Case report - Thoracic oncologic
Successful intentional lobectomy for lung cancer after treating contralateral diaphragmatic eventration

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Abstract

Diaphragmatic eventration permanently raises all or part of the hemidiaphragm, thus impairing respiratory function by compressing the ipsilateral lung and mediastinum. A 55-year-old woman had cT1N0M0 lung adenocarcinoma in the right lower lobe and diaphragmatic eventration in the left hemithorax. We repaired the eventration to recover respiratory function, then performed a radical lobectomy with mediastinal lymph node dissection. Pathologically, the tumor was a well-differentiated acinar adenocarcinoma (pT1N0M0 stage IA). She was free from cancer and eventration 18 months later. This is the first known report of a lung cancer patient with impaired respiratory function who underwent an intentional radical lobectomy following repair of contralateral diaphragmatic eventration to recover respiratory function.

1. Introduction

Diaphragmatic eventration permanently elevates all or part of one hemidiaphragm with continuity and normal attachment to the costal margins, thus impairing respiratory function in a paradoxic movement that compresses the ipsilateral lung and mediastinum [1]. Lung cancer patients with contralateral diaphragmatic eventration are extremely rare and generally undergo limited surgical procedures for the cancer, because preserving respiratory function outweighs the risk of radical surgery. Here, we report the first known case of a lung cancer patient with impaired respiratory function who successfully underwent an intentional radical lobectomy following repair of contralateral diaphragmatic eventration to recover respiratory function.

2. Case report

A 55-year-old woman was admitted for evaluation of abnormal radiography findings. She had suffered a left thoracoabdominal contusion in a traffic accident at age 35, but had no other previous abnormal findings. Although exertional dyspnea was present, respiratory function was not severely impaired. Arterial blood gas analysis (ABG) showed pH of 7.414, PaCO₂ of 45.6 mmHg, PaO₂ of 64.122 mmHg, and SaO₂ of 92.3%. Hypoxemia was easily exacerbated by walking. A pulmonary function test (PFT) demonstrated peak expiratory flow rate (PEFR) of 4.84 l/s (76.0% predicted), vital capacity (VC) of 2.08 l (83.9% predicted), forced vital capacity (FVC) of 1.81 l (73.1% predicted), and forced expiratory volume in 1 s (FEV₁) of 1.47 l (70.5% predicted). Chest radiography showed moderate elevation and no respiratory movements of the left diaphragm (Fig. 1a, b), while computed tomography (CT) revealed an abdominal viscera in the left hemithorax (Fig. 1d). Multiplanar reconstruction CT showed left diaphragm continuity suggesting eventration, but no diaphragmatic hernia. In addition, an irregular 2.5 × 2.0 cm nodule in the right segment S₉ was found, which was diagnosed as primary lung adenocarcinoma (cT1N0M0, stage IA) in bronchoscopic biopsy and metastatic evaluations. Although limited surgery might have been sufficient, we preferred radical excision of the cancer to preserve respiratory function. Prior to a right radical lobectomy, we planned a repair of the left diaphragm to recover impaired respiratory function.

Under general anesthesia in the right lateral decubitus position, a thoracotomy was performed through the eighth intercostal space across the posterior axillary line. The phrenic nerve appeared normal, while the left diaphragm was atonic and membranous (Fig. 1e). The stretched diaphragm was incised to reposition the intraabdominal organs and resected with a linear cutter, while the residual diaphragm was loose and required a 2.0-mm thick prosthetic reinforcement. A prosthetic patch was used to contour the hemiaphragm, and then secured laterally to the ribs and medially to the diaphragmatic muscle rim using 9 mattress sutures with USP-3 sized nylon. The apleatic lower lobe was expanded fully and the patient was extubated in the operating room.
Diaphragmatic eventration is a rare anomaly and its cause remains to be fully elucidated. Congenital eventration is a developmental abnormality characterized by muscular aplasia of the diaphragm, while acquired eventration is caused by injury to the phrenic nerve, with resultant paralysis and elevation of the entire diaphragm [1, 2]. In our case, a previous traffic accident may have caused the phrenic nerve injury. Symptomatic eventration generally requires surgical treatment, such as diaphragmatic plication with or without reinforcement, thus improving respiratory function including FEV1 and FVC [2, 3]. Previously, we treated a case of adult bilateral postoperative phrenic nerve paralysis, in which diaphragmatic plication effectively improved respiratory function including PEFR [4]. Therefore, we repaired the atonic diaphragmatic eventration in the present patient prior to a contralateral lobectomy in spite of mild impairment of PFT, and improvements were obtained in ABG, VC, FVC, FEV1, and PEFR results. The mechanism of improvement was probably due to decreased lung compression, fixing of the thoracic base, and stabilization of the mediastinum by reducing paradoxical movement of the diaphragm [5]. The improved respiratory function enabled a safe lobectomy and her subsequent return to work, though further follow-up examinations are necessary. If diaphragmatic repair had been preceded by the lobectomy, perioperative management would be more difficult.

In cases with a lung adenocarcinoma 3.0 cm or less in length, chest CT findings are generally consistent with the histological subtype, i.e. non-solid lesions have a larger proportion of non-invasive bronchioloalveolar cell carcinoma (BAC) and better prognosis than solid lesions [6]. Patients with an adenocarcinoma mixed subtype with BAC predominance have a good prognosis and may be candidates for sublobar resection [7, 8]. In our patient, chest CT images showed a predominantly solid lesion, suggesting a more invasive adenocarcinoma than BAC. Therefore, rather than a limited surgery without repair of the contralateral diaphragm, we performed a radical left lobectomy following that repair. A histological examination confirmed that the lesion was an invasive acinar adenocarcinoma with partial BAC characteristics.

Lung cancer patients with contralateral diaphragmatic eventration are extremely rare, thus the present procedure would be difficult to perform in significant numbers. Nevertheless, we found that it was feasible and effective for the present lung cancer patient with respiratory function impaired by contralateral diaphragmatic eventration. This procedure may also be applied for cases with more impaired function.

### References