**Original
Article**

Single Institutional Experience with Primary Mediastinal Cysts: Clinicopathological Study of 108 Resected Cases

Yoshiki Kozu, MD, Kenji Suzuki, MD, Shiaki Oh, MD, Takeshi Matsunaga, MD,
Yukio Tsushima, MD, and Kazuya Takamochi, MD

Purpose: To review our institutional surgical outcomes with primary mediastinal cysts (PMCs) and elucidate the clinicopathological differences among several histological PMC variants.

Methods: We retrospectively reviewed 108 patients who underwent surgery for PMC at our institution between 1997 and 2012.

Results: There were 54 thymic cysts (TCs), 26 bronchogenic cysts (BCs), 16 mature cystic teratomas (MCTs), 11 pericardial cysts (PCs), and 1 esophageal duplication cyst. Surgical approach was via thoracoscopy in 44, thoracotomy in 24, median sternotomy in 39, and hemiclamshell incision in 1. Pathological complete resection was achieved in all patients. Postoperative complications occurred in 13 patients. There was no postoperative mortality. All patients were recurrence-free after a mean follow up of 41 ± 26 months. MCT was significantly associated with larger cyst size ($p < 0.001$), more frequent combined resection of invaded organs ($p < 0.001$), more intraoperative bleeding ($p = 0.005$), and longer duration of operation ($p = 0.022$) than the 3 other groups (TC, BC, and PC).

Conclusion: Surgical treatment for PMC is safe and efficacious regardless of approach. Patients with MCT may require more aggressive surgeries than those with other histological variants, reflecting their potential for invasion into surrounding structures and larger cyst size.

Keywords: primary mediastinal cyst, surgical treatment, histological variant

Introduction

Primary mediastinal cysts (PMCs) are mainly of embryonal origin, and are uncommon, accounting for approximately 25% of all mediastinal tumors.¹⁾ PMCs encompass a wide variety of histologies, such as thymic

cyst (TC), bronchogenic cyst (BC), mature cystic teratoma (MCT), pericardial cyst (PC), and esophageal duplication cyst (EDC). With the recent increase in the use of imaging procedures such as computed tomographic (CT) scanning, the chances of encountering this benign entity have increased, even in asymptomatic patients.

Although symptomatic PMC is unequivocally considered indication for surgical treatment, the management of asymptomatic PMC is still debated. Some prefer surgical treatment for fear of malignant transformation, cyst infection, progressive growth, or spontaneous rupture,^{2–4)} whereas others assert that there is no need for universal resection due to the benign nature of PMCs.^{5–7)} Despite this controversy, there has been a paucity of literature concerning surgical experiences with the entire range of PMCs.

Division of General Thoracic Surgery, Juntendo University School of Medicine, Tokyo, Japan

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Corresponding author: Kenji Suzuki, MD. Division of General Thoracic Surgery, Juntendo University School of Medicine, 3-1-3 Hongo, Bunkyo-ku, Tokyo 113-8431, Japan
Email: kjsuzuki@juntendo.ac.jp

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The purpose of the present study was to review our institutional surgical outcomes with PMC over the last 16 years. In addition, we sought to elucidate the differences in clinicopathological features among several histological PMC variants.

Patients and Methods

We retrospectively reviewed a total of 108 patients who were diagnosed with PMC by histological examination following surgical treatment, at the Juntendo University Hospital, Tokyo, Japan, between 1997 and 2012. We excluded multilocular thymic cysts and cystic thymomas from this study, because the former are associated with thymic neoplasm,⁸⁾ and the latter are occasionally malignant.⁹⁾

The routine preoperative workup for a mediastinal cystic mass included a complete blood test, chest radiography, and chest CT. Chest magnetic resonance imaging (MRI) and F18-fluorodeoxyglucose positron emission tomography (FDG-PET) were also used when additional radiological information was needed. FDG-PET was available for the last 5 years of this study. Follow up radiological examinations were performed using the following method: chest radiography at every examination in the outpatient department, and chest CT every 6 months.

Medical records of all patients were reviewed in detail regarding gender, age, symptom at presentation, concomitant malignancy, anatomical location of the cystic mass in the mediastinum,¹⁰⁾ maximum diameter of the cystic mass on the preoperative CT, surgical approach, extent of surgery, frequency of combined resection of invaded organs, intraoperative bleeding, duration of operation, histological variant, surgical curability, postoperative hospital stay, postoperative complication, mortality, and recurrence. Postoperative mortality was defined as any death during hospitalization or within 30 days from surgery. Approval from the institutional review board was obtained with a waiver for patient consent.

Statistical Analysis

Of the different histological PMC variant groups, differences were compared using analysis of variance (ANOVA) for continuous variables and χ^2 tests for categorical variables. A *p*-value of less than 0.05 was considered significant. The reported *p* values are all two-sided. All statistical analyses were performed using JMP 9 software (SAS Institute, Cary, North Carolina, USA).

Results

There were 52 (48%) male and 56 (52%) female patients. All but 1 (9 years old) were adult patients (>15 years) with a mean age at surgery of 50 ± 17 years. MRI and FDG-PET were used in 72 and 26 patients respectively. FDG-PET was interpreted as positive (maximum standard uptake value ≥ 2.5) in 4 of these 26. Conversion to open thoracotomy was not required in any patient who underwent thoracoscopic surgery. All thoracoscopic surgeries were performed using 3–4 ports in the lateral position. Histological variants were as follows: 54 TCs (50%), 26 BCs (24%), 16 MCTs (15%), 11 PCs (10%), and 1 EDC (1%). Pathological complete resection was achieved in all patients. There was no postoperative mortality. All the patients were recurrence-free after a mean follow up of 41 ± 26 months. Clinicopathological features of the patients according to the histological variants are listed in **Table 1**.

Comparison of clinicopathological features among the 4 groups according to histological PMC variants

We compared various clinicopathological features among the 4 groups categorized by histological variants, namely TC, BC, MCT and PC (**Table 1**). We found that there was no significant difference regarding symptoms, concomitant malignancy, postoperative complications, or postoperative hospital stay among the 4 groups. On the other hand, we found that MCT was significantly associated with larger maximum diameter of the cyst ($p < 0.001$), more frequent combined resection of invaded organs ($p < 0.001$), more intraoperative bleeding ($p = 0.005$), and longer duration of operation ($p = 0.022$) than the 3 other groups. **Figure 1** shows representative contrast-enhanced CT imaging of adhesive cystic teratoma for which combined resection of the lung, mediastinal pleura, and pericardium was required to achieve a complete resection.

Discussion

This is one of the largest single-center reports on experiences with surgical treatment for PMCs. Although BC has been reported to be the most common histological variant of PMC,^{2–4)} we found that TC was the most common in the present study, accounting for half of all cases ($n = 54$; 50%). The reason for the predominance of TC in our institution, however, is unclear.

Table 1 Clinicopathological features according to histological variant

	TC (n = 54)	BC (n = 26)	MCT (n = 16)	PC (n = 11)	EDC (n = 1)	p
Gender, (M/F)	29/25	13/13	6/10	4/7	0/1	
Age (years)	59 ± 11	44 ± 17	31 ± 13	46 ± 12	47	
Symptomatic	10 Chest pain 6 Cough 3 Dyspnea 1	6 Chest pain 3 Cough 3	4 Chest pain 2 Cough 2	2 Cough 2	0	0.73
Concomitant malignancy	5 Uterine Ca 2 Colon Ca 2 Breast Ca 1	1 MFH 1	0	0	0	0.52
Location in the mediastinum	Anterior 54	Anterior 6 Middle 16 Posterior 4	Anterior 15 Middle 1	Middle 11	Posterior 1	
Maximal diameter of cyst (cm)	3.3 ± 1.8	3.6 ± 1.9	7.8 ± 4.2	3.9 ± 1.2	2.5	<0.001 ^a
MRI	29	20	13	9	1	
FDG-PET (SUV max ≥2.5)	9 (2)	9 (0)	6 (2)	2 (0)	0 (0)	
Surgical approach	TS 17 TT 10 MS 27	TS17 TT 9	TS 1 TT 2 MS 12 HCS 1	TS 8 TT 3	TS 1	
Extent of resection	Excision 35 To-Thy 19	Excision 26	Excision 7 To-Thy 9	Excision 11	Excision 1	
Combined resection	3 Lung 2Per 1	1 Dia 1	9 Lung 5 Lung + PhrN 1 MedP 2 Lung + MedP + Per 1	1 PhrN 1	0	<0.001 ^a
Intraoperative bleeding (g)	73 ± 80	42 ± 76	149 ± 178	22 ± 30	20	0.005 ^a
Duration of operation (min)	114 ± 37	122 ± 47	152 ± 57	104 ± 26	135	0.022 ^a
Postoperative complication	7 Atelectasis 3 AF 2 RD 1 AE of IPF 1	2 AF 1 RD 1	2 Atelectasis 1 AF 1	2 Atelectasis 2	0	0.90
Postoperative hospital stay (day)	7.1 ± 3.4	7.0 ± 4.7	10.4 ± 8.5	5.8 ± 2.5	4	0.082

Values are reported as the number of patients, or the mean ± standard deviation. ^a Significant difference between MCT and the 3 other groups (TC, BC, and PC). TC: thymic cyst; BC: bronchogenic cyst; MCT: mature cystic teratoma; PC: pericardial cyst; EDC: esophageal duplication cyst; Ca: cancer; MFH: malignant fibrous histiocytoma; MRI: magnetic resonance imaging; FDG-PET: F18-fluorodeoxyglucose positron emission tomography; SUV: standard uptake value; TS: thoracoscopy; TT: thoracotomy; MS: median sternotomy; HCS: hemiclamshell; To-Thy: total thymectomy; Per: pericardium; Dia: diaphragm; PhrN: phrenic nerve; MedP: mediastinal pleura; AF: atrial fibrillation; RD: respiratory distress; AE: acute exacerbation; IPF: idiopathic pulmonary fibrosis

Fig. 1 Representative contrast-enhanced computed tomographic imaging of adhesive cystic teratoma.

In the present study, most of the patients ($n = 86$; 80%) were asymptomatic. Takeda, et al.,³⁾ reported that in a study involving 105 PMC patients, 64% ($n = 67$) were asymptomatic. They found that those with mesothelial (pericardial/pleural) cysts were more likely to be asymptomatic than those with other histological variants ($p = 0.06$). We, however, detected no correlation between symptomatic status and histological variant ($p = 0.73$). This may be partly because of the small number ($n = 22$) of symptomatic patients.

There is still controversy as to surgical indication for asymptomatic PMC patients. We performed surgery in such patients when malignancy could not be ruled out based on the following radiological features on preoperative CT and/or MRI: progressive growth, mural nodule, thickened irregular cystic wall, or invasion into the surrounding structures. For the last 5 years of the study period, PET positivity was also considered to be a surgical indication.

We detected a postoperative complication rate of 12% ($n = 13$), which is comparable to those in previous reports, which range from 6% to 25%.^{2,4)} Postoperative mortality was not observed. Surgical treatment for PMC could be performed safely regardless of the approach used.

Once surgical excision is achieved, postoperative recurrence of PMC is extremely rare.^{3,4)} However, recurrence can occur even 20–25 years after surgery.^{11,12)} Long-term follow up is indicated in case of incomplete resection or intraoperative spillage of the cystic contents due to dense adhesion.

Thoracoscopic surgery for PMC has recently become prevalent, with the advantage of minimal invasiveness.^{13,14)}

A thoracoscopic procedure was used in 44 (41%) patients without conversion to thoracotomy in this cohort. Although this technique offers significant benefits, we should not hesitate to use an open procedure in a complicated case, to achieve complete resection. We could actually obtain pathological complete resection in every case, by using each procedure properly.

The most important clinical implication emerging from this study was that patients with MCT required more aggressive surgeries than those in the 3 other groups (TC, BC, and PC). Specifically, MCT was significantly associated with more frequent combined resection of invaded organs, more intraoperative bleeding, and longer duration of the operation. Although MCT is histopathologically benign as are other histological variants of PMC, MCT can produce proteolytic or digestive enzymes, resulting in rupture and adhesion to other organs.^{15–17)} This potential for invasion into surrounding structures and larger maximum diameter of the cyst may be the explanation for more frequent extended surgeries.

Conclusion

Surgical treatment for PMC is safe and efficacious regardless of approach. We should keep in mind that MCT may be associated with more aggressive surgeries compared with the other histological variants, reflecting their potential for invasion into surrounding structures and larger cyst size.

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Disclosure Statement

None declared.

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