Netherlands) were used for chest CT scans. The scanners came with a 512 X 512 matrix, a 120KVp tube voltage, a 100-200mAs tube current, a 0.875-1.5mm pith, a 0.625-1.0mm collimation, and a 0.5s rotating speed. A medium sharp reconstruction approach with a thickness of 0.625 to 1.0 millimeters was used to rebuild the images. The reconstruction intervals were 5 millimeters thick, with the B50 technique using a 5-millimeter interval without a gap and the B60 approach using a 1-millimeter reconstruction with a 5-millimeter gap. The General Electric CT scanner used all of these parameters: Using dose modulation, 120 kV peak and 100–300 mA are accomplished.

The reconstruction intervals were 5 millimeters thick, with a lung algorithm 5-millimeter interval without a gap and a bone technique 1.25-millimeter reconstruction with a 5-millimeter gap. CT images were generated fifty seconds after intravenous infusion of 100 mL contrast and 50 mL normal saline at 2.5 mL/s using a power injector. The supraclavicular to adrenal gland scan range was covered. The picture archiving and communication system applied axial image adjustments to all photographs. The mediastinal picture was 450 HU wide, and the lung window image was 1500 HU wide and -700 HU. PACS displayed all CT imaging data. When patients were laying supine throughout the operation, all CT pictures were captured from the apex to the base of the lungs while holding their breath while breathing.

➢ *Statistical Analysis*

All of the collected data was tabulated in Microsoft Excel 2007.The study data sample characteristics were assessed by using descriptive statistics parameters which include mean, Median, standard deviations, and percentages.

III. RESULTS

The study on patients with pulmonary solitary pulmonary nodules (PSP) revealed that the mean age was 53.5±9.5 years with a standard deviation (SD) of 9.5. PSP was commonly observed in individuals aged 29 to 68 years, with the lowest and highest age in the group being 29 and 68 years, respectively. The age range was categorized into five groups, and the majority of patients (90.30%) fell into the 40-49 (19.35%), 50-59 (35.48%), and 60-69 (35.48%) age ranges. The study reported a higher prevalence of PSP in females, with 29 (93.5%) female patients compared to only 2 (6.5%) male patients, resulting in a female-to-male ratio of 14.5:1.

Among the PSP patients, only 1 (3.2%) had a history of smoking, while 30 (96.8%) had no history of smoking. In terms of presentation, 22 (71.0%) cases were identified during physical examinations for other reasons; 6 (19.4%) patients underwent a CT scan after experiencing clinical symptoms; 2 (6.5%) patients had a CT scan for pre-operative evaluation; and 1 (3.2%) case underwent a CT scan due to an accident. Symptoms among PSP patients included cough (3.2%), cough with sputum (9.7%), and 77.4% of patients reported no symptoms.

Regarding the location of nodules in PSP cases, 17 (54.83%) nodules were peripheral, and 14 (45.16%) were central. The mean PSP nodule diameter was 14.4±4.6 mm (range, 7–27 mm), with nodules distributed between 1–9 mm (12.9%), 10–19 mm (74.19%), and 20–29 mm (12.9%). The majority of nodules were observed in the lower lobes of the lungs (58.1%).

Morphological CT characteristics of the nodules showed that 38.7% had oval shapes with smooth and clear margins, 32.3% had round shapes with clear margins, 22.6% had lobulated shapes, and 6.5% had irregular shapes. Only 3 out of 31 cases exhibited calcification, particularly punctate calcification. The observed CT values (Hounsfield units) ranged from 6.34 to 87.96.

In terms of treatment, out of the 31 patients, 25 (80.64%) underwent Video-Assisted Thoracoscopic Surgery (VATS) with lobectomy, and 6 (19.36%) had VATS with wedge resection.

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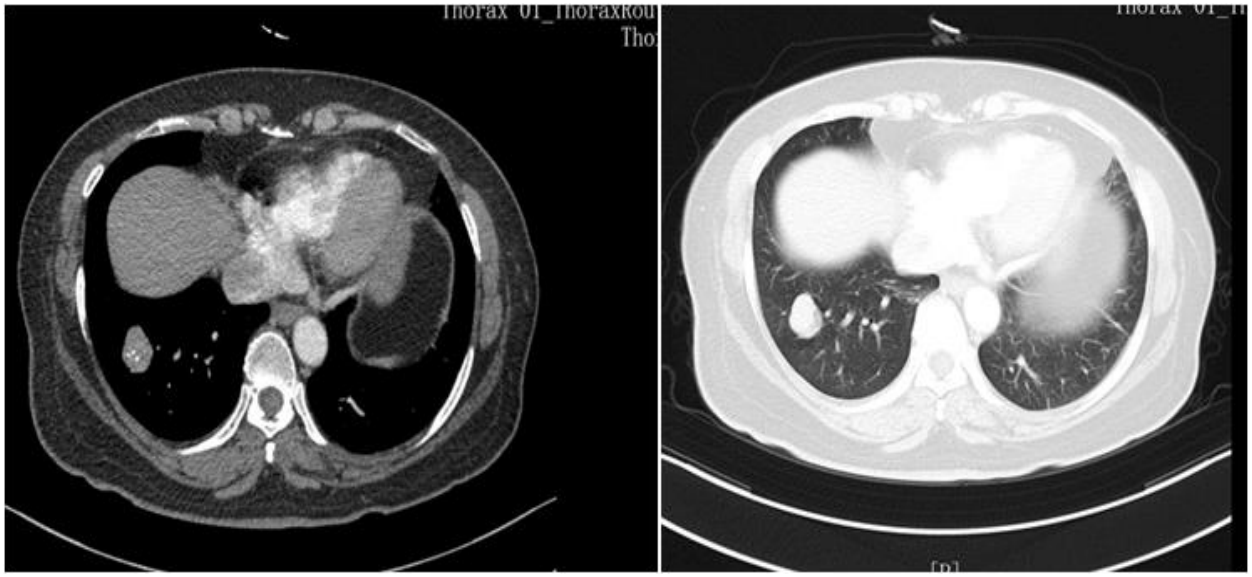

Fig 1 Axial and Mediastinal CT View in a 58 years old Female old Female with PSP, Showing the oval, Smooth Margin PSP,27 mm in Longest Diameter Showing the Calcification in the Mediastinal View

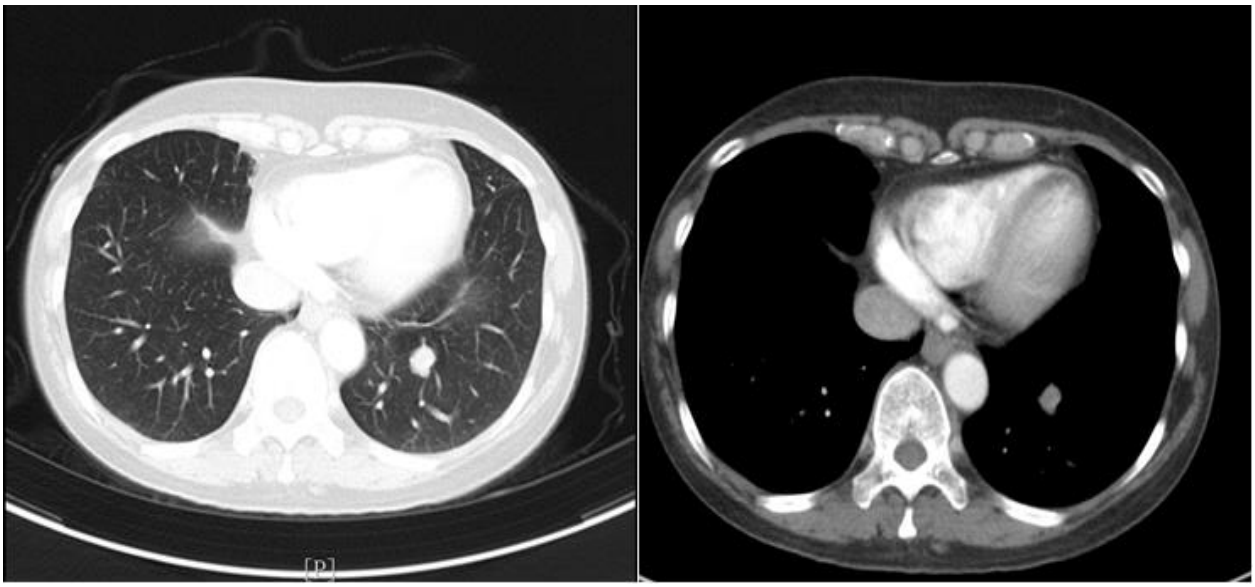

Fig 2 Axial and Mediastinal CT of 51 years old Female with PSP Showing Lobulated, Solid Nodule in the Lower lobe of Left Lungs

Table 1 Clinical Characteristics of the Patients

Characteristics	PSP, (%)
Gender	
Male	2(6.5%)
Female	29 (93.5%)
Mean Age	53. 5(29-68)
Age Range (years)	
20-29	1(3.22%)
30-39	2(6.45%)
40-49	6(19.35%)
50-59	11(35.48%),
60-69	11(35.48%)
Smoking History	
Yes	1(3.2%)
No	30(96.8%)

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Table 2 Clinical Manifestation

Clinical Manifestation	PSP, (%)
Cough	3(9.7%)
Cough, chest pain	0
Cough, fever	1(3.2%)
Cough, sputum	3(9.7%)
Fever, sputum	0
No symptoms	24(77.4%)

Table 3 Manifestation of Lung Lesion at on Set

Location of Lobe	
RUL	1 (3.2%)
RML	1 (3.2%)
RLL	1 (3.2%)
LUL	1 (3.2%)
LLL	1 (3.2%)
Mean nodule size (mm)	14.4 (7-27)
Size (mm)	
1-9	4 (12.9%)
10-19	23 (74.19%)
20-29	4 (12.9%)

Table 4 CT Findings of Patients with PSP

CT Findings	PSP, (%)
Nodule Laterality	
Central	14(45.16%)
peripheral	17(54.83%)
Mean Nodule size(mm)	14.4 (7-27)
Shape and Margin	
Oval, clear	12(38.7%)
Round, clear	10(32.3%)
Lobulated	7(22.6%)
Irregular	2(6.5%)
calcification	3(9.67%)
CT Value(Hounsfield Unit)	6.34 to 87.96 H.U

Table 5 Surgical Procedure used in PSP

Surgical Procedure	N=31, (%)
VATS with lobectomy	25, (80.64%)
VATS with wedge resection	16, (19.34%)

IV. DISCUSSION

Pulmonary sclerosing pneumocytoma is a rare benign neoplasm originating from type 2 pneumocytes.

Recent studies have reported the female population is affected, mostly occurring in the middle-aged population, with peak incidence in the age group 40–70 years (8, 9). This is similar to our study. The female population is more affected by PSP, with a female-to-male ratio of 14.5:1. The mean age of our study was 53.5 ± 9.5 SD. The Asian female population is the most affected as compared to the western population (8). Thirty of the thirty patients in our research were nonsmokers. The incidence of smokers and nonsmokers with confirmed PSP varied in other papers that are currently accessible; however, none of this research identified smoking as a risk factor or its impact on the neoplasm's development (9). Most patients are asymptomatic, and routine chest radiographs often identify the tumor as a soft-tissue mass incidentally (3). In our study, two-thirds of patients had no symptoms at all; coughing with sputum production was the most common symptom when the condition was clinically apparent. Besides cough and sputum, fever was the only presenting symptom. The presence of unspecific symptoms can be explained by the fact that the most frequent location of the nodule is in the lung parenchyma. Symptoms are typically caused by the compression of surrounding lung tissue as the mass grows at a variable rate (8). Usually, the pulmonary parenchyma is involved in PSP, but there have been a few documented instances of endobronchial presentation. Typically, the tumor in its endobronchial growth appears as a polypoid mass with surrounding mucosa that is edematous or ulcerative, and there may be necrotic and hemorrhagic regions. Severe respiratory arrest may occur if the tumor obstructs the lumen due to its development. A bronchoscopy

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is necessary to reveal this unusual placement. Post-obstructive pneumonia may result from this tumor if it is not appropriately detected [11]. In our study, 22 (71.0%) cases were found during a physical examination. This proved that most patients were asymptomatic, and CT was performed only after a physical examination for other conditions.

In our study, patients' greatest diameters ranged from 7 to 27 mm; other research indicates that lesions have a maximum diameter of 0.3 to 7 cm (3, 8, 12). Some writers have postulated that because of expansion and the pressure it puts on the nearby lung parenchyma, clinical symptoms may become apparent. Other writers, however, have taken issue with this assumption. However, one of the studies reported no relationship between the nodule size and the appearance of the clinical symptoms. Among the patients in our group, the smallest, 7mm, had no symptoms, and the largest, 27 mm, also had no symptoms. Although lobulated shape nodule were also noted. The majority of PSP in our study appeared in a round or oval form with a smooth edge on an unenhanced CT scan. In general, these imaging features point to a benign procedure rather than being specific enough to distinguish PSH from other solitary nodules in the lung. More than half of the nodules were peripherally located in PSP. In terms of the distribution of nodules in different lobes of the lungs, 16 nodules were located in the right lung [upper lobe = three, the middle lobe = seven, and the right lower lobe = eight], and fifteen nodules were located in the left lung [upper lobe = five and lower lobe = ten]. In this study, we observed the maximum number of lung nodules in the lower lobes of the lung. The lack of preference for any specific lung lobe was found in a study that included 28 individuals with a conclusive diagnosis of sclerosing pneumocytoma. Of the nodules, the lung's right upper lobe contained five, the right middle lobe had four, the right lower lobe contained six, the left lower lobe contained nine, and the left upper lobe contained three. (13). Our results are consistent with the other report. In our study, only 3 of the cases had calcification. The fewer incidences might be due to the nature of solid nodules, which are solid and dense in nature. CT results for the PSP in our study range from 6.34 to 87.96 H. U, demonstrating nodule density fluctuation. This difference may be due to the nodules' varied tissue compositions, including fibrous tissue, cellular components, and maybe calcifications. Such components can produce variable CT values. Overall, PSP's median CT value of 28.9 shows the dataset's central tendency and nodule density. Considering composition heterogeneity, it represents the average radiodensity of PSP lesions. Radiologists and clinicians can use CT values to describe pulmonary lesions and diagnose PSP.In our study 26 patients had performed VATS with Lobectomy and only 5 had VATS with wedge resection, Table :5. From our study we can conclude VATS with Lobectomy is the widely used procedure for the treatment of PSP in our center, reducing the post-operative complications and There is no recurrences and post follow up complication observed in our study.

V. CONCLUSION

A rare, benign lung tumor, pulmonary sclerosing pneumocytoma (PSP) mostly affects middle-aged females. Usually asymptomatic, found on routine chest radiographs. If symptoms occur, lung tissue compression is involved. Different nodule sizes contradict size-based symptom presentation assumptions. Imaging properties (round/oval forms, smooth edges) suggest benignity but lack specificity. Favoring peripheral, lower lung lobe. Calcification infrequent, CT density variable. VATS with Lobectomy is preferable due to low complications and no recurrences in our study. Our findings illuminate PSP and emphasize the need for careful assessment and customized surgery for best results.

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