EUS-FNA combined with an intracapsular injection of antibiotics and ethanol for posterior mediastinal cyst: A case report

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Abstract. Mediastinal cysts are rare benign lesions and their diagnosis and treatment remain difficult and controversial. The development of endoscopic ultrasound (EUS) has broadened the horizon for the precise treatment of diseases. The present study reports the case of a 53-year-old male hospitalized with chest pain. All imaging findings, including computed tomography, magnetic resonance imaging and EUS, indicated a benign cystic mass in the posterior mediastinum. The posterior mediastinal cyst was treated with EUS-guided fine-needle aspiration combined with an intracapsular injection of antibiotics and ethanol, and the results indicated no mediastinal infection after the puncture and no recurrence after 3 months of follow-up. The present study provides a new method for diagnosing and treating mediastinal cysts.

Introduction

The mediastinum has a narrow gap. Anatomically, it is divided into the superior and inferior mediastinum based on the sternal angle and the lower margin of the fourth thoracic vertebra; the inferior mediastinum is divided into the anterior, middle and posterior parts based on the anterior and posterior walls of the pericardium. Mediastinal cysts are rare benign mediastinal lesions that account for ~25% of mediastinal masses (1). They are generally asymptomatic and are frequently discovered during health check-ups. However, they may be complicated by infection, enlargement, spontaneous rupture or malignant transformation (2). When cysts become larger or malignant, oppression or invasion of adjacent anatomical structures may cause various types of discomfort, such as chest tightness, chest pain, cough, shortness of breath, hoarseness, hiccups, palpitation and dyspnoea (3). The tissue origin of cysts frequently depends on the close relationship between their location and mediastinal anatomy, such as thymic, bronchogenic, pericardial, esophageal and neurogenic cysts. Clinically, the diagnosis and treatment of mediastinal cysts is primarily surgical resection.

Endoscopic ultrasound (EUS) is a well-established imaging modality that helps to determine the nature, layer of origin and extent of lesions, and is mostly used to diagnose and treat of gastrointestinal and biliary pancreatic diseases (4). In mediastinal lesions, it is mainly used for the evaluation and biopsy of mediastinal masses and lymph nodes (5), as it may distinguish complex structures in the mediastinum, such as blood vessels, lymph nodes and soft tissues, and display the relative position of blood vessels, organs and masses, helping clinicians to avoid damage to blood vessels or tissues during puncture. In recent years, the development of EUS has opened up a new field of vision for precise, minimally invasive diagnosis and treatment of diseases, and its application and scope are becoming increasingly extensive. However, EUS-guided fine-needle aspiration (EUS-FNA) of mediastinal cysts remains controversial due to the risk of complications. The present study reported a case of posterior mediastinal cyst treated with EUS-FNA combined with an intracapsular injection of antibiotics and ethanol, which provides a new method for diagnosing and treating mediastinal cysts.

Case report

A 53-year-old male was admitted to the cardiology department of Mianyang Central Hospital (Mianyang, China) in February 2022 as a referral from the emergency department for persistent chest pain for 20 days. It was the first time the patient had this complaint. The patient did not have any other symptoms/complaints such as fever, cough, chest tightness, fatigue, palpitation, dyspnea or abdominal pain, and he denied any weight loss with a BMI of ~24.2. On physical examination, there were no obvious positive signs, except bradycardia, with a heart rate of 55 bpm. Laboratory workup revealed that only serum tumor marker CA199 (381.83 U/ml; reference range, <37 U/ml) level was significantly increased. Other indicators, including blood routine, myocardial markers, liver function,

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blood lipids, renal function, electrolytes, coagulation function, thyroid function, glycosylated hemoglobin, myocardial markers and pro-B-type natriuretic peptide, were all normal.

Since the patient had chest pain, the cardiologist ordered color doppler echocardiography, coronary computed tomography (CT) and enhanced chest CT to determine the cause. Color echocardiography indicated a posterior left atrial cystic hypoechoic mass and coronary CT displayed a cystic mass in the posterior mediastinum. Plain and enhanced thoracic CT indicated a cystic hypodense mass of ~7.7x4.7 cm above the esophageal hiatus in the posterior mediastinum, with a thick wall, mild enhancement, partly clear boundary, arc-shaped indentation adjacent to the heart, esophagus and inferior vena cava, and the boundary between the inner margin and esophagus was unclear, which revealed a possible mediastinal cyst (Fig. 1). Plain and enhanced mediastinal magnetic resonance imaging (MRI) revealed a lumpy abnormal signal shadow in the posterior mediastinum, with a clear boundary of ~6.0x4.0x5.2 cm, hyperintensity on T2-weighted imaging, iso-slight hyperintensity on T1-weighted imaging, a slightly increased signal on reverse phase, a slightly higher signal on diffusion-weighted imaging, obvious hyperintensity on apparent diffusion coefficients mapping, no obvious enhancement overall and suspicious slight enhancement on the edge, which further supported that the cystic mass was a benign lesion, most likely a cyst (Fig. 2). The upper gastrointestinal barium contrast indicated that the mass compressed the lower part of the esophagus to form an arc-shaped indentation. Endoscopy was performed to clarify further the relationship between the cyst and the esophagus. Gastroscopy indicated a strip of submucosal eminence at a distance of 24-40 cm from the incisors with a smooth mucosal surface (Fig. 3A). EUS (Olympus Ltd) further revealed a cystic mass of ~6x4.5 cm outside the esophageal wall and no blood flow signal under color doppler imaging (Fig. 3B).

Based on these findings, cardiothoracic surgeons and gastroenterologists at our hospital were consulted regarding the diagnosis and treatment, and the patient was referred to our department for further treatment after careful consideration. Under EUS guidance, a 19-gauge needle (Cook Medical, Inc.) was used to puncture the cyst through the lower part of the esophagus while avoiding the blood flow signal. Turbid cystic fluid (~40 ml) was extracted and the capsular wall was lavaged repeatedly with metronidazole (Sichuan Kelun Pharmaceutical Co., Ltd.) and anhydrous alcohol, leaving 3 ml of anhydrous alcohol in the cyst. A small amount of oozing blood was found at the puncture point in the lower part of the esophagus and a titanium clip was used to clamp the puncture point (Fig. 3C-F). Finally, the patient received prophylactic treatment to prevent infection [0.75 g cefuroxime (Guangzhou Baiyunshan Tianxin Pharmaceutical Co., Ltd.); single dose intravenous drip; once in total]. A fluid-based smear of the puncture fluid of the posterior mediastinal cyst revealed a small number of neutrophils and lymphocytes. After 3 days of observation, the patient's chest pain was relieved and there were no symptoms such as fever, cough, expectoration, hematemesis or black stool. The patient's condition improved and he was discharged from the hospital. At a follow-up visit 3 months later, the patient had no further symptoms and chest CT indicated no recurrence of the cyst.

Discussion

The mediastinum harbors the living organs, including the heart and the great blood vessels, esophagus, trachea, thymus, nerves and lymphoid tissues. Chest CT and MRI are the preferred diagnostic methods for mediastinal cysts. Mediastinal cysts of various etiologies share common imaging findings and their shape is generally round and oval with a soft texture when less hindered by surrounding structures. Even when occurring in the organ space, their shape also has certain compliance with adjacent structures and exhibits a corresponding irregular shape. Most cysts have smooth outlines, clear borders and no enhancement. Certain cysts display with regular soft-tissue density walls with a thickness of 2-3 mm, which are usually enhanced on enhanced scans. The cyst has a uniform watery density; CT indicates the characteristic liquid CT value and the MRI shows low signals on T1-weighed and T2-weighted images. For certain proteinaceous, hemorrhagic or infected cysts, CT manifestations and MRI images are atypical, which may indicate soft tissue density CT values and higher T1-weighed signal images (6,7). In the present case, the radiological appearance of the cystic mass was consistent with that described above, suggesting that it was likely to be a benign cyst.

It is well known that histopathology is the gold standard for the diagnosis of masses. Most experts recommend surgical treatment of mediastinal cysts, including thoracotomy, mediastinoscopy and thoracoscopy, which may clarify its pathologic diagnosis, remove the lesion, alleviate the patient's discomfort and prevent possible complications (2,8,9). However, for the present case, chest CT indicated a cystic mass adjacent to the heart, esophagus and inferior vena cava, and surgery had the disadvantages of high risk, postoperative trauma, high cost and slow recovery. Furthermore, certain patients cannot be definitely diagnosed due to advanced age, underlying diseases such as cardiopulmonary insufficiency, other surgical contraindications, intolerance or lack of surgical opportunities. Therefore, it is important and necessary to use a minimally invasive diagnosis and treatment for mediastinal cysts.

Mediastinal cysts appear as well-circumscribed, oval or round, liquid dark areas on intraluminal ultrasonography. EUS is able to delineate the originating layer of the cyst in the esophageal wall and the relationship between the cyst and the esophagus (10). In the patient of the present study, barium in the upper gastrointestinal tract indicated that the esophagus was compressed by the mass, which was further identified by EUS as a cyst outside the esophageal wall. Furthermore, all examination results inferred that the cyst may be benign and located in the posterior mediastinum, which is least likely to contain a malignant mass in the three mediastinal cavities (11). All of these observations indicated that EUS-FNA could be performed. Using EUS-FNA for cyst fluid, a qualitative diagnosis of mediastinal cysts may be made, while avoiding missed diagnosis of malignant diseases and significantly alleviating patients' discomfort symptoms. Compared to surgery, it has the advantages of lower risk, higher safety, wider indications, fewer complications, lower cost, less trauma and faster recovery. Furthermore, even if the puncture fluid confirms malignancy, it is not too late to perform additional surgery after EUS-FNA. In the present case, the results indicated no

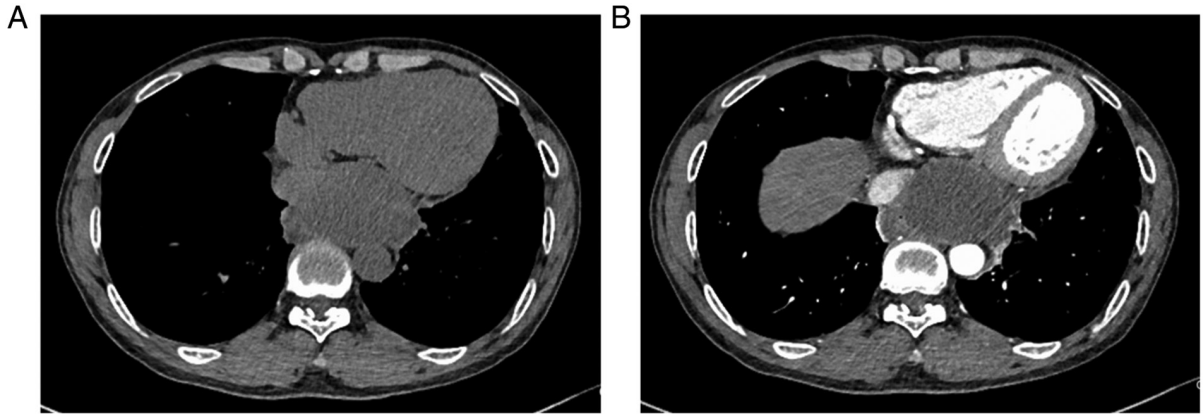

Figure 1. Thoracic computed tomography images of mediastinal cyst. (A) Plain CT image. (B) Enhanced CT image. CT, computed tomography.

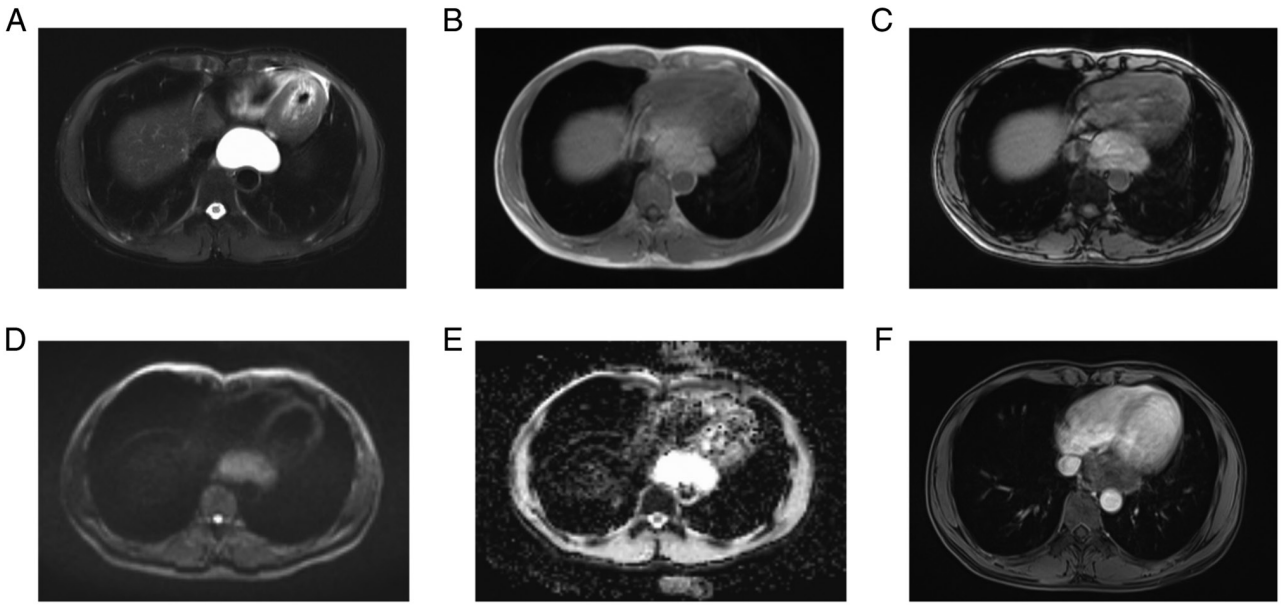

Figure 2. Mediastinal magnetic resonance images of mediastinal cyst. (A) T2-weighted image. (B) T1-weighted image. (C) T1 reverse phase. (D) Diffusion weighted imaging. (E) Apparent diffusion coefficients mapping. (F) Enhanced MRI. MRI, magnetic resonance imaging.

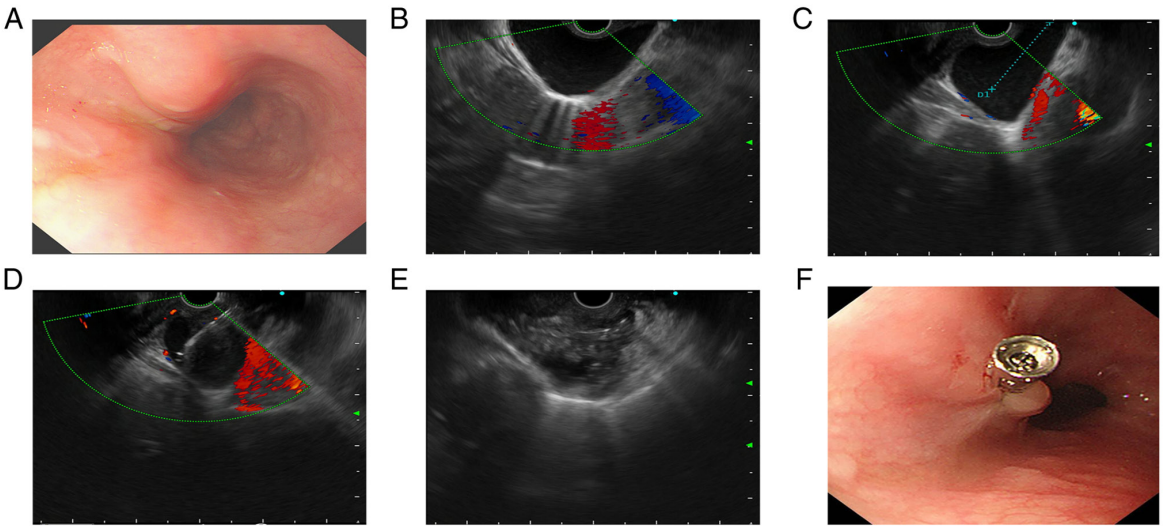

Figure 3. Endoscopic images of mediastinal cyst. (A) Gastroscopic image prior to puncture. (B) Endoscopic ultrasound image prior to puncture with no echo and no flow signal. (C) Localization prior to EUS-FNA. D1 indicates the puncture distance of the needle. (D) During EUS-FNA. (E) Following EUS-FNA. (F) Gastroscopic image following puncture. EUS-FNA, endoscopic ultrasound-guided fine needle aspiration.

malignant cells in the puncture fluid, which proved that the cystic mass in this patient was indeed a benign cyst, and surgery was avoided.

However, EUS-FNA of mediastinal cysts remains controversial due to the risk of complications. One potential complication is infection. Certain studies suggest caution in aspirating for suspected mediastinal cysts due to mediastinum (12). Annema *et al* (13) reported a case of bronchial cyst EUS-FNA without antibiotics causing mediastinitis. Valli *et al* (14) reported that patients in a case series developed severe FNA-induced cyst infection without antibiotics, leading to mediastinitis requiring surgical debridement. Another previous study indicated that EUS-FNA was effective in preventing mediastinitis with a small 22G needle, an intravenous dose of ciprofloxacin (400 mg) before puncture and an oral dose of ciprofloxacin (500 mg 12-hourly for 5 days) after puncture (15). The American Society for Gastrointestinal Endoscopy guidelines also recommended prophylactic antibiotics (mainly intravenous and oral) for EUS-FNA in mediastinal cystic lesions (16). However, Diehl *et al* (17) noted that 3 patients with mediastinal cysts developed infections after EUS-FNA despite receiving accepted techniques, including prophylactic antibiotics; therefore, intravenous antibiotics may not completely prevent mediastinal infection complications. In addition, there is a paucity of studies on intracapsular antibiotic injection. Considering the large cyst in the patient of the present study, to shorten the suction time, a 19G needle and intracapsular injection of metronidazole were used to prevent anaerobic infection, which proved to be successful, and the patient had no infection after EUS-FNA. At 3 days after puncture, the patient was discharged, which not only relieved the symptoms of chest pain but also shortened the hospital stay and saved the hospitalization cost.

Another possible risk is a cyst recurrence, thought to be caused by failure to clear the lining of the cyst wall completely. Ethanol sclerotherapy is an effective treatment for numerous types of benign cyst, such as liver, kidney and bronchogenic cysts. Ethanol can not only dehydrate epithelial cells of the cyst wall, coagulate and denature proteins, and destroy cells to impair their secretory function, but also induces aseptic inflammation and sealing of the cyst cavity, so as to prevent cyst recurrence (18,19). Lee *et al* (20) reported that EUS-guided ethanol-sparing therapy for treating a large symptomatic liver cyst did not result in cyst recurrence at a median follow-up of 66 months, revealing that ethanol may prevent cyst recurrence. Lakadamyali *et al* (21) reported good results with CT-guided aspiration and ethanol sclerotherapy for bronchogenic cysts, with no recurrence observed on follow-up MRI after 1 year. In the present case, the cyst wall was repeatedly lavaged with ethanol and a portion of the ethanol was retained within the cyst. There was no recurrence of the cyst during the 3-month follow-up chest CT. Of course, this also requires a longer follow-up and a larger sample size. If cyst recurrence is unfortunately found during longer follow-up, EUS-FNA treatment may be repeated, but even then, the benefit to the patient is greater than that of surgery.

In conclusion, EUS-FNA combined with intracapsular injection of antibiotics and ethanol is safe and feasible for treating mediastinal cysts, without complications of mediastinal infection and cyst recurrence. It may relieve the discomfort symptoms of patients, avoid surgery, shorten the length of hospital stay and reduce hospitalization costs, so that patients get the maximum benefit. It is a new diagnosis and treatment method worth attempting and recommending for benign posterior mediastinal cysts indicated by multiple imaging examinations.

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Availability of data and materials

All data generated or analyzed during this study are included in this published article.

Authors' contributions

LW and MF were responsible for the clinical management of the patient. LW reviewed the literature and contributed to data collection, analysis, interpretation and manuscript drafting. XZ contributed to data collection, analysis and interpretation. MF contributed to the literature search, data collection, analysis and manuscript revision. XL contributed to the design of the study, analysis and interpretation of data, and reviewed and edited the manuscript. XZ, MF and XL confirm the authenticity of all the raw data. All authors read and approved the final manuscript.

Ethics approval and consent to participate

Not applicable.

Patient consent for publication

Written informed consent for the publication of the case data/information and images was obtained from the patient.

Competing interests

The authors declare that they have no competing interests.

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