Letter to the Editor

Nonoperative relief of dyspnea due to mediastinal mass

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Introduction

Among the variety of mediastinal masses (1,2), the most common primary tumors in the anterior and mid mediastinum include thymoma, teratoma, retrosternal goiter, and lymphoma (1,3). Lymphoma is a general term for a group of malignant tumors originating in the lymphatic hematopoietic system (2,3). According to the Global Cancer Observatory (GLOBOCAN) 2020, there were 544,352 new cases of non-Hodgkin lymphoma (NHL) worldwide in 2020, ranking 13th among all new cases of malignant tumors (3). In the same year, there were 259,793 NHL deaths worldwide, ranking 12th among all malignant tumor deaths (3). Precursor T-cell lymphoblastic lymphoma (T-LBL) is a rare type of malignant lymphoma (2-5), which has the characteristics of high invasion and proliferation with a very high degree of malignancy (4,5). In the early stage, the tumor will proliferate rapidly and invade extensively, compressing the heart, aorta, trachea, esophagus, and other organs (4,5), resulting in shock, acute dyspnea, and a series of emergencies, threatening the life of patients, and representing a difficult problem in clinical practice (1,3,5-8). Due to the wide variety of mediastinal tumors, especially lymphomas, accurate classification of tumors is the key to individualized precision therapy (1,9).

Case presentation

A 17-year-old adolescent, who had no previous history of cancer, no history of smoking, and no family history of cancer, had experienced cough and progressive dyspnea for more than 1 month. He had undergone chest X-ray examination in another hospital, and had been diagnosed with a mediastinal tumor compressing the aorta. He came to the Department of Cardiovascular Surgery of our hospital in September 2022. On physical examination, the patient was conscious, orthopneic, breathing 21 times/min, had a heart rate 98 times/min, and the suprasternal fossa was depressed on inspiration. Several swollen lymph nodes were found in the neck and bilateral groin, with a firm texture, approximately 3.0 cm × 4.0 cm in maximum dimensions. On admission, the patient had severe dyspnea and orthopnea, and could not lie flat for positron emission tomography/computed tomography (PET-CT) examination, so a plain CT scan of the neck and chest was performed. Plain CT scan revealed the following: (I) a large space-occupying lesion in the mediastinum, about 15 cm × 20 cm in size. The masses included cystic and solid parts, mainly solid components, with irregular edges, and wrapped around the heart, aortic tree, trachea, and esophagus. Meanwhile, the trachea and esophagus were obviously compressed, narrowed, and displaced. (II) There were suspicious soft tissue mass shadows at the root of the neck. (III) Multiple spots, nodules, and inflammatory lesions were observed in the right lung. (IV) Small amount of pleural effusion on the right side (*Figure 1A-1D*). Cardiac color ultrasound Doppler indicated mild tricuspid regurgitation and normal left ventricular systolic function measurements. Routine blood test, liver and kidney function, electrolytes, blood gas analysis, high-sensitivity troponin T (hs-TNT), N-terminal pro-brain natriuretic peptide (NT-proBNP), and other laboratory tests were normal.

As the patient was experiencing acute, severe dyspnea,

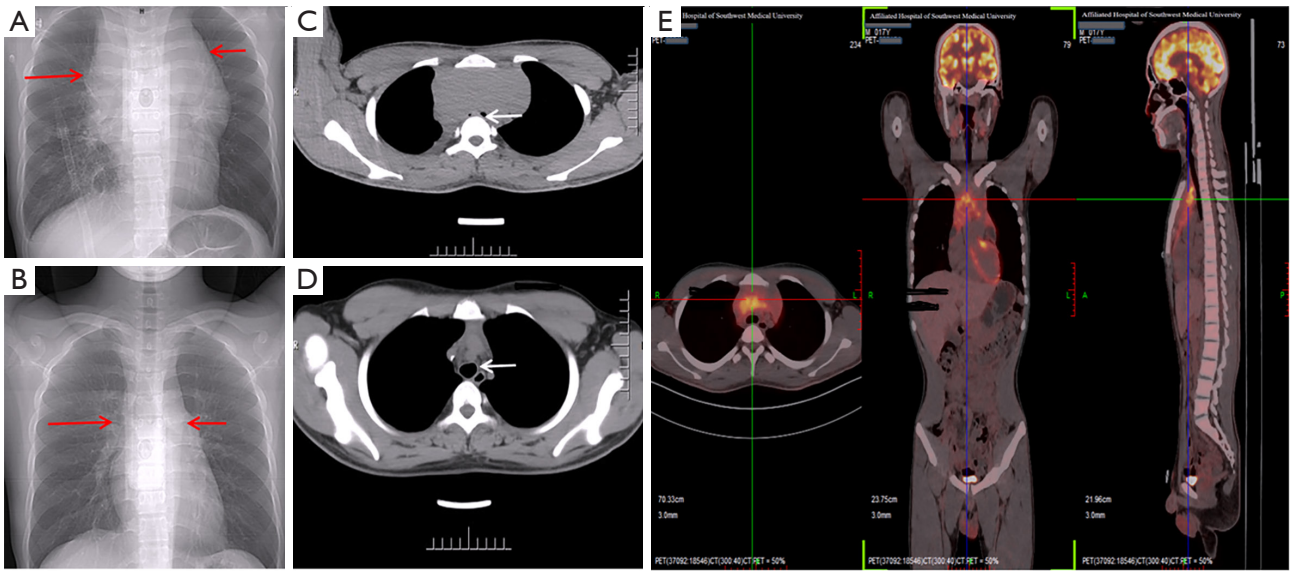
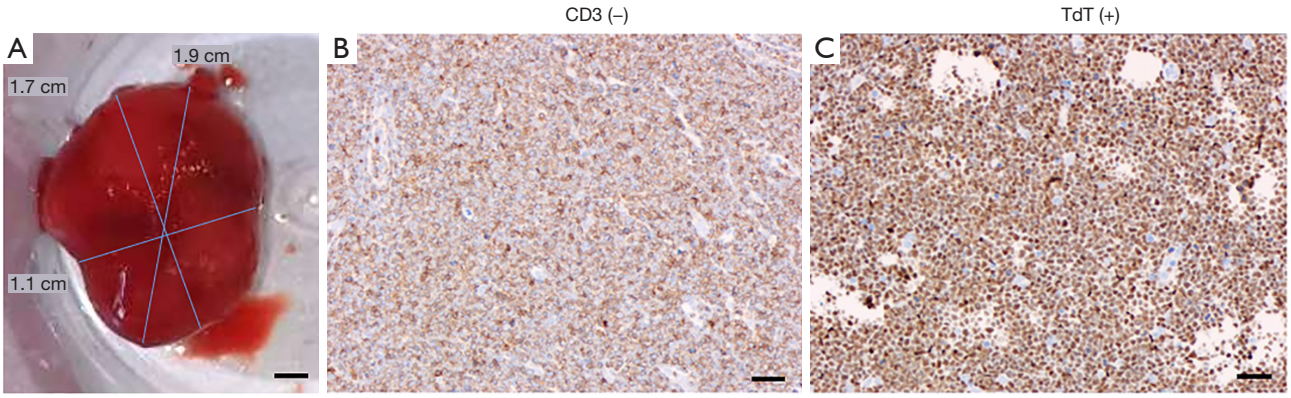


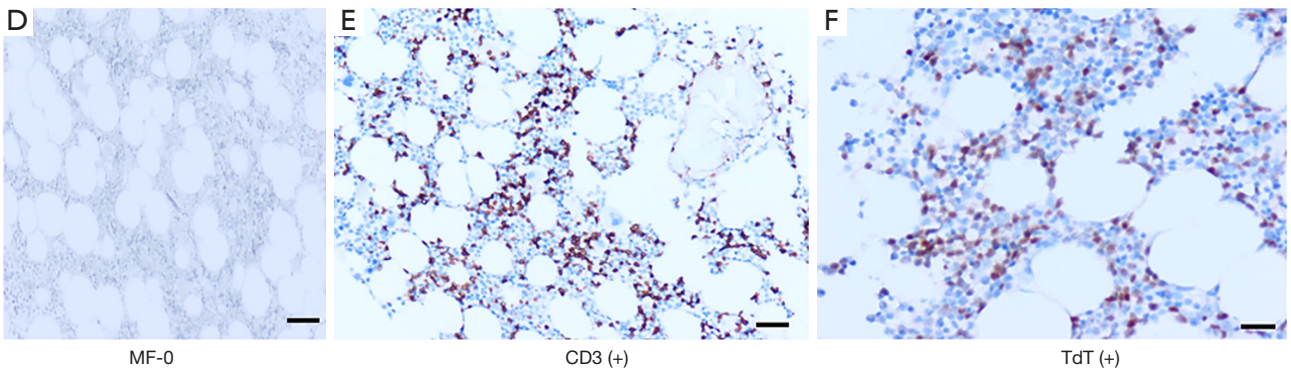
Figure 1 Comparison of imaging data of patients before and after treatment. (A) Prior to treatment, the mediastinal width of the patient's chest radiographs was significantly wider than that of normal individuals, and the red arrows on both sides of the mediastinum indicated the development of mediastinal masses. (B) X-ray examination of the patient's chest after treatment revealed that the width of the mediastinum had decreased significantly compared to that before treatment, and the red arrows on both sides of the mediastinum indicated the development of mediastinal masses. (C) Prior to treatment, a plain CT scan of the patient's chest revealed a huge space-occupying lesion in the anterior mediastinum, with a maximum cross section of about 15.0 cm × 20.0 cm. The mass severely compressed the main bronchus above the bifurcation of the left and right main bronchus, and the narrowest part of the main bronchus was only about 2 mm × 3 mm (indicated by the white arrow). (D) After treatment, plain CT scan of the patient's chest showed that the mediastinal mass had been greatly reduced, and the diameter of the main bronchus originally oppressed by the mass had almost returned to normal level (indicated by the white arrow). (E) On the third day after treatment, the patient's PET-CT examination showed that the mediastinal mass had been significantly reduced, with a maximum cross section of 3.8 cm × 5.3 cm, and the inner diameter of the main bronchus under pressure had almost returned to normal. PET, positron emission tomography; CT, computed tomography.

rapid relief of the dyspnea was a priority. With the consent of the patient's guardian, our team performed an urgent cervical lymph node biopsy on the patient (2 hours after admission). Due to the final diagnosis of T-LBL, the patient was transferred to the Department of Hematology for Hyper-CVAD-A chemotherapy after the rapid pathologic findings of "hyperproliferative lymphoma".

On the first day after initiation of the chemotherapy regimen, the patient's dyspnea began to alleviate. On the third day after chemotherapy, the patient's symptoms of dyspnea were significantly relieved compared with the time of admission. PET-CT was performed successfully after chemotherapy, and the results showed that there was an irregular cystic mass in the anterior mediastinum with a maximum cross-section of 3.8 cm × 5.3 cm, and the boundaries with the adjacent heart, great vessels, trachea, and upper esophagus were unclear. The possibility that the bilateral submandibular, submental, bilateral cervical root, bilateral axilla, prehepatic space, and bilateral inguinal region may be infiltrated by mass was considered (*Figure 1E*). Bone marrow biopsy showed that there was active proliferation of nuclear cells, 3 lines were visible, mainly granular lines, with a grain-red ratio of about 50%. No obvious abnormality was observed in the morphology and distribution of the 3 lines of cells. The size of the lymph nodes obtained is shown in *Figure 2A*, with a maximum diameter of 1.9 cm. Immunohistochemical (IHC) analysis of lymph node tissue showed that CD20 (–), PAX5 (–), CD3 (–), CD5 (+), CD10 (individual cells +), Bcl-2 (–), Bcl-6 (+), MUM1 (–), c-MyC (+, 80%), TdT (+), Ki-67 (+, 90%), CyclinD1 (–), and CD34 (–). Fluorescence in situ hybridization (FISH) revealed Epstein–Barr early RNA (EBER) (–), as shown in *Figure 2B,2C*. Bone marrow puncture was performed with reticular fiber staining, and



Immunohistochemistry: CD20 (–), PAX5 (–), CD3 (–), CD5 (+), CD10 (individual cells+), Bcl-2 (–), Bcl-6 (+), MUM1 (–), c-MyC (+, 80%), TdT (+), Ki-67 (+, 90%), CyclinD1 (–), CD34 (–).
FISH: EBER (–).



Immunohistochemistry: MPO (+) , CD71 (+), CD60 (+), CD20 (+), CD3 (+), TdT (+).

Figure 2 Results of lymphoid histopathology and bone marrow examination of the patient. (A) The size of the lymph nodes obtained is shown, with a maximum diameter of 1.9 cm. Scale bar: 100 μm. (B,C) Immunohistochemical analysis of lymph node tissue. FISH: EBER (–). Scale bar: 100 μm. (D) Bone marrow puncture was performed with reticular fiber staining. Scale bar: 20 μm. (E,F) Immunohistochemical analysis of bone marrow. Scale: 20 μm. PAX5, paired box 5; Bcl-2, B cell lymphoma 2; BCL-6, B-cell lymphoma 6; MUM1, multiple myeloma oncogene 1; c-Myc, cellular-myelocytomatosis viral oncogene; TdT, terminal deoxynucleotidyl transferase; FISH, fluorescence in situ hybridization; EBER, Epstein–Barr early RNA; MPO, myeloperoxidase.

the grading was MF-0, which was in the normal range, indicating no abnormal reticular fibers, as shown in *Figure 2D*. IHC analysis of bone marrow showed MPO (+), CD71 (+), CD60 (+), CD20 (+), CD3 (+), and TdT (+), as shown in *Figure 2E,2F*. The pathological results confirmed the final diagnosis of T-LBL/T-lymphoblastic leukemia (*Figure 2*). The patient's dyspnea was completely relieved after the first course of chemotherapy and he was discharged.

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee(s) and with the Helsinki Declaration (as revised in 2013). Written informed consent was provided by the patient's parents for publication of this case report and accompanying images. A copy of the written consent is available for review by the editorial office of this journal.

Discussion and conclusions

Although the mediastinal space is relatively small, there are a variety of tumors that can be developed over the region (1-3,5). Rare primary mediastinal tumor accounts for less than 10% of all mediastinal masses, including the thymus and neuroendocrine carcinoma, germ cell tumor (GCT), lymphoma, neurogenic tumors, endocrine tumors, and mesenchymal tumors (1). In the case of an airway emergency due to compression by a large anterior

mediastinal tumor, especially when the stenosis extends to the bifurcation of the airway, it is difficult to obtain relief with conventional endotracheal intubation (7). In addition, obtaining biopsy specimens under sedation or general anesthesia can result in complete airway obstruction (7). The risk of airway obstruction during general anesthesia has been reported to be significantly higher if the degree of airway narrowing is more than one-third (5,7). In a disease such as T-LBL, surgery alone does not relieve obstructive symptoms, but chemotherapy does. Thus, the surgeon should not limit their diagnosis and treatment of the disease to surgery, but should consider more patient-friendly treatment options. In addition, extensive resection of mediastinal tumors is not recommended until a definite diagnosis is made (1,10).

At present, histopathological evaluation remains the gold standard for the diagnosis of mediastinal tumors, including T-cell lymphoma (9), and also provides key evidence for individualized precision therapy of tumors (1,3,4). A definitive histological diagnosis can only be accomplished by percutaneous needle biopsy or open surgery (9,10). However, a wide variety of mediastinal tumors, including lymphomas, are classified differently and their treatment regimens vary, thus demonstrating the importance of accurate pathological diagnosis (1,3,9). In addition, it is worth noting that there are artificial limitations in needle biopsy and limitations in the inherent features of the lesion itself (such as necrosis and inflammation) (11). Therefore, the correct selection of biopsy site is the key to accurate pathological diagnosis (11).

T-LBL is a rare malignant lymphoma (4), accounting for about 2% of all lymphoma (3,4). The many complications associated with this tumor are often life-threatening, including cardiac arrhythmias, cardiac, tracheal and esophageal compression, and even death from cardiogenic shock and refractory heart failure (3,4,6-8). In this case, the patient was diagnosed with lymphoma, and presented with severe dyspnea on admission. Mediastinal surgery to remove the mass was an effective way to relieve dyspnea, but he faced the following problems: (I) the diagnosis of mediastinal tumor had not been finalized, and there was the possibility of massive bleeding during emergency thoracotomy or the tumor not being able to be (completely) removed; (II) the patient's trachea was obviously compressed, and anesthesia intubation would have been difficult, so the conditions for mediastinal surgery were not ideal. It has been previously reported that mediastinal tumor tissue can be obtained with the assistance of thoracoscopy, ultrasound, CT, and even PET-CT and extracorporeal membrane oxygenation (ECMO) to determine the pathological diagnosis of the mass. Compared with using ECMO as life support treatment (7), mediastinal operation (10) or puncture to obtain pathological diagnosis (10), or waiting for PET-CT examination to obtain pathological examination of lesion tissue (11), and then formulating a follow-up treatment plan, our team adopted a rapid treatment method for this patient, which not only saved the treatment time for the patient, shortened the length of hospital stay, reduced the hospitalization cost, and minimized the trauma to the patient, but also achieved a satisfactory therapeutic effect.

In summary, we reported a rare case of severe dyspnea caused by extensive mediastinal involvement and tracheal compression of T-LBL. Although the patient was eventually diagnosed with T-LBL [stage IV, group B, international prognostic index (IPI) score 4, high-risk], superficial lymph nodes (cervical lymph nodes) were selected as the biopsy site in case of emergency. The treatment plan was determined according to the rapid pathological report and the clinical manifestations of the patient. The Hyper-CVAD-A effectively relieved the dyspnea symptoms of the patient, which bought time for further diagnosis and individualized treatment plan.

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Footnote

Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at https://qims.amegroups.com/article/view/10.21037/qims-23-1072/coif).

The authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee(s) and with the Helsinki Declaration (as revised in 2013). Written informed consent was provided by the patient's parents for publication of this case report and accompanying images. A copy of the written consent is available for review by the editorial office of this journal.

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