Myocardial Infiltration in Primary Mediastinal B-Cell Lymphoma Detected by Cardiac Magnetic Resonance Imaging

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ABSTRACT
Introduction: Cardiac involvement, particularly myocardial infiltration in primary mediastinal lymphoma, is a rare occurrence with an incidence of only 9% in known cases of primary malignancy. Neoplasm infiltration into the myocardiun manifests through direct invasion, hematogenous spread, transvenous invasion through the great veins, or lymphangitic spreading in the mediastinal. Myocardial infiltration in lymphoma presents a grim prognosis and its treatment may be associated with specific risks, such as myocardial rupture. Various imaging modalities may detect cardiac involvement, with cardiac magnetic resonance (CMR) imaging considered the gold standard. CMR enables clear delineation of myocardial infiltration, making it valuable for local staging, pretreatment planning, and evaluating treatment response.

Case Presentation: A 37-year-old woman patient was diagnosed with primary mediastinal large B-cell lymphoma. Mild chest discomfort and shortness of breath were observed 3 months before hospital admission. A thorax CT scan showed a heterogeneous contrast-enhancing mass with a central necrotic area in the anterior mediastinum. Following thoracotomy and tumor debulking, the patient complained of severe crushing chest pain radiating to her back, accompanied by new T wave inversion on ECG and elevated cardiac troponin levels a week after surgery. Coronary angiogram results showed a normal coronary artery. Subsequent cardiac MRI showed tumor infiltration into the anterior pericardial space, as well as the myocardium of the left and right ventricles. Chemotherapy was promptly initiated, resulting in a gradual improvement of symptoms.

Conclusions: In this study, we discuss the use of 3D-CRT in the re-irradiation of NPC with its limitation on obtaining optimum dose sculpture compared to more sophisticated and widely spread modalities like IMRT. However, with careful planning, we can still obtain optimum tumor dose, minimize OAR dose, and subsequently late toxicities that come after. We hope that this study can bring hope to centers with limited facilities, and we suggest further studies on re-irradiation, especially in OAR dose tolerance guidelines.

INTRODUCTION
Myocardial infiltration in primary lymphoma is a rare occurrence with an incidence of only 9% in known cases of primary malignancy [1]. This condition typically affects individuals aged between 30 and 40 years old, with a higher prevalence among women. Neoplasm infiltration into the cardiac area can result from direct invasion, hematogenous spread, transvenous invasion via the great veins, or lymphangitic spreading in the mediastinal [2,3]. The most common primary malignancies with heart metastasis include non-Hodgkin lymphoma, lung cancer, and breast metastases.

Many patients with pericardial and heart metastasis are asymptomatic, and symptoms depend on the size of the lesion in the heart spreading. Symptoms are
generally non-specific and similar to those of other heart diseases, such as heart failure, heart ischemia, and cardiomyopathy caused by chemotherapy and radiation. Imaging studies play a crucial role in diagnosing and monitoring disease progression and treatment response. Contrast-enhanced CT and Cardiac MRI are the 2 most important modalities for evaluating the soft tissue extension of cardiac mass. However, MRI is better at delineating soft tissue components than CT [4].

This rare case presentation demonstrates a tumor spreading to the heart similar to the theoretical framework outlined in textbooks. The imaging results have been in line with histopathology preparation. This emphasized the importance of imaging for clinicians in achieving a precise and conclusive diagnosis.

CASE PRESENTATION

A 37-year-old woman patient was diagnosed with primary mediastinal lymphoma after experiencing non-specific chest discomfort for the preceding 3 months. Shortness of breath had developed a month before the presentation. Following a chest X-ray that showed pleural effusion, the patient was referred to a pulmonologist. The initial chest contrast CT scan, as presented in Figure 1, showed a heterogenous contrast-enhancing mass with a central necrotic area in the anterior mediastinum, alongside pleural and pericardial effusion, as well as metastatic nodules in the liver. Pleural fluid cytologic evaluation only identified atypical cells without malignancy. Subsequently, the patient was transferred to a tertiary cancer center where thoracotomy with tumor debulking was performed. The intraoperative evaluation identified a large mass in the anterior mediastinum attached to the chest wall, with infiltration into the pericardium, innominate vein, superior vena cava, and encasement of the ascending aorta wall. Limited visual inspection of the anterior aspect of the heart did not suggest mass infiltration. Histopathological features were consistent with primary mediastinal large B–cell lymphoma.

Following a stable postoperative period, the patient was transferred to the ward after 3 days in the ICU. On the 5th day, severe crushing chest pain radiating to the back was observed. An ECG showed new T wave inversion in lateral leads, and laboratory evaluation presented high troponin T levels. The echocardiogram showed normal left ventricular wall motion with an ejection fraction of 60–65%, but there was a decrease in regional longitudinal strain in basal and mid-lateral segments, as shown in Figure 2. Coronary angiogram and CT aortography ruled out obstructive coronary disease and aortic dissection, respectively. A cardiac MRI (CMR) was then ordered, showing mediastinal lymphoma infiltrating the anterior pericardial space and myocardium, specifically the basal anterior wall, mid-lateral, apico lateral of the left ventricle, and the basal-mid right ventricle free wall, as presented in Figure 3.

Considering symptomatic myocardial infiltration, intensive chemotherapy with R-EPOCH (Rituximab, etoposide, prednisone, vincristine, cyclophosphamide, and doxorubicin) was promptly initiated. After the first cycle, the chest pain gradually improved along with ECG normalization. Serial echocardiography evaluation showed stable left ventricular systolic function with improvement in the regional strain of lateral segments. CMR evaluation was scheduled after the second cycle of chemotherapy, as presented in Figure 4.

![Figure 1](https://www.indonesianjournalofcancer.or.id)

**Figure 1.** Initial chest contrast CT. (A). Axial: heterogenous enhancing mass with central necrotic area in anterior mediastinal, attached to the thoracic wall, indistinct border with ascending aorta and cava superior vein; (B). Coronal: pericardial effusion; (C). Bilateral pleural effusion; (D). Metastatic nodule in liver.

![Figure 2](https://www.indonesianjournalofcancer.or.id)

**Figure 2.** Strain echocardiography showed a reduced strain in the anterolateral, posterior, and inferior walls of the left ventricle.
comprising supraclavicular and cervical lymph nodes, necessitating evaluation of adjacent lung parenchyma and pleural space [8,9,10]. However, the thoracic CT scan of this case did not delineate myocardial infiltration of the mass.

CMR imaging is the best tool for evaluating the extent of cardiac involvement in malignancy [11,12]. It may provide valuable information regarding diagnosis, staging, treatment planning, and monitoring. Compared to CT scans, CMR offers superior tissue characterization, including transmurality of myocardial infiltration and tumor content. Furthermore, it provides more information about cardiac function, overcoming limitations observed with echocardiography, particularly in visualizing the right ventricle. CMR can differentiate benign or malignant cardiac mass by contrast enhancement sequences and is instrumental in evaluating surrounding tissue such as the mediastinum, lung, and coronary arteries involvement [13–15]. In this case, left and right ventricle myocardial infiltration is evident.

DISCUSSION

Primary mediastinal large B-cell lymphoma (PMLBCL) is a rare subtype of diffuse large B-cell lymphoma, predominantly affecting individuals between 30 and 40 years old, with a higher incidence in women [5]. Clinically, PMLBCL commonly manifests as fast expanding mediastinal mass causing compressive symptoms such as chest pain, dyspnea, hoarseness, or dysphagia. While chest pain due to direct infiltration to the myocardium is infrequent [6,7], it is accompanied by new ECG changes and elevated troponin levels, supporting myocardial involvement as the etiology. Additionally, a normal coronary angiogram ruled out obstructive coronary disease.

On CT imaging, PMLBCL often appears as a large and bulky mass with heterogeneous soft tissue density in the thymic region, potentially attributed to hemorrhage, necrosis, or cystic degeneration. It may resemble a conglomeration of lymphadenopathy, comprising supraclavicular and cervical lymph nodes, necessitating evaluation of adjacent lung parenchyma and pleural space [8,9,10]. However, the thoracic CT scan of this case did not delineate myocardial infiltration of the mass.

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infiltrated lymphoma, emphasizing the need for prompt aggressive chemotherapy to prevent further damage. Clinical improvement was observed gradually after the first chemotherapy.

CONCLUSIONS

This case report presented the crucial role of CMR imaging in the diagnostic staging of primary mediastinal large B-cell lymphoma with myocardial metastasis. The baseline imaging showed transmural myocardial infiltration exceeding 90%, and following chemotherapy, there was a significant improvement in the severity of the disease, with a reduction to less than 50%.

DECLARATIONS

Ethics approval and consent to participate
The patient has agreed and signed the informed consent to participate in this study.

Competing interest
The author(s) declare no competing interest in this study

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