



# The Pleural Sandwich Sign in Two Cases of Primary Pleural Lymphoma

Yookyung Kim, MD<sup>1</sup>, Myungjae Lee, MD<sup>1</sup>, Yon Ju Ryu, MD<sup>2</sup>, Min-Sun Cho, MD<sup>3</sup>

<sup>1</sup>Department of Radiology, <sup>2</sup>Division of Pulmonary and Critical Care Medicine, Department of Medicine, and <sup>3</sup>Department of Pathology, School of Medicine, Ewha Womans University, Seoul 158-710, Korea

The sandwich sign is used to describe mesenteric lymphoma in which mesenteric vessels and fat are enveloped by enlarged mesenteric lymph nodes. We present two cases of primary pleural lymphoma demonstrating the “pleural sandwich sign”. Contrast-enhanced computed tomography showed conglomerated parietal pleural and extrapleural masses encasing the intercostal arteries. Histopathological examinations confirmed low grade marginal zone B-cell lymphoma in an 80-year-old man and diffuse large B-cell lymphoma in a 68-year-old man. The pleural sandwich sign may suggest the diagnosis of primary pleural lymphoma.

**Index terms:** Lymphoma; Pleura; Computed tomography; Needle biopsy

## INTRODUCTION

The sandwich sign refers to the sandwiching of mesenteric vessels and fat by enlarged mesenteric lymph nodes on cross-sectional imaging (1). Although sandwich sign could occur in metastatic carcinoma, *Mycobacterium avium* complex, and tuberculosis, it commonly occurs in mesenteric lymphoma (1, 2).

Here we present two cases of primary pleural lymphoma. Contrast-enhanced computed tomography (CT) images showed intercostal arteries enveloped by conglomerated parietal pleural and extrapleural masses, representing a type of “sandwich sign”. Sandwich sign has not been reported in pleural diseases. This report is the first description of

“pleural sandwich sign” as a characteristic CT finding in primary pleural lymphoma. This case report was approved by our Institutional Review Board. Patients’ informed consent was waived.

## CASE REPORT

### Case 1

An 80-year-old man presented with cough for one month. He had undergone surgery for colon cancer 10 years earlier. He had no recurrent or metastatic disease. Additionally, he had been treated for hypertension and atrial fibrillation for 10 years. Laboratory tests including serological tests for human immunodeficiency virus (HIV) revealed no abnormality. Chest radiography showed right pleural effusion and cardiomegaly. Pleural effusion and diffuse parietal pleural mass extending into the extrapleural space were observed on contrast-enhanced CT of the thorax. The intercostal arteries enveloped by the mass were well visualized on axial CT images showing the sandwich sign (Fig. 1A). There were a few enlarged lymph nodes at the right cardiophrenic angle. F-18-fluorodeoxyglucose positron emission tomography (FDG-PET) showed hypermetabolism in

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**Corresponding author:** Yookyung Kim, MD, Department of Radiology, Ewha Womans University Mokdong Hospital, 1071 Anyangcheon-ro, Yangcheon-gu, Seoul 158-710, Korea.

• Tel: (822) 2650-5380 • Fax: (822) 2650-5302  
• E-mail: yookkim@ewha.ac.kr

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the right pleural mass (Fig. 1B).

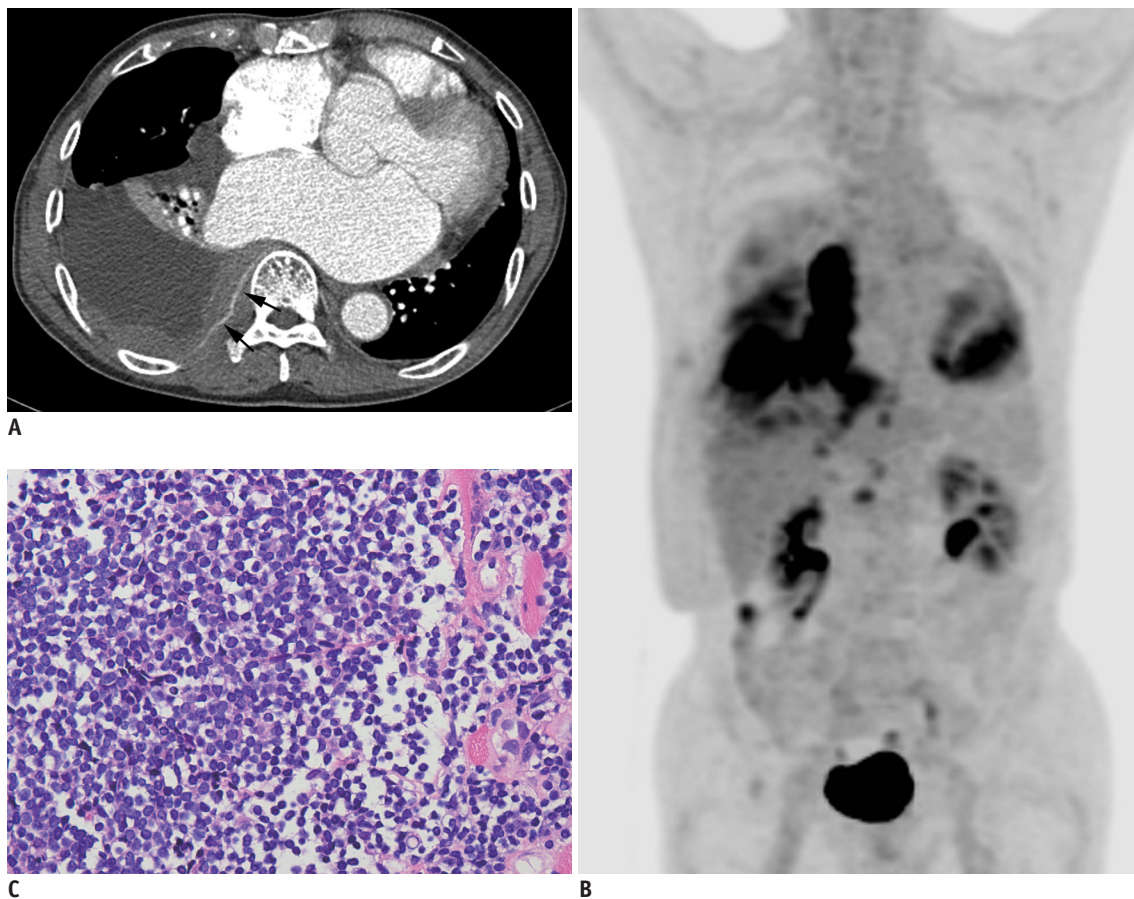
Cytological examination of the pleural fluid and pleural biopsy using an Abram's needle was non-diagnostic. He underwent ultrasonography-guided percutaneous needle biopsy using an 18-gauge automated cutting needle (Pro·Mag Biopsy Needle, Argon Medical Devices, Plano, TX, USA). Multiple biopsies of the pleural mass were performed. Histopathological and immuno-histochemical examinations revealed monotonous infiltration of small B-cells expressing CD-20 antigen (Fig. 1C). A diagnosis of low grade marginal zone B-cell lymphoma was made. Epstein-Barr virus (EBV) was negative in the specimen. No testing for human herpes virus 8 (HHV8) infection was performed. Chemotherapy was started. He was undergoing chemotherapy at the time of writing.

### Case 2

A 68-year-old man was admitted due to dyspnea for 2

weeks. He had no medical history. His laboratory findings were normal. Testing for HIV virus was not performed. Chest radiography showed right pleural effusion. CT revealed right pleural effusion with a diffuse pleural mass and a few small lymph nodes in the mediastinum and left axilla. The pleural mass was homogeneous. It invaded into the extrapleural space with encasement of the intercostal arteries, demonstrating a sandwich sign (Fig. 2A). On FDG-PET, hypermetabolism was noted in the pleural mass.

He underwent thoracentesis. Cytological examination of the pleural fluid showed many large atypical lymphoid cells (Fig. 2B). Pleural biopsy was performed using an Abram's pleural biopsy needle. The biopsy specimen showed infiltration of lymphoid cells with a marked squeezing artifact. Ultrasonography-guided pleural biopsy was performed using an 18-gauge automated cutting needle. Diffuse large B-cell lymphoma was confirmed by histopathological and immuno-histochemical examinations.



**Fig. 1. 80-year-old man with primary pleural lymphoma (marginal zone B-cell lymphoma).**

**A.** Contrast-enhanced CT showing pleural effusion and diffuse homogeneous pleural mass invading into extrapleural space in right hemithorax. Intercostal artery is enveloped by parietal pleural and extrapleural masses, demonstrating sandwich sign (arrows). **B.** F-18-fluorodeoxyglucose positron emission tomography showing diffuse hypermetabolism in right pleural mass. **C.** Pleural biopsy revealing diffuse infiltration of small to medium-sized lymphoid cells with scant to moderate amount of clear cytoplasm which is consistent with marginal zone B-cell lymphoma (hematoxylin and eosin stain, 400 x magnification).

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Research for HHV8 and EBV infection was not performed. He underwent chemotherapy. Follow-up CT showed complete resolution of the pleural mass and effusion. He died of pneumonia 18 months after the diagnosis of primary pleural lymphoma. At that time he was still in complete remission.

### DISCUSSION

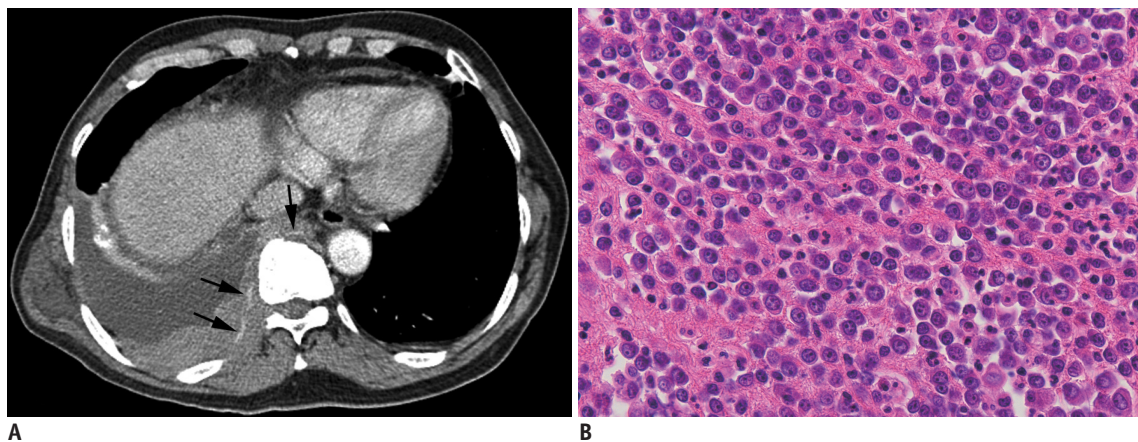
Primary pleural lymphoma is rare, although pleural effusion and pleural mass are common manifestations of secondary lymphoma. Primary pleural lymphoma, accounting for only 7% of primary lymphoma cases (3), usually affects patients with HIV infection or chronic pyothorax (4). Primary pleural lymphoma occurring in immunocompetent patients without history of chronic tuberculous empyema is extremely rare (5, 6).

Primary pleural lymphoma appears as diffuse nodular pleural thickening and localized mass. Occasionally it appears as isolated pleural effusion prior to the development of a demonstrable mass. CT findings of primary pleural lymphoma are similar to those of pleural metastasis or malignant mesothelioma (6, 7). For lymphoma occurring in the thorax, Kunimasa et al. (8) described the "thoracic sandwich sign" as an anterior mediastinal mass encasing the superior vena cava and brachiocephalic vein that is unlikely to be caused by other mediastinal malignancies (such as lung cancer, metastatic cancer, germ-cell cancer, and thymoma) because they often quickly invade large mediastinal vessels.

In a series of patients with lymphoma and pleural effusion, Aquino et al. (9) reported that extrapleural

involvement was commonly (30%) presented as a tumor, enlarged lymph nodes, or direct invasion by the adjacent parietal pleural mass. In the present cases, both patients had extrapleural space involvement by direct invasion of the parietal pleural masses. Intercostal arteries were well visualized in the conglomerated pleural and extrapleural masses on axial contrast-enhanced CT images, representing the "pleural sandwich sign". This sign has not been reported in other pleural tumors, including metastases, malignant mesothelioma, and solitary fibrous tumors that usually do not have extrapleural lesion at the initial presentation or quickly invade intercostal vessels when they invade the extrapleural space. Therefore, this characteristic CT sign would be helpful to differentiate primary pleural lymphoma from other pleural tumors.

Pleural fluid cytological examination or pleural biopsy using an Abram's or fine needle is non-diagnostic in most cases of primary pleural lymphoma. Therefore, minimally invasive surgical biopsy via thoracoscopy or video-assisted thoracoscopy is recommended for early diagnosis (5). However, in cases with large pleural masses, enough specimens for the diagnosis of lymphoma can be obtained by multiple biopsies using a cutting needle (6). In the present two cases, we performed ultrasonography-guided percutaneous needle biopsy using 18-gauge automated cutting needle since the pleural masses were large. Biopsies were performed twice in each patient which provided enough samples for the diagnosis of lymphoma. However, samples obtained by Abram's needle pleural biopsy were non-diagnostic due to squeezing artifact. Therefore, the pleural sandwich sign may suggest the diagnosis of primary



**Fig. 2. Sandwich sign in 68-year-old man with primary pleural lymphoma (diffuse large B-cell lymphoma).**

**A.** Axial image of contrast-enhanced CT showing right pleural effusion and diffuse pleural mass extending into extrapleural space and paraspinal region. Sandwiching of intercostal artery by conglomerated pleural and extrapleural masses is noted by arrows. **B.** Pleural fluid cell block specimen showing numerous large atypical lymphoid cells (hematoxylin and eosin stain, x 400 magnification).

pleural lymphoma. When patients show this sign, an aggressive biopsy procedure including multiple cutting-needle biopsies would be helpful for early diagnosis and treatment.

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