OUR DIAGNOSTIC AND THEARAPEUTIC SURGICAL APPROACHES TO MEDIASTINAL MASSES

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Abstract

The mediastinum is defined as the thoracic space that lies between the two pleural layers. It extends from the thoracic inlet to the superior surface of the diaphragm. It is bordered anteriorly by the internal surface of the sternum and posteriorly by the longitudinal spinal ligaments. The mediastinum comprises of important anatomical structures. Surgical treatments and the results of patients who had a pre-diagnosis of mediastinal masses were examined.

A total of 93 patients who underwent surgery for a pre-diagnosis of mediastinal masses between June 2003 and June 2008 were retrospectively reviewed. Preoperative evaluations, operative procedures and results of the patients were examined.

Of the 93 patients, 47 were females and 46 were males. The age range was 5-76 years, while the mean age was 46.5 years. Mediastinal lesions were mostly located in the anterior mediastinum. Cough and chest pain were observed as the two main symptoms in symptomatic patients. The surgical procedures performed were mediastinoscopy, posterolateral thoracotomy, median sternotomy, and anterior mediastinotomy. Post-operative histopathological examination of collected specimens resulted in a variety of pathologic diagnoses. Two patients developed incision wound infection, whereas one patient, known to have thymoma, died on the 16th post-operative day as a result of respiratory muscle insufficiency. Two patients diagnosed with osteosarcoma and chondrosarcoma metastasis died four months after surgery due to primary pathologies.

The surgical procedure used in the diagnosis and treatment of mediastinal masses is very important. The surgical approach is determined according to localization. Operative mortality is very low. Surgical management of mediastinal masses is suggested to be the most appropriate approach since histopathological diagnosis and treatment can be achieved synchronously in many patients.

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Introduction

The mediastinum is an important anatomical compartment consisting of very important structures that are vital for life. Benign or malignant masses may be found in the mediastinum. Malignant mediastinal tumors may be primary or secondary to lymphatic nodal spread of neoplasia. On the other hand, benign mediastinal masses may arise from primary mediastinal structures and from infectious or inflammatory diseases with lymphatic nodal involvement. This wide spectrum forms a diverse histopathology in the mediastinum[1] (Table 1).

Diagnosis and treatment are imperative in patients with mediastinal masses, which are generally coincidentally identified. They may lead to life threatening clinical scenarios, such as local invasion or compression on adjacent organs. Surgery plays a very important role in the diagnosis and treatment of these patients.

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Anterior Mediastinum	Visseral Mediastinum	Paravertebral Sulcus
-Thymoma	- Lymphoma	-Schwannoma
-Germ cell tumor	-Pericardial cyst	-Neurofibroma
-Lymphoma	-Enteric cyst	-Ganglioneuroma
-Thymic cyst	-Neuroenteric cyst	-Fibrosarcoma
-Thyroid adenoma	-Mesothelial cyst	-Paraganglioma
-Parathyroid adenoma	-Ductus thoracicus cyst	-Ganglioneuroblastoma
-Aberrant thyroid	-Mediastinal granuloma	-Malignant schwannoma
-Lymphangioma	-Lypmhoid hamartoma	

Table 1. Localization of Mediastinal Tumor and Cyst.

Materials and Methods

A total of 93 patients who underwent surgery for the pre-diagnosis of mediastinal masses between June 2003 and June 2008 were retrospectively reviewed. Preoperative evaluations, operative procedures and results of the patients were examined. The mediastinum is classified anatomically as the anterior, middle and posterior mediastinum. Pathologies associated with the esophagus and the diaphragms were not included in the study.

Of the 93 patients, 47 were females and 46 were males. The age range was 5-76 years, while the mean age was 46.5 years. The female/male ratio was calculated as 1.1. Preoperative posterior-anterior (PA) chest X-rays, lateral X-rays and computerized tomography (CT) scans of the thorax of all the patients were performed(Figures 1,2). The localization and character of mediastinal masses and their relation with neighboring structures were evaluated. Eighteen patients suspected of having local invasion or compression of adjacent organs were also evaluated regarding resectability using magnetic resonance imaging (MRI) (Figures 3,4).

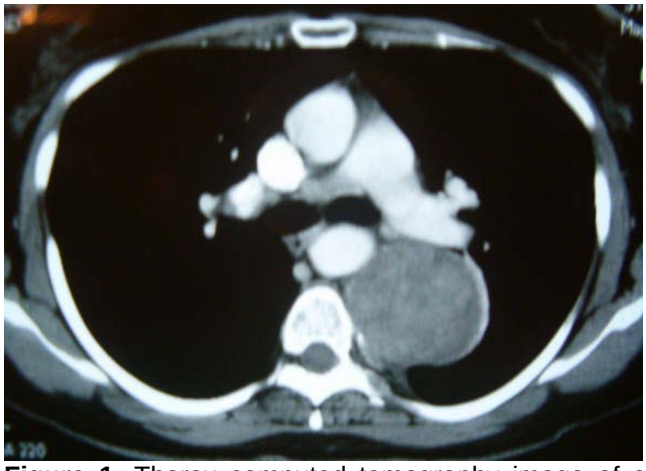

Figure 1. Thorax computed tomography image of a left paravertebral sulcus mass, histopathologic diagnosis was schwannoma.

Figure 2. Thorax computed tomography image of a left paravertebral sulcus mass, histopathologic diagnosis was ganglioneuroma.

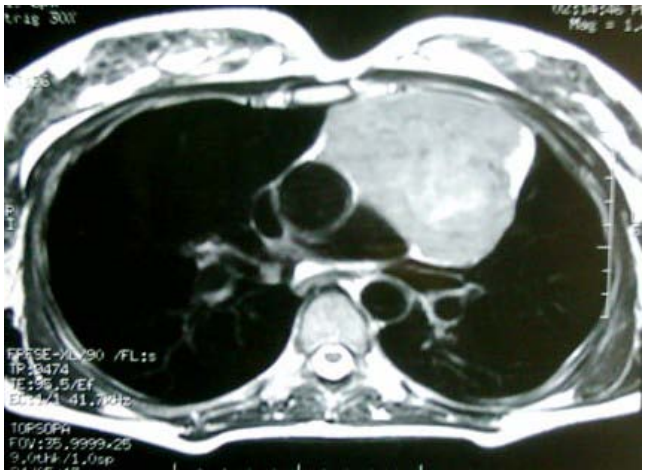

Figure 3. Magnetic resonance image of a left paravertebral sulcus mass, histopathologic diagnosis was schwannoma.

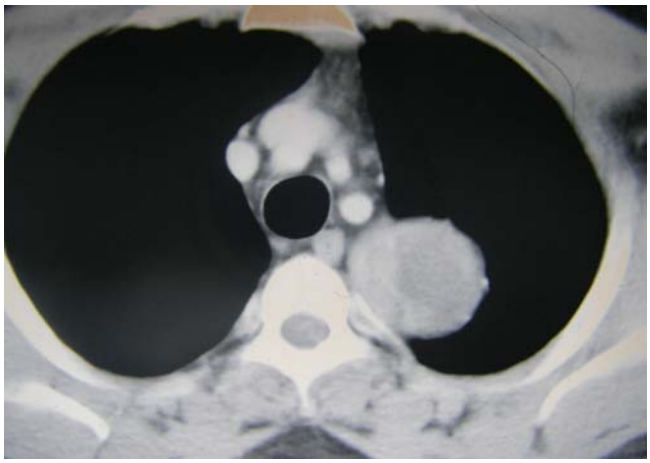

Figure 4. Magnetic resonance image of a left

paravertebral sulcus mass, histopathologic diagnosis was thymoma.

Evaluation with positron emission tomography (PET) were performed on three patients with suspicion of malignity following clinical and radiological examination, and on one patient previously diagnosed with malignity. Additional evaluation with bone scintigraphy in one patient and thyroid scintigraphy in three patients was performed. Fiberoptic bronchoscopy was performed on all patients before surgery.

The appropriate surgical approach was determined on the basis of radiological findings. Mediastinoscopy was performed on 42 (45%) patients, right posterolateral thoracotomy on 30 (32%), median sternotomy on 12 (13%), left posterolateral thoracotomy on eight (8.5%) and anterior mediastinotomy was performed on one (1.5) patient (Table 2).

SURGICAL PROCEDURES	NUMBER	PERCENTAGE (%)
Mediastinoscopy	42	45
Right posterolateral thoracotomy	30	32
Median sternotomy	12	13
Left posterolateral thoracotomy	8	8,5
Anterior mediastinotomy	1	1,5
TOTAL	**93**	**100**

Table 2. The surgical procedure carried out, the number of operations in respect to patients, and the percentage distribution.

Results

Twenty-six (28%) patients were asymptomatic. Of the symptomatic patients 32 (34%) had cough, 14 (15%) had chest pain, 10 (11%) had dyspnea, seven (7.6%) had hoarseness, two (2.2%) patients had mediastinal findings, one (1.1%) had joint pain, and one patient (1.1%) had headache (Table 3).

Before the operation all patients were evaluated using fiberoptic bronchoscopy. Compression of the trachea from the outside was observed in 11 patients, while bluntness of the carina was observed in five patients; no endobronchial lesion was identified. Anatomically, three compartments of the mediastinum were examined. It was demonstrated that 79% of the mediastinal masses were localized in the anterior mediastinum (n=74), 15.5% were localized in the posterior mediastinum (n=14), and 5.5% in the middle mediastinum (n=5) (Table 4).

COMPLAINT	NUMBER	PERCENTAGE (%)
Asymptomatic	26	28
Cough	32	34
Chest pain	14	15
Dyspnea	10	11
Hoarseness	7	7,6
Myasthenic findings	2	2,2
Arthralgia	1	1,1
Headache	1	1,1

Table 3. Distribution of complaints.

MEDIASTINAL COMPARTMENT	NUMBER	PERCENTAGE(%)
Anterior mediastinum	74	79
Paravertebral sulcus	14	15,5
Visseral mediastinum	5	5,5
TOTAL	**93**	**100**

Table 4. The localization distribution, number and the percentage of cases in the mediastinal compartments.

HISTOPATHOLOGIC DIAGNOSIS	NUMBER	PERCENTAGE (%)
Sarcoidosis	21	22,5
Thymoma	13	14
Tuberculosis lymphadenitis	11	11,7
Reactive lymphadenopathy	7	7,5
Schwannoma	6	6,,4
Metastatic adenocarcinoma	8	8,4
Nodular goiter	4	4,2
Hodgkin's lymphoma	6	6,4
Bronchogenic cyst	3	3,3
Castelman disease	2	2,2
Ganglioneuroma	2	2,2
Askin tumor	1	1,1
Chondrosarcoma	1	1,1
Adenoid cystic carcinoma of trachea	1	1,1
Amyloidosis	1	1,1
Parathyroid adenoma	1	1,1
Teratocarcinoma	1	1,1
Usual intertitial pneumonia	1	1,1
Squamous hyperplasia	1	1,1
Paraganglioma	1	1,1
Neuroendocrine tumor	1	1,1
Lymphangiectasia	1	1,1
Pericardial cyst	1	1,1
TOTAL	**93**	**100**

Table 5. Histopatologic diagnoses and distributions.

Histopathological examination of surgery specimens obtained from the patients who underwent surgery for mediastinal masses revealed 21 cases of sarcoidosis (22.5%); 11 of tuberculous lymphadenitis (11.7%); 13 of thymoma (14%); 7 of reactive lymphadenopathy (7.5%); 6 of schwannoma (6.4%); 8 of metastatic carcinoma (8.4%); 4 of nodular goiter (4.2%); 6 of Hodgkin's lymphoma (6.4%); 3 of bronchogenic cyst (3.3%); 2 of Castleman disease (2.2%); 2 of ganglioneuroma (2.2%); 1 of Askin's tumor (1.1%); 1 of chondrosarcoma (1.1%); 1 of tracheal adenoid cystic carcinoma (1.1%); 1 of amyloidosis (1.1%); 1 of parathyroid adenoma (1.1%); 1 of teratocarcinoma (1.1%); 1 case of usual interstitial pneumonia (1.1%); 1 of squamous hyperplasia (1.1%); 1 of paraganglioma (1.1%); 1 of neuroendocrine tumor (1.1%); 1 of lymphangiectasia (1.1%) and 1 case of pericardial cyst (1.1%) (Table 5).

Incision wound infections developed in two patients during the post-operative early period. Healing was achieved through antibiotic treatment and wound care. The perioperative mortality was 1.1%. One patient who was known to have thymoma died on the 16th post-operative day as a result of respiratory muscle insufficiency.

Discussion

The mediastinum is bordered laterally by the pleura, superiorly by the thoracic inlet and inferiorly by the diaphragm. It is divided into three compartments based on lateral X-ray: the anterior mediastinum, middle mediastinum and posterior mediastinum. This division is not made according to a real anatomic or facial plan.

The anterior mediastinum is the area covering the sternum posteriorly, the anterior border of the pericardium and bordered by the brachiocephalic vein anteriorly at the superior border. It extends from the diaphragm to the thoracic inlet, and contains the thymus gland, mediastinal adipose tissues and lymph nodes. The middle mediastinum is the area containing the heart, pericardium, aortic arc, brachiocephalic vessels, pulmonary arteries, pulmonary veins, trachea, bronchus and lymph nodes; and extending from the front of the esophagus to the anterior mediastinum. On the other hand, the posterior mediastinum is the area that extends from the anterior border of the esophagus to the vertebrae. The posterior mediastinum contains the descending aorta, the esophagus, azygos and hemizygos veins, ganglions and nerves, thoracic dust, lymph nodes and adipose tissues. Hence, these compartments can be approached as important for the pre-diagnosis of mediastinal masses.

The most encountered tumors of the anterior mediastinum are thymomas, lymphomas, and germ cell tumors. Apart from these, vascular and mesenchymal tumors, ectopic thyroid tissue, and tumors of the parathyroid gland are also seen. The most commonly encountered tumor of the middle mediastinum is lymphoma. Structures that cover cystic areas are most commonly found in the middle mediastinum. Of the tumors that are localized in the posterior mediastinum, 70% are of neurogenic origin[1-4] (Table 1).

Mediastinal masses can be detected in all age groups. There is a close female to male incidence rate[5]. In our clinical study, the female/male ratio was found to be 1.1, at various ages between 5 to 76 years. The female to male incidence rate was also similar in our study.

Mediastinal masses are mostly asymptomatic. They are coincidentally detected through lung X-ray. In literature, symptoms are seen between 63-93% of the patients. Signs and symptoms depend on whether the mass is malignant or benign, the size, localization, presence of infection, presence of an accompanying systemic disease, and also on whether the tumor produces specific endocrine or chemical secretions. In symptomatic cases, there is compression or invasion of adjacent organs.

Symptoms associated with compression are dyspnea, cough and dysphagia; symptoms associated with invasion of adjacent tissue are hoarseness, paralysis of the diaphragm, pain, and hemoptysis. There is a strong correlation between malignity and symptoms. Mediastinal tumors can cause syndromes such as Cushing's syndrome and myasthenia gravis due to hormonal factors. Large anterior mediastinal masses cause airway obstruction when the patient is in the supine position. There is severe pain during invasion of the wall of the chest and thorax. There may be effusion when there is pleural and pericardial invasion. Horner syndrome associated with invasion of the stellate ganglion may be identified in the posterior mediastinum, in the presence of a neurogenic tumor. Effort dyspnea, rhythmic abnormalities and syncope may exist in the presence of cardiac

compression[6]. The incidence rate of symptoms in this clinical study was 74%. Cough and chest pain were the most common complaints. Literature data is in support of these findings.

The following information is investigated during preoperative diagnostic evaluation:

1) Determination of the differential diagnosis of masses, which have the same radiological image as the mediastinal mass;
2) Identification of the systemic problems, which may be detected before or after the operation;
3) Identification of compression and invasion of the tracheobronchial tree, pulmonary vascular structures, superior vena cava and other mediastinal vascular structures;
4) Identification of vertebrae invasion, if present;
5) Resectability;
6) Identification and prevention of possible medical morbidity.

The first test to be performed in radiological examination of mediastinal lesions is to obtain lateral and anteroposterior X-rays.

Evaluation of localization, size, density, contents of the mass, presence of calcification, structure of the mass and its relationship with neighboring tissues are performed using CT. CT scans should definitely be performed using an intravenous contrast substance when evaluating mediastinal pathologies[7]. MRI may be performed in cases of suspected vascular structures invasion and of masses having posterior mediastinal localization. MRI is suggested to produce good results during mediastinal evaluation. The cardiac and pericardial origin of middle mediastinal lesions can be investigated using echocardiography. Gallium scintigraphy is especially sensitive in cases of mediastinal lymphadenopathy. Aberrant thyroid tissue may be analyzed through thyroid scintigraphy, while cases suspected of having mediastinal lymphadenopathies and mediastinal mass may be evaluated with PET/CT[1,8,9]. In this study, all patients were first evaluated using lung roentgenogram and CT of the thorax. MRI was performed in patients with vascular involvement, patients suspected of adjacent organ invasion (n=18), while PET/CT evaluation was performed in four patients who were thought to have metastatic mediastinal masses. Those who were thought to have aberrant thyroid tissue following radiological investigation were evaluated by thyroid scintigraphy. These evaluations, known to play important diagnostic roles, were very helpful before surgery[10,11].

Fiberoptic bronchoscopic assessment was performed on all patients before commencing the surgical operation. The relationship of the mediastinal mass with the trachea was investigated. Tracheal compression from the outside was identified in 11 patients with anterior mediastinal masses. These patients were symptomatic and were those with malignant mediastinal masses. This result strongly supports the fact that symptoms are most commonly observed in patients with anterior mediastinal masses and that there is a close relationship with malignity.

Of the mediastinal masses, 50% are located in the anterior mediastinum; this is followed by posterior and middle mediastinal localization. In a study conducted with 400 patients, Davis demonstrated that masses were located, 59% in the anterior mediastinum, 27% in the posterior mediastinum and 14% in the middle mediastinum. In this study, the most common site was the anterior mediastinum, with a rate of 75%. This result was in line with literature[12].

In patients with mediastinal masses, the surgical procedure should be determined according to the site of localization. The surgical approach can be planned only with biopsy, or with biopsy and resection. Diagnostic mediastinoscopy performed in patients with mediastinal lymphadenopathy is considerably beneficial. In these patients, the first procedure to be carried out following imaging techniques should be mediastinoscopy[1,13].

A variety of histopathological diseases are seen in the mediastinum. With regards to this histopathological diversity, anatomically dividing the mediastinum into three compartments and evaluating them accordingly, plays an important role in pre-diagnotic determination.

The surgical morbidity rate of mediastinal masses is 17%, while the mortality rate is between 3-6% [9, 14]. In our series, the mortality rate was 1.1%, while the morbidity rate was 2.2%. One patient with osteosarcoma died four months after the operation due to primary disease, while another patient with chondrosarcoma died five months after the operation also as a result of primary disease. The mortality and morbidity rates in our study were within acceptable limits and were even at a very low level.

Conclusions

In conclusion, it is suggested that surgical intervention should be performed in order to make histopathological diagnoses of mediastinal masses. Apart from the beneficial role it plays in diagnosis, its role in treatment is also very important. Surgery constitutes a low mortality and morbidity rate. Surgery, for a diagnostic or treatment purpose, should be performed in all suitable patients.

Declaration of Interest

The author report no conflict of interest and the article is not funded or supported by any research grant.

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