

Primary Mediastinal Cysts: A Review of 41 Surgically Managed Cases

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ABSTRACT

Objective: To review the surgical outcomes of primary mediastinal cysts (PMCs) and to determine the differences among various histopathological types.

Methods: We retrospectively analysed the medical records of 41 patients (19 men, 22 women; mean age 46.5 ± 13.7 years, range 19–78 years) with PMCs who underwent surgical excision between January 2007 and January 2016. Age, sex, indication for surgical intervention, surgical technique, histopathological diagnosis, postoperative complications and duration of hospital stay were recorded for all patients. The differences among the various histological types of PMCs were determined using analysis of variance for continuous variables and Chi-square test for categorical variables. A p-value of less than 0.05 was considered statistically significant.

Results: A total of 41 patients with PMCs were managed surgically at our clinic over a period of 9 years. A total of 19 men (46.3%) and 22 women (53.7%) were included in the study. The patients had a mean age of 46.5 ± 13.7 years, a mean duration of hospital stay of 4.0 ± 1.0 days and a mean postoperative follow-up duration of 11.2 ± 3.7 months. According to the histopathological analysis, 21 (51.2%) patients were diagnosed as having a pericardial cyst; 16 (39%) had a bronchogenic cyst; 3 (7.3%) had a cystic hygroma and 1 (2.4%) had a thymic cyst. No postoperative mortality or recurrence was observed over a period of 11.2 ± 3.7 months. No statistically significant difference was found among the variables, either.

Conclusion: Despite advanced non-invasive diagnostic techniques, the definitive diagnosis of PMCs can only be made by interventional techniques. Surgery often provides curative therapy with low morbidity and mortality.

Keywords: Bronchogenic cyst, cyst, mediastinum, thoracotomy.

INTRODUCTION

Mediastinal masses may originate from any thoracic organ and display a wide array of pathological findings as malignant and benign lesions (1). Primary mediastinal masses (PMM) constitute approximately 10%–25% of these masses (1, 2). These PMM lesions are congenital or acquired, or formed as a result of the degeneration of a previously existing solid tumour (1). Therefore, cystic lesions may occur in both childhood and adulthood. Primary mediastinal cysts (PMCs) may display a wide array of histological types, such as thymic cysts (TCs), bronchogenic cysts (BCs), pericardial cysts (PCs), and lymphangiomas (cystic hygroma

[CH]). Although symptomatic PMCs are unequivocally considered an indication for surgery, the management of asymptomatic PMCs is still controversial. Some surgeons prefer surgical management due to a fear of malignant transformation, cyst infection, progressive growth or spontaneous rupture, while some others advocate that not all PMCs should be removed given the benign nature of these lesions (3–5). Despite this uncertainty, literature data on the surgical experience in PMCs is considerably limited.

The aim of this study was to review the outcomes of the surgical procedures aimed at treating PMCs at our institution in the last 9 years and to report the

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clinicopathological variations with a discussion of the relevant literature.

SUBJECTS AND METHODS

We reviewed the medical data of 41 patients (19 men, 22 women; mean age 46.5 ± 13.7 years (range 19–78 years)) diagnosed with PMC by the histological examination after surgical treatment between January 2007 and January 2016. Patients who were not treated surgically but followed conservatively were excluded. The examined variables included age, sex, indication for surgical treatment, side of surgical treatment, histopathological diagnosis, time to chest tube removal, duration of hospital stay and postoperative complications. The study protocol was approved by the local ethics committee of our hospital. The study was conducted in compliance with the criteria of the Helsinki Declaration.

In the preoperative period, a posteroanterior chest film, thoracic computed tomography (CT) examination with contrast enhancement and/or pulmonary mediastinal magnetic resonance imaging (MRI) taken within the preceding month were reviewed by the surgeon operating on the patients. All patients underwent complete blood count, routine biochemistry tests, respiratory function testing and cardiological examination with electrocardiography as well as echocardiographic examination as needed. All patients were informed about the advantages and disadvantages of the thoracotomy, sternotomy and video-assisted thoracoscopic surgery (VATS) approaches.

Operative technique

All patients were intubated with a double-lumen endotracheal tube following general anaesthesia, except for one patient who was operated on with median sternotomy. Patients to be operated on with thoracotomy were placed in the right or left posterolateral thoracotomy position depending on the lesion's side, and the thoracic cavity was entered through the fifth intercostal space. The thoracoscopic operations were performed using three to four ports with the patients lying in the lateral position. In the TC case, the patient was placed in the supine position following single-lumen intubation. A pillow support was placed in the interscapular area, and median sternotomy was performed (due to our inexperience in endoscopy). Total excision was carried out and extubation was performed at the operating theatre in all patients. All patients had a control chest X-ray at the early postoperative period.

Statistical analysis

The differences between various histological types of PMC were compared with the analysis of variance test for continuous variables and Chi-square test for categorical variables. A *p*-value of less than 0.05 was considered significant for all tests. All statistical analyses were carried out using SPSS version 21.0 (IBM) (Chicago, IL, USA) software package.

RESULTS

A total of 41 patients with PMC were surgically treated over a period of 9 years. As a total, 19 (46.3%) men and 22 (53.7%) women were enrolled. The age range of the study subjects was 46.5 ± 13.7 years; the postoperative duration of hospital stay was 4.0 ± 1.0 days and the postoperative duration of follow-up was 11.2 ± 3.7 months. Based on the histopathological examination, 21 (51.2%) patients were diagnosed as having a PC, 16 (39%) had a BC, 3 (7.3%) had a CH and 1 (2.4%) had a TC. The operations were right sided in 22 (53.7%) patients, left sided in 18 (43.9%) patients and in supine position in 1 (2.4%) patient. Neither postoperative mortality was observed nor there was any recurrence after a mean of 11.2 ± 3.7 months. Table 1 provides a comparison of clinical characteristics, treatment modalities and follow-up information of 41 patients. No significant difference was found between the groups with respect to studied variables (sex, age, pathological diagnosis).

Bronchogenic cyst

Eight of 16 BC cases were asymptomatic. Six patients had cough and two had dyspnoea. In thoracic CT and MRI examinations, two patients had lesions in anterior mediastinum, nine had lesions in middle mediastinum and five had lesions in posterior mediastinum. Thirteen patients were operated on with thoracotomy and three with the VATS technique. One patient had atelectasis and another one had prolonged air leakage as a postoperative complication.

Pericardial cyst

While 15 of 21 patients with PC were asymptomatic, six had chest pain, cough and dyspnoea. All lesions were located in middle mediastinum. Seventeen patients were operated on with thoracotomy and four with VATS. As a postoperative complication, two patients developed atelectasis, one wound site infection and one transient phrenic nerve paralysis.

Table 1: Demographic properties of patients by histological type

Property	PC (n = 21)	BC (n = 16)	CH (n = 3)	TC (n = 1)
Sex, F/M	10/11	10/6	1/2	1/0
Age, years*	47 ± 1.5	43	49	53
Symptoms	Chest pain, cough, dyspnoea	cough, dyspnoea	Chest pain, dyspnoea	Chest pain, dyspnoea
Mediastinal localization	Middle	Anterior 2, middle 9, posterior 5	Middle	Anterior
Maximum cyst diameter, cm*	4.6 ± 1.3	3.9 ± 1.7	6.9 ± 1.2	4
Thoracic CT	15	13	2	1
Thoracic MR	6	3	1	1
Surgical technique	Thoracotomy 17, VATS 4	Thoracotomy 13, VATS 3	Thoracotomy 3	Sternotomy
Resection width	TE	TE	TE	TE
Postoperative complication	Atelectasi 2 wound inf.1, Phrenic nerve paralysis 1	Atelectasis 1, prolonged air leakage 1	Minimal haemorrhage 1	no
Postoperative duration of hospital stay, days*	4.0 ± 1.0	4.1 ± 1.0	5.0 ± 1.0	5
Postoperative follow-up duration, months*	9.0 ± 3.3	12.9 ± 3.5	11 ± 1.5	17

*Values denote mean ± standard deviation. TC = thymic cyst; BC = bronchogenic cyst; PC = pericardial cyst; CH = cystic hygroma; MRI = magnetic resonance imaging; CT = computerized tomography; VATS = video-assisted thorascoscopic surgery; Min = minute; TE = total excision.

Cystic hygroma

Of three patients with CH, two were asymptomatic, while one patient had chest pain and dyspnoea. The lesions were in middle mediastinum. After showing the relationship of the CH with the adjacent tissues, all three patients were operated on with thoracotomy. The cyst was filled with a serous fluid and enveloped by a thin, transparent membrane. One patient developed minimal postoperative haemorrhage.

Thymic cyst

The patient with the TC had chest pain and dyspnoea. The lesion was located in anterior mediastinum. On thoracic CT, there was a thin-walled cyst filled with a cystic content of fluid density. Lung MRI was used to reveal the borders of the cyst with other adjacent organs. It was observed to have a low signal intensity on T1-weighted images and a high-signal intensity on T2-weighted images. We totally excised the TC with median sternotomy.

DISCUSSION

Primary mediastinal cyst lesions appear as congenital or acquired lesions, or as a result of the degeneration of a previously existing solid tumour. The prevalence of PMCs among mediastinal masses ranges between 10% and 25%. They affect both sexes equally (6).

The prevalence of cysts varies by age groups. While foregut cysts constitute approximately half of congenital mediastinal cysts in adults, 90% of all cysts are foregut cysts (BC, enteric cyst, neurenteric cyst) in the

paediatric age group. Pericardial cyst is more common among adults, whereas it is extremely rare in the paediatric age group (1, 2, 6). Depending on cyst size and adjacent organ compression, patients may present with variable symptoms and clinical presentations.

Asymptomatic congenital cysts may not be detected until adulthood. Bronchogenic cysts (mediastinal-bronchogenic) typically arise along the tracheobronchial tree. They are well-circumscribed cystic lesions of bronchopulmonary origin typically located in the middle mediastinum. They constitute approximately half of all mediastinal cysts (7). In a study comprising 86 patients under follow-up for mediastinal and lung BCs, 72.1% of all patients were symptomatic. In the same study, 67% of patients with mediastinal BC were symptomatic, as were 90% of patients having lung BC (8).

The most common symptom of patients with BC was retrosternal pain (61.4%), while those with lung BC mostly had cough, dyspnoea, fever and purulent sputum (8). In a domestic case series containing 22 patients from all age groups, 81% of patients were symptomatic, with cough being the most common symptom (45%) (9). Although BC has been reported as the most common histological variant of PMC, PC was the most common variant in our series, which was responsible for almost half of cases (n = 21; 51.2%) (3, 4). Eight of our BC cases (n = 16) were asymptomatic. Six patients had cough and two had dyspnoea. The cysts were located in anterior mediastinum in two patients, middle mediastinum in nine and posterior mediastinum in five. Signs of BC can be found on plain films in two-thirds of patients. It is

typically seen as a well-circumscribed, round, homogeneous mass lesion of 2–10 cm in diameter. When a cyst opens into a bronchus or is infected, however, an air-fluid level may become evident (1).

Thoracic CT is the most commonly employed diagnostic method in the evaluation of BCs, mainly due to its ability to provide detailed information about a cyst's structure, density, properties of its fluid, calcium content of its wall, its relationship with neighbouring structures and its vascular supply (1, 9). Magnetic resonance imaging provides information depending on a cyst's content. In cysts with fluid content, very-low-density images are obtained on T1-weighted sections and very-high-density images on T2-weighted sections. However, due to low-quality images, it is rarely used in cysts containing a large amount of proteinaceous material (9). Moreover, thoracic CT is superior to MRI for the evaluation of an intraparenchymal BCs since it may more clearly distinguish a cyst from an aerated region (1). Thoracic CT was also the most commonly used diagnostic method in our series ($n = 13$).

There are some case reports on the use of more invasive histopathological diagnostic methods such as bronchoscopy, endobronchial and oesophageal ultrasonography (EBUS and EUS), mediastinoscopy and thoracoscopy, for the diagnosis of BC (10). Surgical resection is the single method used for confirming the diagnosis (9). If patients are not treated surgically, most of them develop symptoms and complications. Moreover, it has been reported that some patients who are left untreated may develop malignancy originating from cyst mucosa (1, 9, 11). It is particularly recommended that all symptomatic patients be treated surgically (1, 8, 9, 12). Therefore, thoracotomy is usually needed for resection (1, 8, 12). It has been reported that lobectomy is the best surgical choice for intraparenchymal BCs and wedge resection for peripherally located small cysts (13). Mediastinal BCs can also be treated using mediastinoscopy through a small incision (1, 14). It has been reported that VATS can achieve favourable results in the resection of mediastinal cysts, with recurrence rates being not increased (15, 16). Some recent studies have indicated that robotic surgery can be safely used with low morbidity for the treatment of mediastinal tumours and cysts (17, 18). As we were in the beginning of the VATS experience, we performed VATS for three patients and thoracotomy for the remaining 13 patients.

Pericardial cyst is a benign pathological lesion developing as a result of incomplete lacunar fusion during the formation of coelomic cavity during the intrauterine

period (19). It is extremely rare in the childhood period (1). Its incidence is 1/100 000 and constitutes 7% of all mediastinal mass lesions (19). The cyst wall is lined by a single layer of mesothelial cells and connective tissue that is rich in elastic and collagen fibres. A cysts' size varies between 1 and 30 cm (19, 20). Cysts can be found in any mediastinal compartment from upper mediastinum to diaphragm (21). They are most commonly located in the lateral basal corner of the pericardium, where it meets diaphragm (cardiophrenic angle), and mostly in the right cardiophrenic angle (51%–70%) (1, 22).

Pericardial cyst is usually asymptomatic (1, 19, 23). It may rarely give rise to compressive signs (right ventricular outflow obstruction, pulmonary stenosis secondary to compression, cyst rupture and sudden death) (23). In our patients with PC, the lesions were located in middle mediastinum, while 15 patients were asymptomatic, 6 had chest pain, cough and dyspnoea.

The cyst appears as a well-circumscribed, round or oval mass in the costophrenic angle on conventional chest films (1). Used for definitive diagnosis, thoracic CT attains a diagnostic accuracy of nearly 100%. Thoracic CT and MRI have no superiority over each other. In our series, the radiological diagnosis of PC was made by thoracic CT in 15 patients and MRI in 6 patients. PCs are benign lesions for which there exists no clear consensus for therapy. Surgery is usually recommended when radiological cyst size changes or when certain signs such as arrhythmia, hemodynamic instability, pericarditis or tamponade emerge (1, 19, 20, 22, 23).

However, malignant transformation has been described in the literature; therefore, surgery is recommended even for asymptomatic cases. A choice between an endoscopic and open surgical approach is influenced by cyst's location, size and relationship with vital organs (1).

Cystic hygroma is a multilocular, thin-walled cystic mass of lymphatic origin. Approximately, 1% of all lymphangiomas are located in the mediastinum. It is a rare tumour that usually develops in the first decade of life. The major reason of its rare occurrence is its asymptomatic nature or very delayed symptoms. Its aetiology commonly involves abnormal dilatation of the lymphatic system (24). Although typically located in anterior mediastinum, it may also be seen in middle mediastinum. Although ultrasonography and thoracic CT are quite helpful for making the diagnosis by detecting CH, definitive diagnosis is made by histopathological examination. On ultrasonography, it appears as having septae

composed of multilocular masses with a dominant cystic appearance.

Thoracic CT and MRI delineate the relationship of CH with the surrounding structures (25). In one of our cases in which mediastinal CH was found, an MRI was taken to clarify the relationship of the lesion with great vessels. Although some authors have recommended a conservative therapy for asymptomatic CH cases, spontaneous regression of these lesions is rare (25). A number of authors have reported favourable outcomes with total surgical excision (25). Riechelmann *et al* (24) did not observe any recurrence after total excision but did so in 56% of cases after subtotal excision and 100% of cases after partial excision or aspiration. We carried out total excision for all of our patients and observed no recurrences after a mean follow-up period of 11.2 ± 3.7 months.

Thymic cyst is a rare lesion located in anterior mediastinum, which may be both congenital and acquired (1, 6). It is believed that congenital cysts develop from remnants of the bronchial sac. Acquired ones are seen after infections, trauma or immune pathologies. It constitutes less than 1% of mediastinal lesions (26).

Symptoms depend on a cyst's localization and relationship with adjacent organs (26). Despite being a benign lesion, it should be differentiated from malignant tumours of anterior mediastinum (such as thymoma, germ cell tumours and lymphoma) (1). It appears as a well-circumscribed mass lesion in anterior and superior mediastinum. The typical sign on thoracic CT is a thin-walled cyst and cyst content of fluid density. Lung MRI clearly demonstrates the relationship of a cyst with adjacent organs (1). Surgical intervention via thoracotomy or thoracoscopy is recommended both for making differential diagnosis and providing a curative therapy (1, 6, 26).

CONCLUSION

Despite advanced noninvasive diagnostic methods, definitive diagnosis of PMC lesions can usually only be achieved by surgical interventions. Surgery is usually a curative option with low morbidity and mortality.

AUTHORS' NOTE

EA conceived paper, oversaw data collection, conducted data analysis, statistical analysis, wrote manuscript and approved final version. TE participated in study design, data analysis and interpretation, critically revised manuscript and approved final version. The authors declare that they have no conflicts of interest. The authors

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