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Solitary extramedullary plasmacytoma in the lung misdiagnosed as lung cancer: A case report and literature review

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Background: Extramedullary plasmacytoma (EMP) is an extremely rare kind of soft tissue plasma cell neoplasm without bone marrow involvement or other systemic characteristics of multiple myeloma. Primary pulmonary plasmacytoma (PPP), with no specific clinical manifestations, is an exceedingly rare type of EMP. Because of its complexity, PPP is often difficult to diagnose. Computed tomography-guided percutaneous core needle biopsy (CT-guided PCNB) has been shown to have high sensitivity, specificity and accuracy for characterization of pulmonary lesion, particularly if malignancy is suspected. Here we presented a rare case of PPP diagnosed with CT-guided PCNB.

Case presentation: A 78-year-old female smoker who visited our outpatient clinic for a mass in the left lower lobe of the lung. Pathological based on CT-guided PCNB yielded a PPP with no lymph node or other distant metastasis.

Conclusions: Extramedullary plasmacytoma should be considered in the differential diagnosis of a pulmonary mass.

KEYWORDS

primary pulmonary plasmacytoma, extramedullary plasmacytoma, CT scan, pathology, prognosis

Background

Extramedullary plasmacytoma (EMP) is a rare monoclonal plasma cell tumor involving tissues outside the bone marrow. The entity comprises approximately 3–5% of all plasma cell neoplasms. More than 80% of EMP cases occur in the head and neck, and most cases involve the upper aerodigestive tract (1). Primary pulmonary plasmacytoma (PPP) is an extremely rare variant of EMP. In a comprehensive literature search reviewing patients with PPP, only 16 reports were found (2–15) summarized in Table 1). Here, we present an extremely unusual presentation as a pulmonary mass and without bone marrow involvement. With respect to the different biologic characteristics and prognoses of PPP, it is essential to consider in differential diagnosis of lung mass. CT-guided needle aspiration biopsy should be considered as first line to gain biopsy sample.

Case presentation

A 78-year-old female with a mass in the left lower lobe of the lung was referred to our hospital. The patient was diagnosed with hypertension and coronary heart disease prior. She had an approximately 60-year history of smoking. She has suffered from post-exercising dyspnea for 3 years without any apparent cause. The patient showed up with chest pain intermittent on the left, and the dyspnea was deteriorated a half months ago. No obvious abnormalities were found in physical examinations. A routine laboratory test showed white blood cell count, 4.77 $\times 10^9$/L; neutrophil percentage, 50.8%; haemoglobin, 122 g/L; blood platelet count, 152×10^9/L; urine protein +/-. Serum calcium and phosphorus were within normal ranges. The rest of the routine laboratory examinations at the time of admission showed no obvious abnormalities. A chest computed tomography (CT) scan demonstrated a well-circumscribed mass measuring 23.14 × 21.33 × 20.28 mm located in left lower lobe (Figure 1). The mass was homogeneous and without any area of calcification or necrosis on a CT plain scan. It was marginal and spiculated with adjacent pleural retraction without bronchiolar obstruction. No obvious enlarged lymph nodes were found in the mediastinum. CT data resulted in a diagnosis of peripheral lung cancer. All the tumor marker was normal in the blood. Subsequently, the patient received CT-guided needle aspiration biopsy. The histological examination of the specimen revealed multiple lymphocyte and plasma cells were accumulated (Figure 2A). Immunohistochemistry was positive for LCA (CD45) (+++), CD 138 (+++), CD 38 (+++), kappa (+++), CK (-), CD 20(-), INSM1 (-), CD 56(-) (Figures 2B–I). In addition, specific stain of pathology including PAS, GMS were negative (Figures 2J–L). Pathological biopsy indicated extramedullary plasmacytoma. The patient was further evaluated by other diagnostic tests, including urine Bence-Jones protein, serum electrophoresis (Figure 3A), urine electrophoresis (Figure 3B), and bone marrow biopsy. However, all of the above tests had no abnormal change. The PET-CT revealed solid lesions with high grade increase 18F-fluorodeoxyglucose (18F-FDG) uptake in the lower left lobe of lung. There were no signs of abnormal metabolism in other organs and tissues, and no osteolytic lesions (Figure 4). Ultimately, the patient was diagnosed with PPP.

Discussion and conclusions

In the present study, we encountered an extremely rare case of primary lung plasmacytomas without involving bone marrow. According to the classification of the Wilshaw method (4): Stage I, the tumour is confined to the primary site; stage II, the tumour has invaded local lymph nodes; and stage III, there are obvious widespread metastases. Therefore, in this case, the tumor should be classified as stage I.

Solitary plasmacytomas (SP) are rare neoplasms, involving solitary plasmacytoma of the bone (SPB), solitary extramedullary (extra-ossesous) plasmacytoma (SEP) or multiple solitary plasmacytomas (MSP) (16). Generally SP do not involve systemic manifestation or bone marrow. However, the entity has a propensity to eventually progress to MM (16). SEP is encountered more frequently in sites having a rich lymphatic drainage such as nasal cavity, nasopharynx, and upper respiratory tract (16).

In the present study, we encountered an unusual site of SEP. The average age of PPP was 60 years old, one fourth of patients were under 50 years old. No gender difference was showed. The symptoms of PPP were nonspecific and depended on the location of the neoplasms and their tumor classification. Most PPP presented solitary pulmonary masses, multiple shadowed masses was rare on CT image. Therefore, PPP is often misdiagnosed as tuberculosis or lung cancer. The imaging findings of PPP reported in the literature are mostly solitary pulmonary nodules or masses, mostly located around the hilar, with round or quasi-circular shape, relatively uniform density and clear boundary (2). A few patients also show multiple nodules, masses or diffuse lesions in the lung (3). Consistently with previous reports (2), the tumor in this case on CT image was rounded masses with well-defined margins that was initially misdiagnosed as peripheral lung cancer. There are some subtle differences between PPP and peripheral lung cancer, tuberculoma, but there is no characteristic difference. In general, peripheral lung cancer is deeply lobulated with short hard burrs. The radiography of tuberculoma shows no lobule with calcified foci, and satellite lesions around. Peripheral lung cancer shows obvious enhancement, but tuberculoma shows no or light strengthening on enhanced CT scan. PPP presents with moderate uniform reinforcement on enhanced CT scan (2). The

TABLE 1 Summary of the literature in the clinical treatment and prognosis of primary pulmonary plasmacytoma.

Author	Age	Gender	Radiography	Histopathology	Immunohischemistry	Immunofixation and/or eletrophoresis	Bone marrow biopsy	Treatment	Prognosis
Si Nie[2]	48	Male	A well-circumscribed mass in the left lower lobe dorsal segment	Large plasma cells with Russell bodies	Positive for κ, CD138, CD38 Negative for CD20, λ,CD79a	Not mentioned	Not mentioned	Chemotherapy (detail not mentioned)	Disease free for 1.5 years after surgery followed
Sang-Heon Kim[3]	26	Female	Infiltrative lesions in both lower lung lobes	Diffuse infiltration of plasma cells	Positive for λ	Serum electrophoresis: decreased albumin, increased γ globulin	Negative	Chemotherapy	Complete resolution after 6 cycles therapy
Yi Zhou[4]	61	Female	A soft tissue mass in the middle and lower lobes of the right lung	Bronchial mucosa was infiltrated with inflammatory cells	Positive for LCA,CK, VIM,EMA,CD79a, CD38,CD138 Negative for CD3, CD68,S-100,κ, λ,CD56	Serum electrophoresis: decreased albumin, increased γ globulin Serum immunofixation electrophoresis: increased IgG,κ chain and λ chain	Negative	Surgery and chemotherapy (melphalan and prednisone)	No recurrence for 1.5 years after surgery followed
Rahim Y[5]	55	Male	A well-circumscribed opacity in the right upper lung zone	Infiltration by plasma cells with moderate degree of nuclear atypia	Positive for MUM-1, CD138,CD56	Serum immunofixation showed IgG-λ monoclonal gammopathy	Negative	Radiotherapy and chemotherapy (bortezomib, cyclophosphamide, dexamethasone)	Tumor size reduced at 6 months
Maqsood U[6]	77	Female	A bilobed, well-defined right apical mass	Medium sized atypical plasmacytoid cells with extracellular and perivascular amyloid deposition	Not mentioned	Not mentioned	Not mentioned	Radiotherapy	Not mentioned
Zhang L[7]	92	Female	A mass detected in the right posterior thoracic cavity	Plasma cells with rich cytoplasm infiltrated in lung tissue	Positive for CD38, CD56 CD56,VS38C, CD138 Negative for CD3, CD20,CD79a, LCA,EMA	Serum electrophoresis: decreased albumin, increased γ globulin	Not mentioned	Not mentioned	Not mentioned
Coelho LRA[8]	53	Male	Ovoid opacity in the right hilar region	Hypercellular light-brownish fragments	Positive for CD138, λ Negative for CD3,	protein electrophoresis was normal	Negative	Radiotherapy	After 3 years no finding of

(Continued)

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TABLE 1 Continued

Author	Age	Gender	Radiography	Histopathology	Immunohischemistry	Immunofixation and/or eletrophoresis	Bone marrow biopsy	Treatment	Prognosis
				and well differentiated plasmacytoid cells with small eccentric nuclei	CD20,κ AE1/AE3				disease recurrence
Z Moham-mad Taheri[9]	60	Female	Bilateral alveolar consolidation	infiltration by plasmacytoid cells with fine chromatin	Positive for CD79a, CD138 Negative for CD20, CK	Serum electrophoresis: M component in γ region	Negative	Chemotherapy (melphalan and prednisolone)	After 4 monthly courses chest X-ray became normal
Montero C[10]	59	Male	A tumor in the left main bronchus and enlarged lymph nodes	infiltration by plasmacytoid cells	Positive for IgA-κ	protein electrophoresis was normal	Negative	Surgical and radiotherapy	Disease free during a follow-up of 10 years
	64	Male	A mass in the right upper lobe	infiltration by plasmacytoid cells	Positive for IgG,κ	protein electrophoresis: increased IgG	Not mentioned	Radiotherapy	Disease free for 15 years followed
	56	Male	A mass in right upper lobe	infiltration by plasmacytoid cells	Positive for IgA,κ	protein electrophoresis: increased IgA-κ	Negative	Radiotherapy and chemotherapy (detail not mentioned)	Developed to septic shock during 3 cycle and died
Shi-Ping Luh[11]	42	Female	Right anterior mediastinal shadow with multiple pulmonary nodules	a solid mass made up mostly of plasma cells	Positively for κ chains Negatively for λ chains	plasma electrophoresis: Negative	Negative	Surgery and chemotherapy (detail not mentioned)	Symptoms improved after 2 months treatment
Nozomi Niitsu[12]	71	Female	A tumor in the right middle lobe	monotonous medullary proliferation of mature plasma cells	Positively for IgG,λ, CD79a,CD138,CD20 Negatively for κ,CD3	Not mentioned	Not mentioned	Chemotherapy (melphalan, prednisolne)	After 3 courses therapy, mass decreased in size
Geetha Joseph[13]	79	Male	A right hilar mass	infiltration by plasmacytoid cells	Postive for monoclonal λ chains	Not mentioned	Not mentioned	Right middle lobectomy	Not mentioned
Takahiro Horiuchi[14]	45	Female	Massive parenchymal infiltrate in the lower lobes	massive infiltration of lymphoidcells in interstitium and parenchyma	Positively for IgA,κ	Immunoelectrophoresis: monoclonal IgA-κ M-peak was recognized on electrophoresis	Negative	Chemotherapy (melphalan and prednisolone)	After 4 monthly courses, chest X-ray became normal
James N Wise[15]	65	Male	A right hilar mass	metastatic small oval cells present with hyperchromatic nuclei and occasional mitoses	Not mentioned	Serum electrophoresis: increased M-protein	Negative	A right upper lobectomy	15 months without recurrence

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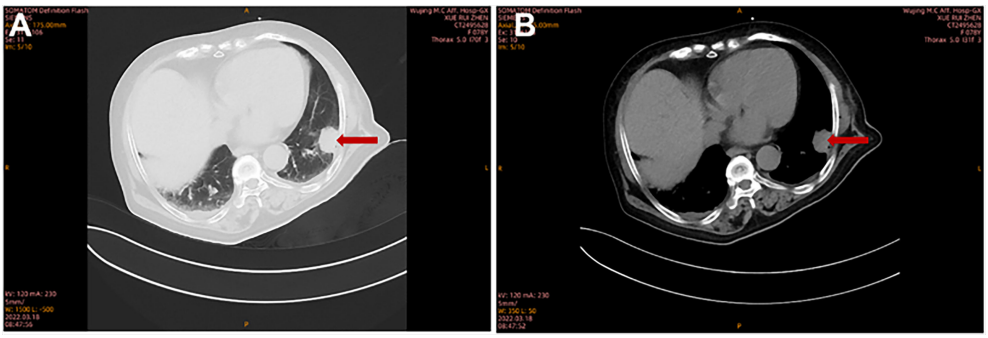

FIGURE 1
The imaging characteristics of PPP on pulmonary CT scan. Chest CT showed a solid lesion in the left lower lobe at lung window **(A)** and at mediastinal window **(B)**.

tumor markers of pulmonary carcinoma can be elevated, while tumor marker was negative in tuberculoma and PPP. Consistent with the CT presentation of previous cases, the mass was homogeneous and necrosis and calcification are rarely seen in this case (17). Few patients showed diffuse consolidation in bilateral lung (3, 9). Castleman disease is also a lymphoproliferative disease with hyperplastic germinal center of the lymphatic node. According to the distribution of lymph nodes, it was divided into Unicentric Castlman disease and Multicentric Castlman disease. According to pathology, There are three pathologic subtype, including hyaline vascular type, plasma cell type and intermediate type (18). Unicentric Castleman's disease, which mimic PPP, usually shows well-circumscribed and homogenous masses in mediatum with intense reinforcement on enhanced CT scan. Nevertheless, Unicentric Castleman's disease predominantly consists of the hyaline vessel variant (90%) (19). Histopathology is the only method to make a definitive diagnosis. The feature of Castleman disease is multiple concentric rings of mantle zone lymphocytes encircling atretic follicles. However, CD 38 and CD 138 are indicative of the diagnosis of plasmacytoma, especially CD138 (2, 4). In most circumstances, features of PPP tumor cells are positive for CD138, CD38, CD45, PC, EMA, and CD20, while negative for CD15. In a few cases, CK and EMA are positive, but negative for CD45 (4).

The use of PET/CT in evaluation of plasma cell malignancy has opportunities of detecting MSP or additional bone lesions when biochemical and laboratory investigations are within normal limits (20). Eletrophoresis of most cases showed decreased albumin and increased γ globulin (3–5, 7) or M-

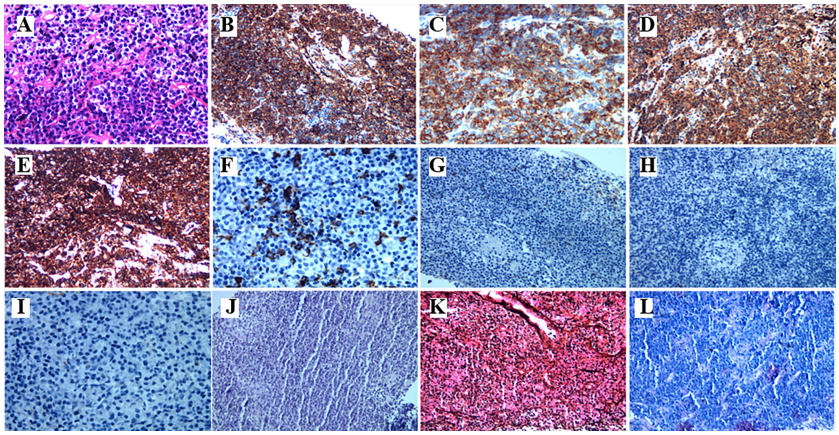

FIGURE 2
The histopathological characteristics of the tumor in the lung demonstrated by H&E and immunohistochemical staining. **(A)** Hematoxylin and eosin staining. The higher power view shows uniform small round blue cells with scant cytoplasm. **(B–I)** Immunohistochemical staining (400×magnification) was positive for CD38, CD138, Kappa, and LCA(CD45), CD20, but negative for CD56, CK, INSM1, respectively. **(J–L)** Specific stain of pathology of PAS, GMS, and acid fast stain, respectively.

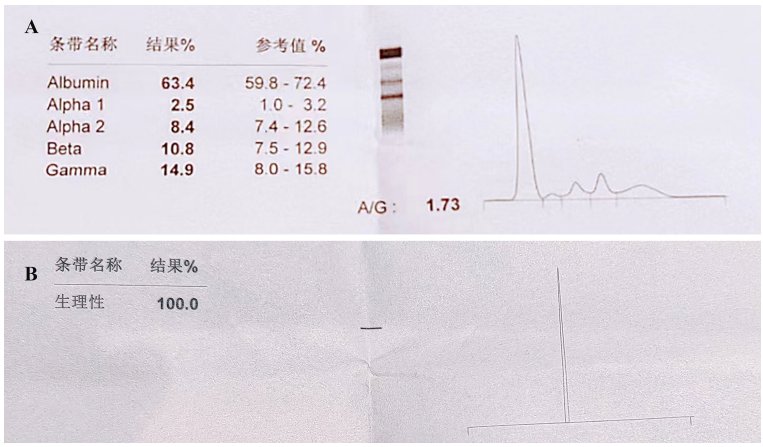

FIGURE 3
Serum and urine electrophoresis. No obvious abnormalities are detected in **(A)** Serum electrophoreis and **(B)** urine electrophoresis.

peak (9, 14, 15). Consistent with few cases serum eletrophoresis showed normal (8, 10, 11). In this case, immunohistochemistry findings showed the infiltration of numerous lymphocyte and plasma cells positive for CD138 and CD38. PET-CT showed no evidence of osteolytic lesions and distant metastasis. Thus, a diagnosis of PPP was made.

There are no established treatments for patients with PPP. Anatomic pulmonary resection with or without radiotherapy are the most therapeutic approach for PPP (6). Adjuvant chemotherapy is usually conservative treatment in case of diffuse infiltration, aggressive lesion on histopathology, or poor local control after local surgery or radiotherapy (21, 22). Melphalan and prednisone are commonly used chemotherapy scheme (21, 22). Chemotherapy is considered in patients with tumors larger than 5cm (4). Taking into account, the size of the primary lesion without local infiltration or distant metastasis. We planned complete radiation therapy for the elderly patients with multiple comorbidities. Long-term survival in PPP remains unclear, due to limited follow-up data on too few patients. PPP has a relative favourable prognosis, as evidence by previous

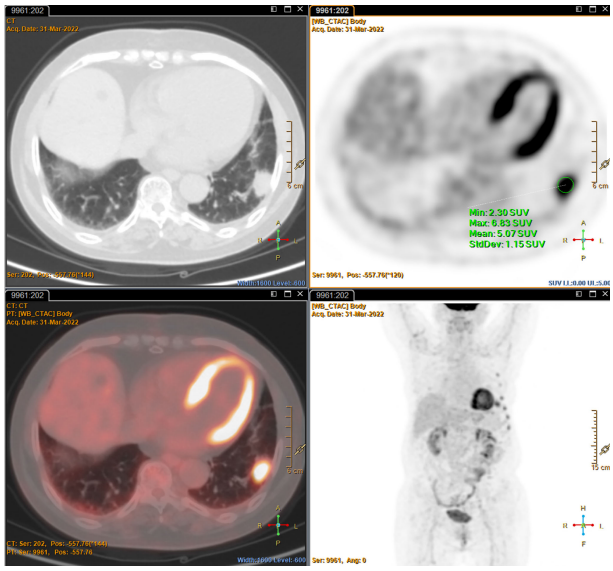

FIGURE 4
The Positron emission tomography-CT imaging characteristics shows a soft tissue density with hypermetabolism in the left lower lobe, but no abnormal metabolism in other organs and tissues, and no osteolytic lesions.

findings that these patients survived 10-20 years (10, 21). 20%-40% rate of progress to MM was noted (23). After 4 courses of radiotherapy, the chest X-ray became normal. Further follow-up is needed to monitor the progression of this case, and determine optimal treatment strategies for similar case.

In conclusion, we report an extremely rare presentation of SEP. This case highlights that attention should be paid to the differential diagnosis of pulmonary mass. Precise biopsy and optimal pathological evaluation will confirm the diagnosis. Doctors should be mindful of PPP as a differential diagnosis.

Ethics statement

This case report was approved by the Medical Ethics Committee of Characteristic Medical Center of Chinese People's Armed Police Force. The patient and her family consented to participate the study.

Author contributions

The authors' contributions are described as followed. JW and BL collected the data of medical history. JW wrote the manuscript. XY and XL collected the imaging data. TH collected the pathological data. LY and JL did the CT-guided needle aspiration biopsy. JL and FY revised the manuscript. JL and FY were the guarantors of this work and take responsibility for the contents of the article. All authors have contributed significantly and are in agreement with the content of the manuscript. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

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