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CLINICAL CASE REPORT

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Primary Pulmonary Diffuse Large B-Cell Lymphoma on FDG PET/CT-MRI and DWI

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Abstract: Primary pulmonary diffuse large B-cell lymphoma (PPDLBCL) directly arising from lung tissue is extremely rare. It may usually be misdiagnosed as inflammation including pulmonary tuberculosis, even lung cancer, because its clinical symptoms and signs are often nonspecific. The final diagnosis usually depends on lung biopsy. Herein, we report a case of PPDLBCL and review of diagnosis of this disease, particularly in radiology.

A 44-year-old man presented with cough, sputum, and intermittent chest pain for 4 weeks. Multiple radiological examinations showed an irregular mass in the right upper lobe with ground-glass opacities around it and air-filled bronchi in the consolidation. Fluorodeoxyglucose (FDG) positron emission tomography/computed tomography-magnetic resonance imaging (MRI) detected positive FDG uptake, and diffusion-weighted imaging indicated abnormal hyperintension in the lesion. Inflammation was suspected, but malignance cannot be excluded.

Finally, ultrasound-guided fine-needle aspiration cytology was performed for histological examination and definitive diagnosis yielded lymphomatous cells infiltration in the right upper lobe.

This report emphasizes the significance of multimodality radiological examinations. Multimodality imaging contributes to proper diagnosis, staging, and management of lymphomas.

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Abbreviations: CHOP = cyclophosphamide hydroxydaunorubicin oncovin prednisolone, CT = computed tomography, DWI = diffusion-weighted imaging, FDG = fluorodeoxyglucose, MRI = magnetic resonance imaging, PET = positron emission tomography, PPDLBCL = primary pulmonary diffuse large B-cell lymphoma.

INTRODUCTION

Diffuse large B-cell lymphoma (DLBCL), a kind of non-Hodgkin lymphomas, is extremely rare directly arising from lung tissue. It occurs only in 10% cases of primary pulmonary non-Hodgkin lymphoma, which is uncommon and accounts 0.4% of all lymphomas.[1,2] The clinical symptoms and radiological findings are often nonspecific, which may misdiagnose as inflammation, tuberculosis, even lung cancer. Definitive diagnosis most often requires invasive open lung biopsy or computed tomography (CT)-guided fine-needle aspiration cytology.[3] In this report, we describe a case of primary pulmonary diffuse large B-cell lymphoma (PPDLBCL) who presented with pulmonary shadows mimicking inflammation.

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CASE REPORT

Ethical Review and Patient Consent

It is not necessary to achieve ethical approval for this case report and this report requires obtaining patient consent because this study is dealt with only the patient's medical record and related images, retrospectively. Consent of this case report was obtained from the patient.

Case

A 44-year-old Xuzhou-born Chinese man presented with cough, sputum, and intermittent chest pain of 4 weeks' duration. His past medical history included hyperglycemia and thyroiditis. Physical examination found normal skin and no hepatosplenomegaly or peripheral lymphadenopathy. Laboratory investigations revealed a significant white blood cell count of 15.4×10^9/L and the percentage of neutrophils was 79.6%. Other abnormal laboratory data included C-reactive protein, 35.1 mg/L; erythrocyte sedimentation rate, 36 mm/h; and blood platelet count, 325×10^9/L. The serum lactate dehydrogenase concentration was increased (269 IU/L). The serum level of neuron-specific enolase was slightly increased (15.7 ng/mL). Liver function parameters and serum immunoglobulin concentration were normal.

Chest radiograph revealed an irregular mass in the right upper lobe, and the mediastinum was no evidence of abnormality (Figure 1A). Unfortunately, because of losing follow-up, the patient was untreated until 6 months later. A CT of the chest showed a huge mass in the right upper lobe with ground-glass opacities around it and air-filled bronchi in the consolidation. Enhancement was homogeneous after intravenous contrast injection (Figure 1B–E). Then, fiberoptic bronchoscopy was performed, including bronchial washing, brushing, and transbrochial biopsy. The specimen showed histological finding of ''chronic inflammation of mucosa'' and had no evidence of acid-fast bacilli, fungi, or malignant cells by cytology examination. The patient was initially treated with quinolones empirically for presumed atypical lobar pneumonia, but he failed the antibiotic therapy. Further examinations of fluorodeoxyglucose (FDG) positron emission tomography (PET)/CT-magnetic resonance imaging (MRI) and diffusion-weighted imaging (DWI) were performed. As shown in 3-dimensional maximum intensity projection, fused PET/CT and PET/MR images (Figure 2A–C), there were an FDG-avid mass and a smaller lesion in the right upper lobe, and the maximum standardized uptake value (SUV_{max}) was about 22.7 g/mL. After delay scanning, the SUV_{max} was up to 24.4 g/mL. Furthermore, some abnormal

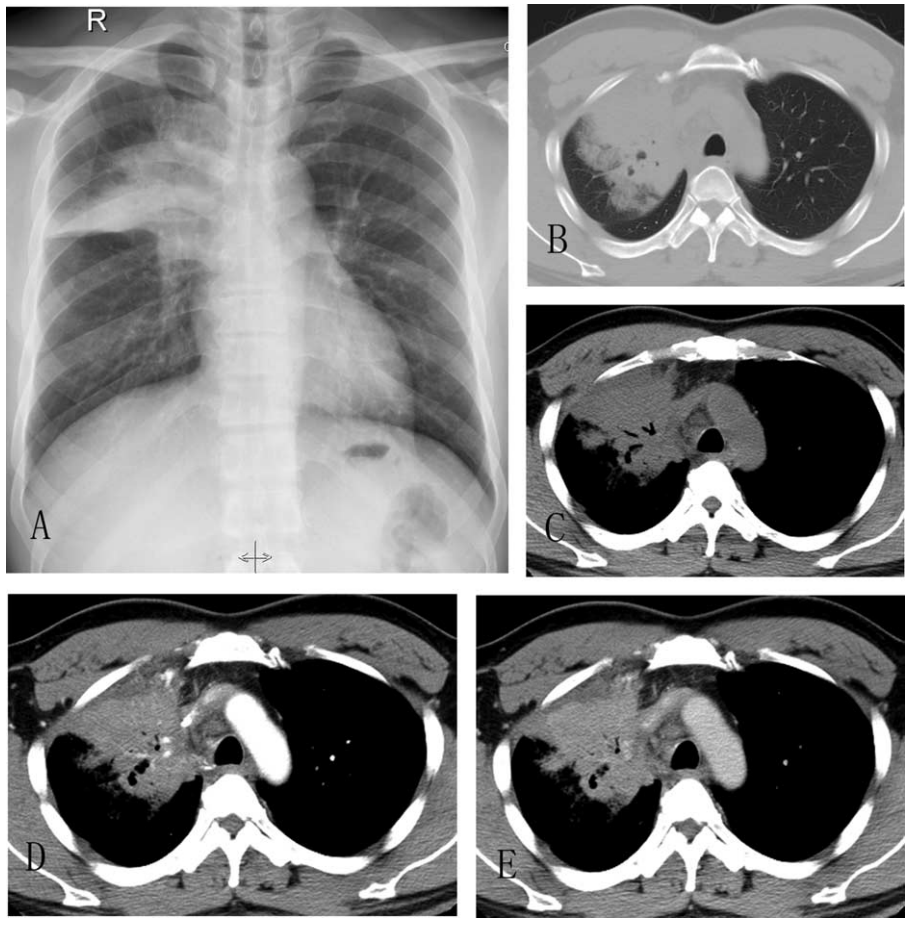

FIGURE 1. (A) Chest radiograph showing a mass of 8.9 × 6.7 cm. After 6 months, computed tomography scan images for a 8.3 × 7.2-cm-sized, homogeneous enhanced irregular mass on the right upper lobe and 1.2 × 1.1-cm-sized lymph node in the mediastinum were observed (B, lung setting view; C–E, mediastinal window view).

uptake nodules in right upper and lower paratracheal area were believed to represent lymph nodes enlargement, SUV_{max} was approximately 5.9 g/mL, and had no significant change after delay. Heterogeneous high-intensity signals were observed in the right upper lobe upon the axial DWI (b value: 600 s/mm2, repetition time/ echo time: 12,857/56 ms, field of view: 420 × 378 mm, matrix: 96 × 128, thickness: 7 mm, spacing: 2, and fat suppression method: spectral attenuated inversion recovery). The interior parts of the bronchus did not have high signal intensity (indicated by arrowhead in Figure 2D).

Ultrasound-guided fine-needle aspiration cytology was performed for definitive diagnosis in other hospital. The sample was reported as a lymphohistiocytic infiltrate with atypical lymphocyte. Immunohistochemically, the tumor cells expressed cluster of differentiation 20 (CD20), CD79a, MUM-1, and bcl-2 with a proliferation of 60% by staining with Ki-67. They were not stained for CD10, CD3, and CD15. Thus, a diagnosis of PPDLBCL was made. After definitive diagnosis, the patient underwent rituximab–cyclophosphamide hydroxydaunorubicin oncovin prednisolone (CHOP) chemotherapy treatment with mabthera, vindesine, doxorubicin, cyclophosphamide, and prednisolone, which were planned to be repeated every 21 days for 6 cycles. Following the administration of 2 cycles of rituximab–CHOP chemotherapy, chest radiography confirmed obviously remission of the right lung mass (Figure 3).

DISCUSSION

The criteria for the diagnosis of PPDLBCL include the following: pathological and immunohistochemical features of DLBCL, a primary lesion restricted to the lung (parenchyma and/or bronchi) with or without minimal hilar lymph node involvement, and clinical, radiological, and pathological exclusion of the disease at distant sites.[4,5] Our case meets these criteria.

Primary pulmonary lymphomas (PPLs) originate from mucosa-associated lymphoid tissue (MALT), which may be Hodgkin or non-Hodgkin lymphoma. The most common PPL is MALT lymphoma, yet DLBCL is less frequent and is believed to have a poorer prognosis than MALT lymphoma. The incidence of PPL peaks in the 5th and 7th decades of life, with a male-to-female ratio of 1.07:1.[6] Most PPLs patients present with nonspecific symptoms, such as dry cough or chest pain. High lactic dehydrogenase levels, high sedimentation rates, and anemia are typical.[7] In addition, PPLs can attack hilar or mediastinal lymph nodes and adjacent or distant organs during the proceeding. Sometimes bone marrow may be involved.[8] In the present case, direct invasion of lymphoma cells into the

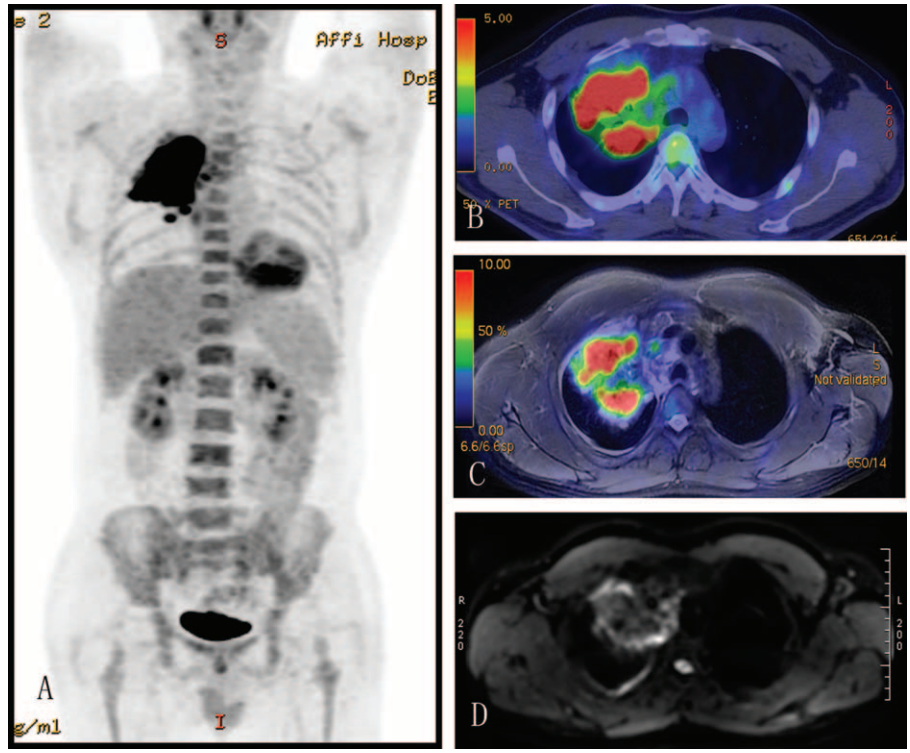

FIGURE 2. FDG PET/CT-MRI and DWI examinations were performed. The 3-dimensional MIP image in (A) coronal plane demonstrated FDG uptake lesions, including the primary pulmonary lymphoma and mediastinal lymph nodes. Selected axial slices of fused (B) PET/CT; (C) PET/MR images showed abnormal focal FDG uptake. (D) DWI showed heterogeneous high-intensity signal mass, but the interior parts of the bronchus were normal (arrowhead). CT = computed tomography, DWI = diffusion-weighted imaging, FDG = fluorodeoxyglucose, MRI = magnetic resonance imaging, PET = positron emission tomography.

upper respiratory tract was not demonstrated, whereas the axial skeleton including thoracic and lumbar vertebras, ribs, pelvis, and bilateral femur slightly express FDG uptake. However, bone marrow examination was not performed. As PPLs can present with different radiological manifestations, an accurate diagnosis is often not easy. Definitive diagnosis usually requires an open thoracotomy and lung biopsy.

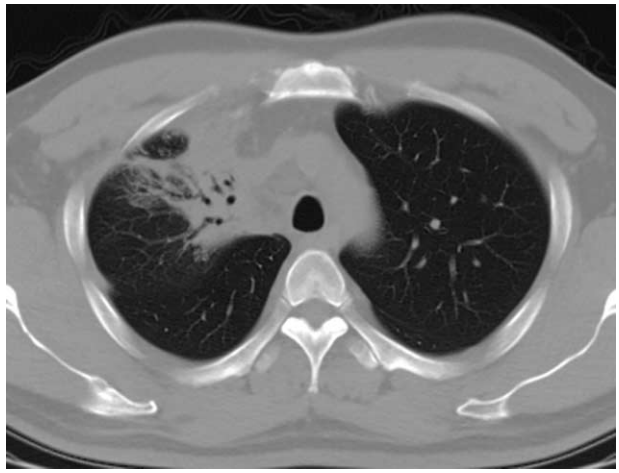

FIGURE 3. After 2 cycles of rituximab–CHOP chemotherapy, the lesion was remised visibly. CHOP = cyclophosphamide hydroxydaunorubicin oncovin prednisolone.

Nevertheless, radiological examinations are significant. CT provides morphologic information. FDG PET/CT has emerged as a powerful functional imaging tool with high sensitivity and specificity for the diagnosis of lymphoma with or without invasion around the whole body and is feasible for lymphoma staging and therapy response assessment in lymphoma.[9] At present, there is also growing interest in the application of FDG PET/MRI and high-b-value DWI. Pilot studies by Platzek et al[10] demonstrated that FDG PET/MRI appears to be a promising modality for the evaluation of lymphoma because of the excellent soft tissue contrast of MRI.[11] DWI provides a high lesion-to-background contrast, which is considered to be a sensitive imaging modality for detection of pathologic lymph nodes. Limited in the size and different biophysical and biochemical underpinnings of lymph nodes, both DWI and FDG PET may appear false negative, which may change the clinical staging and therapeutic regimen.[12] Therefore, the information provided by the multimodalities may be regarded as complementary. The addition of diagnostic DWI could improve the accuracy of FDG PET, especially for extranodal lymphoma involvement. In our case, there are many enlarged mediastinal lymph nodes; however, just nodules in right upper and lower paratracheal area are positive on FDG PET and DWI.

The stage and histopathological diagnosis of the malignancy have a major impact on its treatment and prognosis. Treatment options for localized disease include definitive resection, chemotherapy, or radiotherapy. Large B-cell lymphoma, usually progress rapidly, is frequently treated by CHOP,

and rituximab may improve the response to CHOP treatment. The median time to disease recurrence or death in this series is 6 years,[6] and patients who did have disease recurrence were all successfully treated with chemotherapy. In our case, rituximab–CHOP treatment had been proved efficacious.

In summary, PPDLBCL is extremely rare, suited for differential diagnosis in occupying lesion of lung. Multimodality imaging contributes to the diagnosis and management of intranodal and extranodal lymphoma.

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