

# CT and PET/CT findings of primary pulmonary diffuse large B-cell lymphoma

## One case report and literature review

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### Abstract

**Rationale:** Primary pulmonary diffuse large B-cell lymphoma (PPL-DLBCL) is rare and its clinical manifestations lack specificity. In this report, we present one case of PPL-DLBCL with complete clinical and imaging data, including uncontrast-enhanced CT, contrast-enhanced CT, and positron emission tomography (PET)/CT. Previous cases will also be reviewed and summarized.

**Patient concerns:** A 62-year-old woman was hospitalized due to a swelling pain located in the right side of her back that persisted for >1 month. Local CT examination indicated a pulmonary infection and anti-infective therapy was administered; however, her symptoms did not improve. In the hospital, a lung CT scan with enhancement showed hyperintensity of the right upper lobe (RUL), ill-defined margins, inhomogeneous density, with air bronchograms, and mild-to-moderate enhancement. PET/CT showed a slight hyperintensity of mass with high uptake (about 14.7 standardized uptake value [SUV]), and no high uptake was found in other locations.

**Interventions:** A CT-guided percutaneous needle biopsy with Tru-Cut needles was performed.

**Diagnoses:** The final diagnosis was PPL-DLBCL.

**Outcomes:** After 4 rounds of chemotherapy using the rituximab-cyclophosphamide hydroxydaunorubicin oncovin prednisolone (R-CHOP) regimen, the patient's pain was significantly relieved.

**Lessons:** Finally, the PPL-DLBCL manifestation was similar to other types of PPL clinical manifestations and CT manifestations, but the PPL-DLBCL PET/CT showed an apparent, high metabolism. CT-guided percutaneous transthoracic needle biopsy can clearly diagnose the disease.

**Abbreviations:** MALT = mucosa-associated lymphoid tissue type, PET = positron emission tomography, PPL = primary pulmonary lymphoma, PPL-DLBCL = primary pulmonary diffuse large B-cell lymphoma, R-CHOP = rituximab-cyclophosphamide hydroxydaunorubicin oncovin prednisolone, RUL = right upper lobe, SUV = standardized uptake value.

**Keywords:** computed tomography, imaging, positron emission tomography, primary pulmonary lymphoma

## 1. Introduction

Primary pulmonary lymphoma (PPL) is defined as a clonal lymphocytic proliferative disease that primarily appears in one or both sides of the lung parenchyma and/or bronchus without extrapulmonary tissue invasion of the lesion during the diagnosis

or 3 months after the diagnosis.<sup>[1]</sup> PPL is a rare extranodal lymphoma which accounts for <1% of all non-Hodgkin lymphoma cases.<sup>[2]</sup> PPL has the most common manifestation as mucosa-associated lymphoid tissue type (MALT) lymphoma, which accounts for about 70% to 90% of cases, and the proportion of primary pulmonary diffuse large B-cell lymphoma (PPL-DLBCL) cases is only 10%.<sup>[3]</sup> Because PPL-DLBCL does not have specific symptoms and signs, and imaging results are easily confused with other diseases, PPL-DLBCL is difficult to diagnose.

At present, there is only a small amount of literature that reports the manifestations of PPL-DLBCL.<sup>[3–12]</sup> Here we report a case of PPL-DLBCL that was confirmed by CT-guided lung biopsy with complete clinical and imaging data.

## 2. Informed consent of the patient

The patient signed the relevant document. The patient knows and agrees that the relevant clinical and imaging data may be used for research or magazine publication.

## 3. Case report

A 62-year-old female presented with swelling pain in her right back that persisted for >1 month. The patient had an occasional

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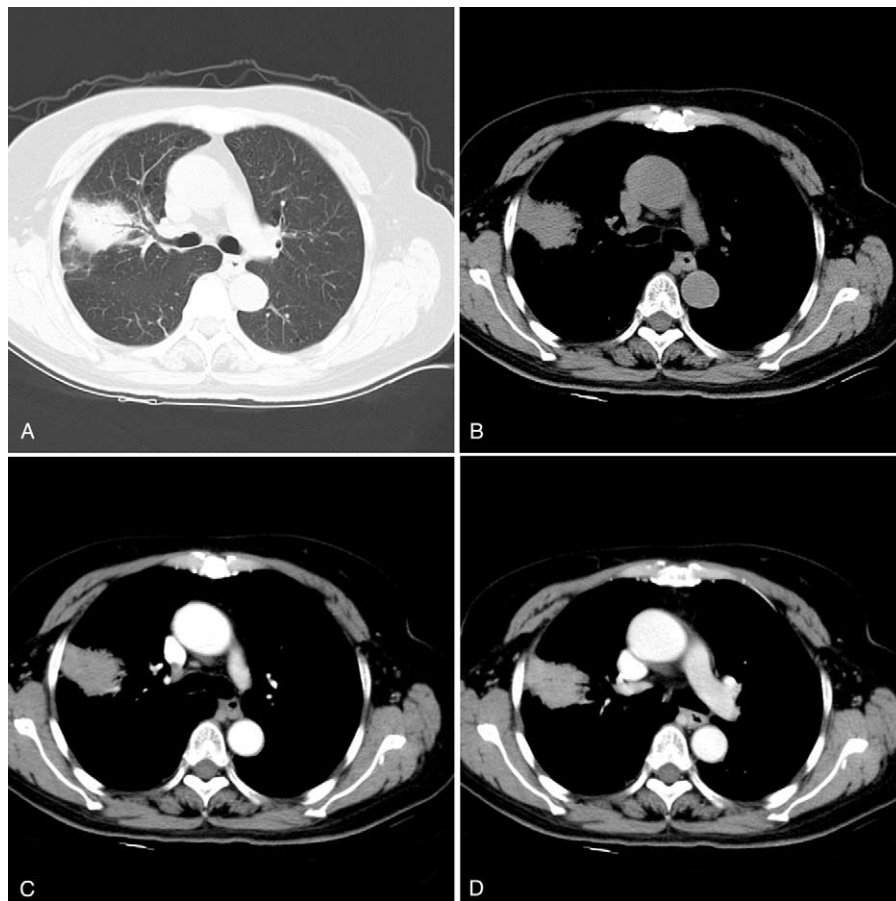
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**Figure 1.** (A) Transverse lung CT shows consolidation of the right upper lung and air bronchograms inside. (B) Mediastinal window shows inhomogeneous density of lesions. (C) and (D) Contrast-enhanced CT shows the lesion appears with mild-to-moderate reinforcement. (B–D) CT values of the lesion are about 46.6, 58.9, and 78.0 HU, respectively).

cough without sputum, the degree of her swelling pain was not severe, and the pain was not relieved in the supine posture. The patient was without smoking or alcohol abuse history. Then, the patient carried out a chest CT examination in the local hospital that showed an infectious lesion in the superior lobe of the right lung. After 2 weeks of anti-infection treatment with ceftiozime, pain in her right back was relieved; however, a chest CT examination found that the size of the lesion in her right upper lung did not shrink. Therefore, a biopsy was performed and results showed a lymphoproliferative lesion, with B lymphocyte and plasma cell proliferation. The patient was admitted to our hospital for further diagnosis. Her physical examination did not show swollen surface lymph nodes, liver, and spleen. We did not find obvious abnormalities in the laboratory examination, routine blood test, liver and kidney functions, or tumor markers. Bone marrow biopsy showed that hematopoietic tissue hyperplasia was still active without atypical lymphoid cells.

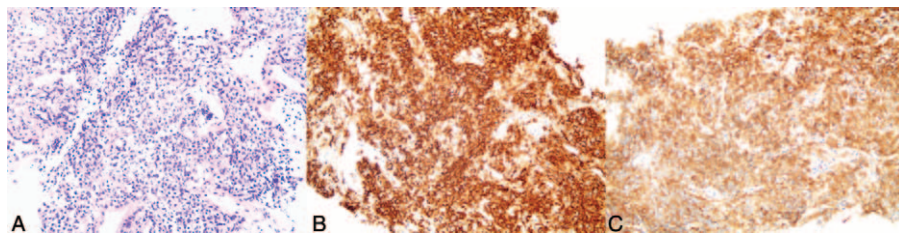
The pulmonary CT scan with enhancement showed hyperdensity of the right upper lobe (RUL), ill-defined margins, and inhomogeneous density, with air bronchograms. The contrast-enhanced CT scan showed mild-to-moderate enhancement of the lesion (Fig. 1). We did not find an obvious swollen lymphonodus shadow in the 2 pulmonary hila and mediastinum. Combined with the biopsy results in the local hospital, the imaging diagnosis may have been PPL. In our institution, CT-guided percutaneous transthoracic needle biopsy showed that the B lymphoid cells have abnormal hyperplasia and immunohistochemical analysis

showed CD20(+), CD79a(+), CD43(+), parts of CD3/CD5(+), scattered CD30(+), CD21/CD23FDC(+), few Bcl-6(+), Bcl-2(+), CD10(–), Kappa(k)(–), and Lambda(λ)(–) (Fig. 2). The pathologic diagnosis was PPL-DLBCL. Complete PET/CT examination showed that the superior lobe of the right lung had RUL hyperdensity, with a size of  $2.2 \times 3.5 \times 4.0 \text{ cm}^3$  and obscure edges, and part of the superior lobe of the right lung had adhesions with the adjacent pleura. A bronchial shadow and abnormal increase of radioactivity uptake was observed. The maximum standardized uptake value (SUV) was 14.7, and other parts of the body did not have an obvious abnormal increase of [ $^{18}\text{F}$ ]-2-fluoro-2-deoxy-D-glucose (FDG) metabolism, such as the bone marrow and systemic lymph nodes (Fig. 3). Finally, the clinical diagnosis was PPL-DLBCL.

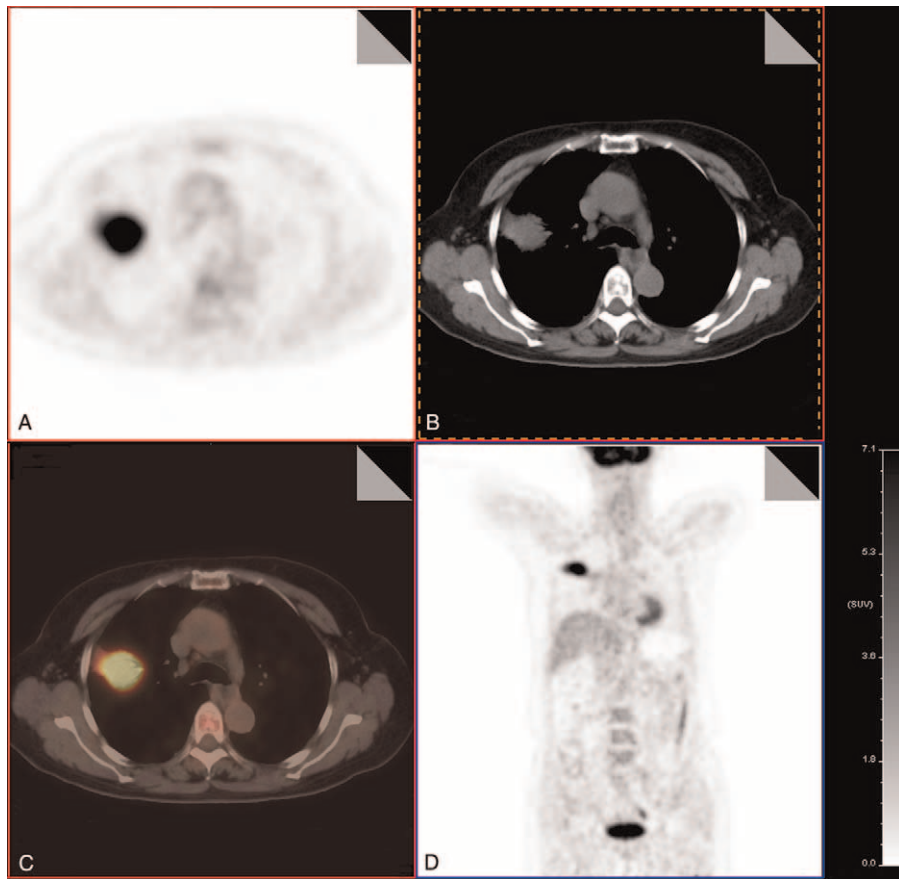
After a clear diagnosis, 4 courses of rituximab-cyclophosphamide hydroxydaunorubicin oncovin prednisolone (R-CHOP) chemotherapy were successfully carried out. The previous symptoms were relieved after the treatment and a pulmonary CT scan showed the lesion had markedly reduced in size.

#### 4. Discussion

The age of onset of PPL is 5 to 6 years, and men and women have similar rates of involvement.<sup>[2]</sup> The age of onset of the reported PPL-DLBCL ranges from 26 to 79 years old, with an average age of onset of about 61 years old.<sup>[3–12]</sup> The morbidity rate in men and women is basically the same.<sup>[3–11]</sup> About half of PPL cases have no



**Figure 2.** (A) Nuclear large dimorphism B lymphoid cell infiltration (HE staining at 200× magnification). (B) and (C) CD20 and CD79a positive staining (100× magnification).



**Figure 3.** (A–C) High FDG uptake in the right upper lung tumor (A: PET image, B: CT mediastinal window, C: PET and CT fusion images). (D) Other parts in the body do not have obviously high metabolism, except the tumor in the right upper lung.

symptoms, or the manifestation is that patients lack specific respiratory symptoms, such as cough, dyspnea, and pectoralgia.<sup>[2]</sup> In addition to the one case of the reported PPL-DLBCL without clinical symptoms,<sup>[8]</sup> other cases have clinical symptoms from 1 week to 3 years, including systemic manifestations of fever and weakness and partial symptoms of difficulty breathing, cough, shortness of breath, chest pain, backache, and occasional weight loss.<sup>[3–7,9–12]</sup> Similar to previously reported PPL-DLBCL cases, in our case, older women have similar respiratory symptoms. Therefore, the age of onset and the gender preference of PPL-DLBCL are similar to MALT lymphoma, a type of PPL, but PPL-DLBCL is more likely to present clinical symptoms.

CT manifestations of PPL include pneumonia-like consolidation, lumps, nodules, ground glass opacities, or interstitial

lesions. The reported PPL-DLBCL imaging is also diverse and it cannot be distinguished from other types of PPL. In CT scans, PPL-DLBCL has patchy or irregular consolidations with or without ground glass opacities.<sup>[4,6,10–12]</sup> PPL-DLBCL has single or multiple nodules<sup>[5,7]</sup> or huge lumps<sup>[9]</sup> and multiple thick wall cavities of occasional manifestation.<sup>[8]</sup> Interstitial involvement can also occur in PPL-DLBCL cases.<sup>[3]</sup> When PPL-DLBCL infiltrates walls of the chest, the imaging may show a thickening pleural nodule with pleural effusion.<sup>[10]</sup> The enlargement of the mediastinal lymph node is occasionally merged.<sup>[7]</sup> Although PPL-DLBCL imaging lacks specificity, PPL-DLBCL needs to be considered in the condition of tumor-like consolidation with the pulmonary nodules in an air bronchogram.<sup>[6]</sup> Only one case describes that the contrast-enhanced CT manifestation of

PPL-DLBCL has a homogeneous enhancement.<sup>[9]</sup> The contrast-enhanced CT of our case of PPL-DLBCL also has a homogeneous enhancement, and the degree of mild and moderate enhancement is different, with an obvious enhancement of pneumonia. We believe that the difference in the degree of enhancement may have a potential value for the differential diagnosis between PPL-DLBCL and pneumonia. In PET/CT, low-grade B-cell PPL is reported with even, mild FDG uptake and the maximum SUVs range from 2.3 to 5.7 SUV, with an average value of 3.3 SUV.<sup>[11]</sup> However, the PPL-DLBCL cases show marked increase in FDG uptake,<sup>[3–5,8–12]</sup> and the maximum range of uptake is from 6.4 to 26.1 SUV, with an average value of 15.7 SUV.<sup>[3,8–11]</sup> The high FDG metabolism observed in PPL-DLBCL cases suggests a higher grade and more invasive malignancy in comparison with low-grade PPL.

Bronchial endoscopy has little value in diagnosing PPL-DLBCL,<sup>[5,6]</sup> but transbronchial needle aspiration, transbronchial lung biopsy, and fine-needle aspiration cytology are considered to have a certain diagnostic value.<sup>[6,7,9–12]</sup> Some PPL-DLBCL cases can be clearly diagnosed through thoracoscopy or thoracotomy.<sup>[3,4,8,10,11]</sup> However, our case of PPL-DLBCL obtained the final pathological result through CT-guided percutaneous biopsy with Tru-Cut needles. We believe that we can obtain a relatively large tumor tissue specimen using Tru-Cut needles, and it is beneficial for obtaining a clear pathological diagnosis compared with needle aspiration. PPL-DLBCL treatment, including local excision and chemotherapy, can have good therapeutic effect.<sup>[3,4,6–12]</sup> For patients with PPL-DLBCL, the R-CHOP chemotherapy regimen is an option.

In conclusion, having nonspecific clinical symptoms, the age of onset of PPL-DLBCL is similar to other types of PPL. There are a variety of PPL-DLBCL CT manifestations with mild and moderate enhancement. PET/CT shows apparent, high metabolism of PPL-DLBCL, which is different from low-grade B-cell PPL. CT-guided Tru-Cut needle biopsy can get a clear diagnosis.

Lastly, the R-CHOP chemotherapy regimen can be used for PPL-DLBCL treatment.

## References

- [1] Freeman C, Berg JW, Cutler SJ. Occurrence and prognosis of extranodal lymphomas. *Cancer* 1972;29:252–60.
- [2] Cadranet J, Wislez M, Antoine M. Primary pulmonary lymphoma. *Eur Respir J* 2002;20:750–62.
- [3] Wróbel T, Dziatczenia J, Prochorec-Sobieszek M, et al. Primary pulmonary diffuse large B-cell lymphoma. *Am J Hematol* 2012;87:107–8.
- [4] Ogata-Suetsugu S, Maeyama T, Takeshita M, et al. A case of diffuse large B-cell lymphoma of the lung demonstrating diffuse ground-glass shadows. *Ann Thorac Cardiovasc Surg* 2011;17:591–4.
- [5] Madan K, Purkait S, Arava S, et al. A 79-year-old woman with bilateral cavitating lung nodules. *Chest* 2014;145:1419–24.
- [6] Jiang AG, Gao XY, Lu HY. Diagnosis and management of a patient with primary pulmonary diffuse large B-cell lymphoma: a case report and review of the literature. *Exp Ther Med* 2014;8:797–800.
- [7] Shinoda K, Taki H, Tsuda T, et al. Primary pulmonary lymphoma presenting with multiple lung nodules. *Am J Respir Crit Care Med* 2014;190:e30–1.
- [8] Yoshino N, Hirata T, Takeuchi C, et al. A case of primary pulmonary diffuse large B-cell lymphoma diagnosed by transbronchial biopsy. *Ann Thorac Cardiovasc Surg* 2015;21:396–8.
- [9] Xu H, Xu K, Wang R, et al. Primary pulmonary diffuse large B-cell lymphoma on FDG PET/CT-MRI and DWI. *Medicine (Baltimore)* 2015;94:e1210.
- [10] Tanriverdi E, Acar M, Ozgul G, et al. Primary pulmonary lymphoma: four different and unusual radiologic and clinical manifestations. *Leuk Lymphoma* 2017;58:1231–3.
- [11] Agarwal KK, Dhanapathi H, Nazar AH, et al. Primary pulmonary lymphoma—role of fluoro-deoxy-glucose positron emission tomography-computed tomography in the initial staging and evaluating response to treatment—case reports and review of literature. *Indian J Nucl Med* 2016;31:194–7.
- [12] Zhu Z, Liu W, Mamlouk O, et al. Primary pulmonary diffuse large B cell non-Hodgkin's lymphoma: a case report and literature review. *Am J Case Rep* 2017;18:286–90.