

Tumours of the thymic region

Symptomatology, diagnosis, treatment, and prognosis

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Bertelsen, S., Malmstrøm, J., Heerfordt, J., and Pedersen, H. (1975). *Thorax*, 30, 19-25
Tumours of the thymic region. Symptomatology, diagnosis, treatment, and prognosis. Fifty-three patients operated on between 1952 and 1971 were originally diagnosed as having thymoma. Re-examination of the material shows that only half of these tumours were true thymomas. The rest were classified as malignant lymphomas, primary and secondary carcinomas, and a few haemangiomas.

Half of the patients had symptoms at the time of diagnosis. However, in half of the asymptomatic cases the tumours had penetrated the capsule. Decisive in prognosis are the macroscopic findings around the capsule. Of 33 patients with infiltration of the capsule, 30 had died at the time of investigation. Twenty-five patients died within two years of operation.

Twenty-five patients had thymomas, of which 14 were well defined. Twelve patients with thymomas suffered from myasthenia gravis. The treatment of choice of thymoma is total excision, if necessary en bloc, and if there is penetration of the capsule, radiotherapy should be given. None of the patients with a well-defined thymoma had died from their tumour while only two patients with infiltrating thymomas are still alive.

Of eight patients with Hodgkin's disease located in the thymus, six had penetration of the capsule, and of these only one patient is still alive. Two patients with well-defined tumours are both alive. The treatment of localized Hodgkin's disease is excision and irradiation.

The prognosis for patients with other malignant tumours was bad, the mean time of survival being less than six months.

Mediastinal neoplasms, including tumours of the thymic region, constitute important diagnostic and therapeutic problems.

Formerly, considerable uncertainty prevailed regarding the classification of neoplastic diseases within the thymic region, and the problems cannot yet be said to have been definitely solved. Some investigators consider any neoplastic process within the stated region as a thymoma, while others will include only certain well-defined lympho-epithelial tumours in this group (Iverson, 1956).

Further, it has been impossible so far to pronounce with reasonable certainty on the prognosis of thymomas on a cytological and a histological basis, and disagreement still prevails regarding the diagnosis of a malignant thymoma (Castleman, 1955; Lattes, 1962).

Within recent years some clarification has been attained, however. It is now universally agreed that germinal tumours, including teratomas, may occur in the thymic region and that these have no other feature in common with thymomas than their location. In addition, Katz and Lattes (1969) have convincingly argued in favour of the view that the so-called granulomatous thymoma should be classified as Hodgkin's disease derived from the thymus.

The present investigation is concerned with a series of patients all operated on for tumour of the thymic region. The original diagnosis had in all cases been one of thymoma, made both by frozen section microscopy during the operation and on subsequent histological examination of the resected tumour tissue. A recent review of the case records disclosed that a reliable prognosis

based on the original histological diagnosis was impossible.

We therefore decided to investigate whether a better correlation between histological diagnosis and prognosis might be obtainable by re-examining the histological preparations. It was our intention to narrow down the concept of thymoma to tumours constructed of the cell types existing in the normal thymus, that is lympho-epithelial tumours.

All the histological preparations were re-studied, blank analyses being undertaken. The histo-pathologist was informed of the patient's name, birth date, and histology number, but nothing else. Further histological examination afforded a basis of a classification into the groups described.

CLINICAL PICTURE

The symptoms of tumours in the thymic region are due to compression and/or tumour invasion of adjacent organs.

Cough and dyspnoea are frequent symptoms, local pain in the chest suggests infiltration of the surrounding tissue, while neurological root symptoms and/or the superior vena caval syndrome suggest an invasive malignant tumour.

Tumours of the thymic region usually cause mild symptoms. Benign and malignant tumours may long remain almost symptom-free.

The diagnosis is primarily made by study of the postero-anterior and lateral chest radiographs. This examination should be supplemented by tomography. Bronchoscopy gives a correct diagnosis only in the small number of lesions with infiltration of the tracheobronchial tree. Bronchography, pneumomediastinography, and venography are of little diagnostic value. Angiography is indicated on suspicion of an arterial aneurysm.

A substernal tumour, and other mediastinal tumours, are best treated by operation. A trans-sternal approach is frequently employed. However, in cases with a lateral location in one of the pleural cavities thoracotomy is often the operation of choice.

PATIENTS

The series under review comprised 53 patients admitted to Rigshospitalet Departments of Thoracic Surgery between 1952 and 1971.

The patients included in the series fulfilled the following requirements: (1) the chest radiograph revealed a space-filling lesion in the anterior mediastinum; (2) at operation a tumour was found in the thymic region; and (3) frozen section microscopy and

subsequent histological examination of paraffin sections disclosed a tumour originally diagnosed as a thymoma.

The series comprised 32 males and 21 females, their ages ranging from 6 months to 73 years (mean age 42 years) at the time of operation.

In 22 patients with no symptoms the tumour was disclosed by mass radiography. In 16 patients cough and mild dyspnoea were the only symptoms, while 15 patients had such grave symptoms as stridor, neurological root symptoms, and/or the cava superior syndrome. Eight of these latter patients suffered from pain (Table II).

Two plane chest radiographs were in the majority of cases supplemented by frontal tomography. Angiography was carried out in a small number of patients, and bronchography in only one.

All the patients were operated on. Twenty-seven patients were subjected to sternotomy and 26 to thoracotomy, dependent on the site of the tumour.

The diagnosis of the revised series is shown in Table I while Table II shows the gross findings at operation compared with the symptoms and histological findings. Twenty patients had a well-defined tumour enclosed in an intact capsule. In 33 cases the tumour was seen to have penetrated through the capsule.

At operation the tumour was in 24 patients found to be so well defined that radical removal was claimed. In 12 patients such pronounced penetration through the capsule and invasion of the adjoining tissue were seen that only partial resection was possible. In 17, such infiltration and fixation to adjoining structures were present that operation was limited to obtaining a biopsy.

Two patients developed postoperative thrombo-embolic complications manifested by pulmonary embolism. One died suddenly. Two patients with a normal vocal cord function prior to the operation displayed a persistent, unilateral, postoperative recurrent nerve paresis, while nine patients developed a degree of pulmonary atelectasis within 24 hours of operation.

Four patients died postoperatively. One, with tumour invasion of the pulmonary artery, died from acute haemorrhage a few hours after operation. Two died of infective lung complications. One of these

TABLE I
TOTAL PATIENTS

Type	Male	Female	Total	Dead	Alive
Thymoma	12	13	25	12	13
Epithelial					
Mixed					
Lymphatic					
Cyst of thymus		1	1		1
Hodgkin's disease	7	1	8	5	3
Secondary carcinoma	7	2	9	9	0
Other malignant lymphoma	5	0	5	5	0
Embryonal carcinoma	1	1	2	2	
Haemangioma		3	3		3
Total	32	21	53	33	20

TABLE II

SYMPTOMS, SIGNS, AND FINDINGS AT OPERATION IN 53 PATIENTS WITH TUMOURS OF THE THYMIC REGION

Type	No Symptoms	Cough, Mild Dyspnoea	Grave Dyspnoea, Stridor, Pain, Neurologic Root Symptoms, Vena Caval Syndrome
Thymoma	12	9	4
Cyst of thymus	7	1	1
Hodgkin's disease	1	0	5
Secondary carcinoma	1	3	2
Other malignant lymphoma	0	2	2
Embryonal carcinoma	0	0	1
Haemangioma	1	1	
Total	22 (12/10) ¹	16 (8/8)	15 (13/2)

¹Bracketed fraction: infiltrating capsule/well-defined.

suffered from myasthenia gravis. One patient died of pulmonary embolism, as stated above.

All the surviving patients were followed up. Three were followed up for three years and the remainder for five years or more after operation.

Our review of the material is based on the histological classification resulting from further examination by the same histopathologist who had no knowledge of the clinical data at the time of the histological examination.

THYOMAS

Only tumours made up of lymphocytes and/or epithelial cells figure as thymomas. These have been divided into three subgroups: predominantly lymphocytic, mixed lympho-epithelial, and predominantly epithelial thymomas. Using these criteria, the number of thymomas was reduced to 25.

It is seen in Table II that half of the patients had no local symptoms. Ten patients suffered from myasthenia at the time of operation.

Table III shows the distribution of the three types and the gross findings.

At operation well-defined tumour tissue was seen inside the thymic capsule in 14 cases. In one case tumour growth was so extensive that intervention was limited to biopsy.

TABLE III

GROSS AND MICROSCOPIC FINDINGS IN 25 PATIENTS WITH THYMOMA

Type	Infiltration of Capsule	Well defined
Lymphocytic	4/2	7/4
Epithelial	3/1	5/2
Lympho-epithelial	4/3	2/0
Total	11/6	14/6

Numerator: no. of patients.

Denominator: no. of patients with myasthenia.

Of the 14 patients with well-defined thymoma, 11 were alive with neither clinical nor radiographic signs of recurrence at follow-up. One patient had died of myasthenia, one of heart disease, and one after a traffic accident (Table IV).

Six of these patients were affected with myasthenia. None recovered but over half experienced considerable improvement.

Nine of 11 patients with infiltrating tumours died (Table IV), half within 18 months of operation; only one survived for more than three years after operation. Of the two patients still alive, one is judged to have been subjected to radical operation. The tumour, which had invaded the left upper lobe, was removed with the lobe. The other

TABLE IV

RELATION BETWEEN FINDINGS AT OPERATION AND PROGNOSIS

Type	Well Defined			Infiltration of Capsule		
	No.	No. Alive/Mean Survival Period (yr)	No. Dead/Mean Survival Period (yr)	No.	No. Alive/Mean Survival Period (yr)	No. Dead/Mean Survival Period (yr)
Thymoma	14	11/6	3/4	11	2/3	9/1.5
Cyst of thymus	1	1/3				
Hodgkin's disease	2	2/12		6	1/12	5/6
Secondary carcinoma				9	0	9/0.5
Other malignant lymphoma				5	0	5/0.5
Embryonal carcinoma				2	0	2/0.3
Haemangioma	3	3/9				
Total	20	17	3	33	3	30

surviving patient had a subtotal excision. Both patients were given high-voltage radiotherapy, 4000 rads postoperatively. They were alive three years after operation without clinical or radiographic signs of recurrence. They both have myasthenia but experienced considerable improvement, which is maintained.

One patient had metastases to the liver.

Of the 11 patients with infiltrating thymomas, six had myasthenia. Four of these have died, but, as stated above, two were still alive at the time of the investigation.

Nine of the 11 patients with infiltrating thymoma received postoperative radiotherapy, latterly up to 4000 rads to a local field.

Of the total of 25 patients with thymoma, 10 suffered from myasthenia gravis at the time of the operation, while two developed clinical myasthenia about two years after operation. The gross and microscopic findings in the 12 patients with myasthenia are shown (Table III).

One patient with thymoma had lymphatic leukaemia of the immature type (Andersen and Pedersen, 1967), whereas none of the patients displayed any signs of 'autoimmune' or 'collagenous' diseases.

HODGKIN'S DISEASE

The eight patients all presented classical Hodgkin changes. The group is divisible into five patients with nodular sclerosis, two with mixed cellularity, and one with lymphocytic depletion. In each case the changes were localized to and possibly derived from the thymus. None showed signs of any general disease at the time of operation.

Seven of the eight patients were symptom-free at the time of operation (Table II). One patient had grave symptoms from the vena caval syndrome and recurrent nerve palsy.

In two patients operation showed changes localized within the thymic capsule. In six patients tumour tissue penetrated through the capsule, and four of these displayed considerable infiltration of the adjoining structures.

On the basis of the above findings the following operative procedures were considered appropriate. Radical excision of the tumour was judged to be possible in four cases, subtotal excision in two, and in two the intervention was limited to biopsy, because the tumour was considered inoperable.

The two patients with well-defined changes were still alive at the time of the investigation, while five of the six with penetration through the capsule died from their disease (Table IV). The mean survival period for the survivors is 12 years and

that for the deceased six years. The patient with lymphocytic depletion died three months after operation.

OTHER MALIGNANT LYMPHOMAS

This group comprised two patients with classical reticulosarcoma, one with lymphosarcoma, and two with a malignant, though not classifiable, reticulosis. At operation these patients were all found to have infiltrating tumour masses in the mediastinum.

All had grave symptoms, three with stridor and the vena caval syndrome. One patient presented generalized malignant lymphomas and hepatosplenomegaly; none of the others showed general spread.

Owing to the infiltrative growth no tumour excision was possible, but only removal of tumour tissue for biopsy.

Four patients were given postoperative radiotherapy, locally up to 4000 rads.

The patients' mean postoperative survival period was six months.

SECONDARY CARCINOMATOUS INFILTRATION

The group with secondary carcinoma consisted of nine patients with extensive ill-defined tumour masses infiltrating the thymic region at operation.

A diagnosis of secondary carcinomatous infiltration was confirmed by demonstration of a primary tumour (Table V).

TABLE V

SITE OF PRIMARY TUMOUR RESPONSIBLE FOR SECONDARY CARCINOMA		
No.	Secondary Carcinoma	Site of Primary Tumour
4	Anaplastic	Bronchus
1	Planocellular	
2	Adenocarcinoma	Thyroid gland
1	Adenocarcinoma	Breast
1	Adenocarcinoma	Prostate

Six of the patients had grave symptoms (stridor, pain, the vena caval syndrome, recurrent palsy), two had mild symptoms, and one was symptom-free.

One patient had had a breast carcinoma removed 17 years previously. At the time of operation none of the others showed signs of the primary extramediastinal tumour which was later disclosed.

No operation was radical; in four subtotal excision was undertaken, and in five only biopsy.

Six patients were given postoperative radiotherapy to the thymic region (up to 4000 rads), supplemented by chemotherapy in one case.

Three patients died in hospital. Five of the remaining six patients died less than 12 months after the operation, while one survived for just over four years (well-differentiated Hürtle-cell carcinoma of the thyroid).

EMBRYONAL CARCINOMA

Tumour tissue of a very primitive epithelial type was found in the thymic region in two patients. In one case it was possible to identify endodermal sinus structures. The other patient had an embryonal carcinoma with no specific characteristics.

Both patients had severe compression symptoms. At exploration the tumour was so large and infiltrative that the operation was limited to taking a biopsy.

One patient died postoperatively. The other received radiotherapy to the mediastinum (4000 rads) but died less than six months after operation.

Neither patient showed any primary extra-mediastinal tumour, and the histological picture was fully compatible with a diagnosis of primary mediastinal embryonal carcinoma (of the endodermal sinus tumour type in one patient).

OTHER BENIGN TUMOURS

This group comprised three patients with broad-based cavernous haemangiomas, presumably arising from the thymic capsule, and one with an uncharacteristic solitary cyst having no epithelial lining. It communicated with an otherwise normal thymus, from which it probably was derived, but it could not be definitely classified.

All these patients were subjected to radical operation, and were alive with no signs of recurrence at the time of the study.

DISCUSSION

A characteristic feature of tumours in the anterior mediastinum is that many are symptom-free at the time of operation, the diagnosis being made fortuitously. The same was true in our series, barely half having had no symptoms (Table II).

It is remarkable that just over half of the 22 symptomless patients were found to have infiltrating tumours. Among the patients with such moderate symptoms as coughing and mild dyspnoea the ratio of invasive to noninvasive tumour growth was approximately the same. Out of eight patients having pain, seven showed invasive tumour growth, while all the patients with

stridor, neurological symptoms and/or the superior vena caval syndrome had extensively infiltrating tumour.

Table IV illustrates that the prognosis depends largely on the gross findings, 30 of the 33 patients with tumour penetration having died.

It is evident from our results and previous investigations that neither the clinical picture nor the radiographic findings can confirm whether a substernal tumour is benign or malignant (Key, 1954; Videbæk and Thomsen, 1959; Daniel, Diveley, Edwards, and Chamberlain, 1960; Kalter, Liebermann, and Pauzner, 1964; Sawyers and Foster, 1968; Shields, 1969; Fontanelle *et al.*, 1971). Any patient with a tumour of the thymic region must therefore be subjected to operation without delay.

These 53 mediastinal tumours were originally diagnosed as thymomas; however, on reclassification only 25 are classifiable as thymomas constructed of lymphocytes and epithelial cells.

The tumours diagnosed as secondary carcinomata have been classified correctly.

Only patients with classical infiltrations of the thymus were classified as Hodgkin's disease. More doubtful cases were classified as other malignant lymphomas, which also includes two cases of reticulosarcoma.

An all-over assessment of the histological reclassification showed in all groups a close relationship between the histological diagnosis and the clinical course.

In all papers dealing with the true thymoma the histological picture affords no basis for deciding on malignancy. The prognosis can be much more reliably evaluated on the basis of the tumour's gross extent (Wilkins, Edmunds, and Castleman, 1966; Oldham and Sabiston, 1967; Sawyers and Foster, 1968; Shields, 1969). Tumour penetration of the capsule worsens the prognosis considerably (Table IV).

Radical removal by excision en bloc should be attempted even in cases of invasive thymoma. Thymomas of uncertain histology should be treated postoperatively by high-voltage irradiation in maximum doses (Wilkins *et al.*, 1966; Sawyers and Foster, 1968; Shields, 1969; Fontanelle *et al.*, 1971).

About 50% of patients with thymoma suffer from myasthenia gravis (Ochsner and Burch, 1966; Wilkins *et al.*, 1966; Boyd and Midell, 1968; Sawyers and Foster, 1968; Bernatz, Khonsari, Harrison, and Taylor, 1973). A similar percentage was present in our series. The presence of myasthenia gravis is commonly held to worsen the

prognosis for patients with thymoma, because this disease as such carries a relatively poor prognosis (Grob, 1953; Henson and Stern, 1965).

After thymectomy in the treatment of myasthenia gravis some patients obtain complete remission and others definite improvement. The effect is less convincing in the presence of a thymoma (Simpson, 1958). In our series total excision of the tumour was followed by marked improvement in just over half of the cases. In four the improvement was of short duration, but in two the improvement continued after three years.

In our series, unlike many others, the cases of predominantly lymphocytic thymoma seemed to be those most frequently complicated by myasthenia gravis.

Various writers claim that epithelial thymomas more often present invasive growth and accordingly carry a poorer prognosis than the other types (Wilkins *et al.*, 1966; Sellors, Thackray, and Thomson, 1967; Sawyers and Foster, 1968; Bernatz *et al.*, 1973). The present investigation does not confirm this theory.

Haematogenous metastases, though rare, have been described previously (Ochsner and Burch, 1966; Oldham and Sabiston, 1967; Sawyers and Foster, 1968; Pedersen, 1970). Metastases to the liver from an epithelial thymoma developed in one of our patients.

Hodgkin's disease in the thymus deserves to be further commented on. Katz and Lattes (1969) mention that this disease carries a better prognosis if originating from the thymus. The present investigation bears out this view. The incidence of mediastinal Hodgkin's disease is about 4%. The percentage was, however, considerably higher in our series owing to the special selection of the patients. All our patients displayed localized changes (stage I) and half of them nodular sclerosis. The original histological diagnosis 'granulomatous thymoma' suggests that the changes often are extremely localized.

The modern treatment of stage I cases consists in surgery combined with irradiation therapy (Blades, 1946; Molander and Pack, 1965; Burke *et al.*, 1967).

Primary, mediastinal, germinal tumours are frequently malignant. The present series included two examples of undifferentiated tumours. One was an endodermal sinus tumour and the other an embryonal carcinoma. When the former type of tumour was first described, it was found in the gonads (Teilum, 1950, 1959, 1965). The first tumours in the mediastinum were reported only

recently (Teilmann, Kassis, and Pietra, 1967; Pedersen, 1970).

Haemangiomas in the mediastinum are rare, no more than 100 cases having been published previously. They may occur in any age group, with cavernous haemangiomas as the most frequent type. Surgical removal may be difficult but should be radical owing to the risk of recurrence (Ellis, Kirklin, and Woolner, 1955; Toch, Hagstrom, and Steinberg, 1965; Baker, 1967; Whittaker and Lynn, 1973).

In addition to the solid tumours, a group of cystic tumours may be found located in the thymic region. It is often stated that cystic degeneration or necrosis of thymomas of different types may occur and cause large cysts. Another group is the congenital cyst, which, like the thymus, is of branchiogenic origin and always contains epithelium. Lymphatic tissue is frequently seen in the wall. However, the genesis of thymic cysts often cannot be clarified because the epithelium may have perished (Zanca, Chuang, DeAvila, and Galindo, 1965; Oldham and Sabiston, 1967; Whittaker and Lynn, 1973).

In the series under review we found a cyst of an unidentifiable type.

In the thymic region other tumours may be seen, for instance, goitre, adenomas of the parathyroids, teratoid tumours, benign lymphomas, bronchogenic cysts, and a variety of benign and malignant mesenchymal tumours.

Tumours in the thymic region, and other mediastinal tumours, represent a varied and diagnostically interesting field in thoracic surgery. It is impossible from the clinical and radiological picture to predict either the type of tumour or the degree of its malignancy. It is therefore important that every patient with a tumour in this region shall be treated by operation.

REFERENCES

- Andersen, V. and Pedersen, H. (1967). Thymoma and acute leukaemia. *Acta Medica Scandinavica*, **182**, 581.
- Baker, J. M. (1967). Unusual vascular tumours of the mediastinum. *Annals of Thoracic Surgery*, **3**, 358.
- Bernatz, P. E., Khonsari, S., Harrison, E. G., and Taylor, W. F. (1973). Thymoma: factors influencing prognosis. *Surgical Clinics of North America*, **53**, 885.
- Blades, B. (1946). Mediastinal tumours. *Annals of Surgery*, **123**, 749.
- Boyd, D. P. and Midell, A. I. (1968). Mediastinal cysts and tumors. *Surgical Clinics of North America*, **48**, 493.

- Burke, W. A., Burford, T. H., and Dorfman, R. F. (1967). Hodgkin's disease of the mediastinum. *Annals of Thoracic Surgery*, **3**, 287.
- Castleman, B. (1955). Tumors of the thymus gland. In: *Atlas of Tumor Pathology*, section 5, fasc. 19. Armed Forces Institute of Pathology, Washington.
- Daniel, R. A., Diveley, W. L., Edwards, W. H., and Chamberlain, N. (1960). Mediastinal tumours. *Annals of Surgery*, **151**, 783.
- Ellis, F. H., Kirklin, J. W., and Woolner, L. B. (1955). Hemangioma of the mediastinum. *The Journal of Thoracic Surgery*, **30**, 181.
- Fontenelle, L. J., Armstrong, R. G., Stanford, W., Lindberg, E. F., and Dooley, B. N. (1971). The asymptomatic mediastinal mass. *Archives of Surgery*, **102**, 98.
- Grob, D. (1953). Course and management of myasthenia gravis. *Journal of the American Medical Association*, **153**, 529.
- Henson, R. A. and Stern, G. M. (1965). Thymectomy for myasthenia gravis. *Brain*, **88**, 11.
- Iverson, L. (1956). Thymoma, a review and reclassification. *American Journal of Pathology*, **32**, 695.
- Kalter, Y. E., Liebermann, Y., and Pautner, Y. M. (1964). Pitfalls in diagnosis of mediastinal tumors. *Diseases of the Chest*, **46**, 174.
- Katz, A. and Lattes, R. (1969). Granulomatous thymoma or Hodgkin's disease of thymus? *Cancer*, **23**, 1.
- Key, J. A. (1954). Mediastinal tumors. *Surgical Clinics of North America*, **34**, 959.
- Lattes, R. (1962). Thymoma and other tumours of the thymus. *Cancer*, **15**, 1224.
- Molander, D. W. and Pack, G. T. (1965). Management and survival of 883 patients with malignant lymphoma. *American Journal of Roentgenology*, **93**, 154.
- Ochsner, A. and Burch, A. (1966). Tumors of the thymus. *Surgical Clinics of North America*, **46**, 1437.
- Oldham, H. N. and Sabiston, D. C. (1967). Primary tumors and cysts of the mediastinum. *Surgical Sciences*, **4**, 243.
- Pedersen, H. (1970). Tumours of the anterior mediastinum. *Acta Pathologica et Microbiologica Scandinavica, Supplement*, **122**, p. 128.
- Sawyers, J. L. and Foster, J. H. (1968). Surgical treatment of thymomas. *Archives of Surgery*, **96**, 814.
- Sellers, T. H., Thackray, A. C., and Thomson, A. D. (1967). Tumours of the thymus. *Thorax*, **22**, 193.
- Shields, T. W. (1969). The thymus gland. *Surgical Clinics of North America*, **49**, 61.
- Simpson, J. A. (1958). An evaluation of thymectomy in myasthenia gravis. *Brain*, **81**, 112.
- Teilum, G. (1950). Mesonephroma ovarii (Schiller). An extraembryonic mesoblastoma of germ cell origin in the ovary and testis. *Acta Pathologica et Microbiologica Scandinavica*, **27**, 249.
- (1959). Endodermal sinus tumors of the ovary and testis. *Cancer*, **12**, 1092.
- (1965). Classification of endodermal sinus tumour (mesoblastoma vitellinum) and so-called 'embryonal carcinoma' of the ovary. *Acta Pathologica et Microbiologica Scandinavica*, **64**, 407.
- Teilmann, I., Kassis, H., and Pietra, G. (1967). Primary germ cell tumor of the anterior mediastinum with features of endodermal sinus tumor (Mesoblastoma vitellinum). *Acta Pathologica et Microbiologica Scandinavica*, **70**, 267.
- Toch, H., Hagstrom, J. W., and Steinberg, I. (1965). Hemangioma of the mediastinum. *American Journal of Roentgenology*, **94**, 580.
- Videbæk, Aa. and Thomsen, G. (1959). Tumours of the thymic region. *Acta Radiologica, Supplement*, **188**, p. 261.
- Whittaker, L. D. and Lynn, H. B. (1973). Mediastinal tumors and cysts in the pediatric patient. *Surgical Clinics of North America*, **53**, 893.
- Wilkins, E. W., Edmunds, L. H., and Castleman, B. (1966). Cases of thymoma at the Massachusetts General Hospital. *Journal of Thoracic and Cardiovascular Surgery*, **52**, 322.
- Zanca, P., Chuang, T. H., DeAvila, R., and Galindo, D. L. (1965). True congenital mediastinal thymic cyst. *Pediatrics*, **36**, 615.

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