Anterior Mediastinal Mass

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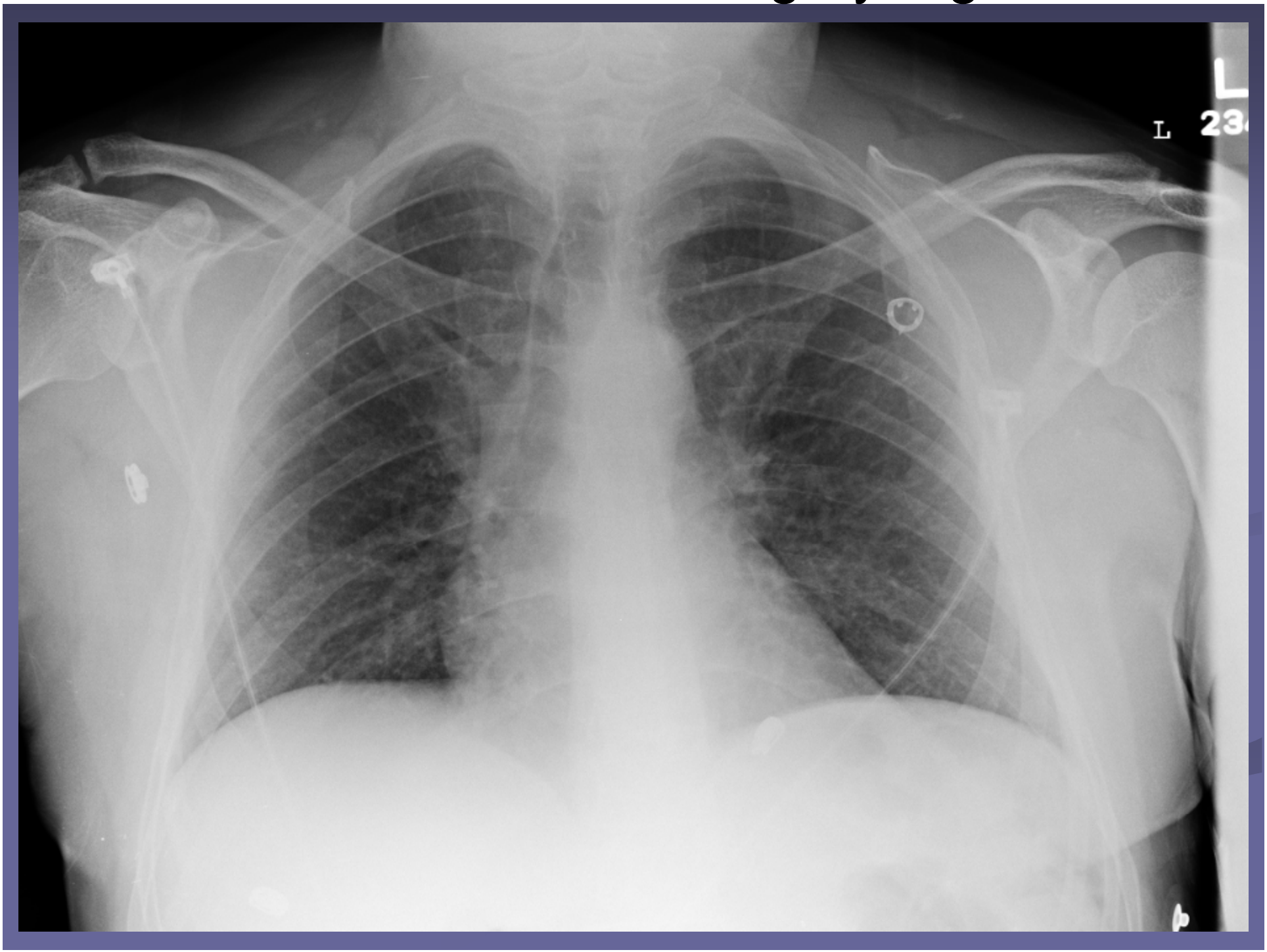
- 49 M presents with incidental finding of mediastinal mass on chest CT
- PMH/SH: hyperlipidemia; appendectomy
- Home meds: None
- Allergies: NKDA
- Social Hx: 1 pack/day 30 years ex-cigarette use
- Family Hx: non-contributory

- Vitals: WT 75 kg, T 37.0 C, HR 65, BP 112/69, RR 16, O2 saturations 100% on room air.

- General: Healthy-appearing male, in no apparent distress.
- Lungs: Clear to auscultation bilaterally.
- Heart: Regular rate and rhythm without any murmurs, rubs or gallops.

- Labs: Triglyceride 1150 mg/dL, Total cholesterol 244 mg/dL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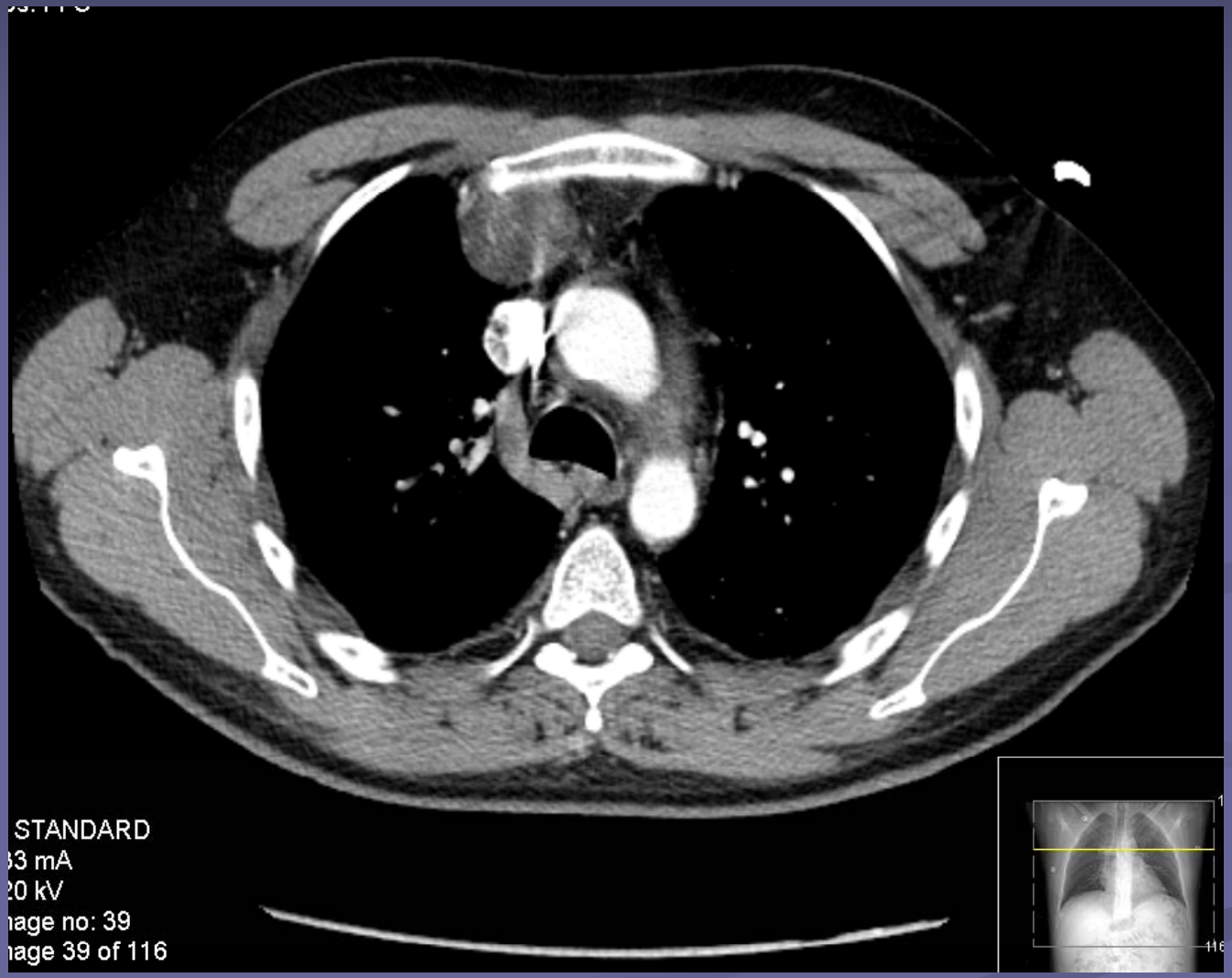

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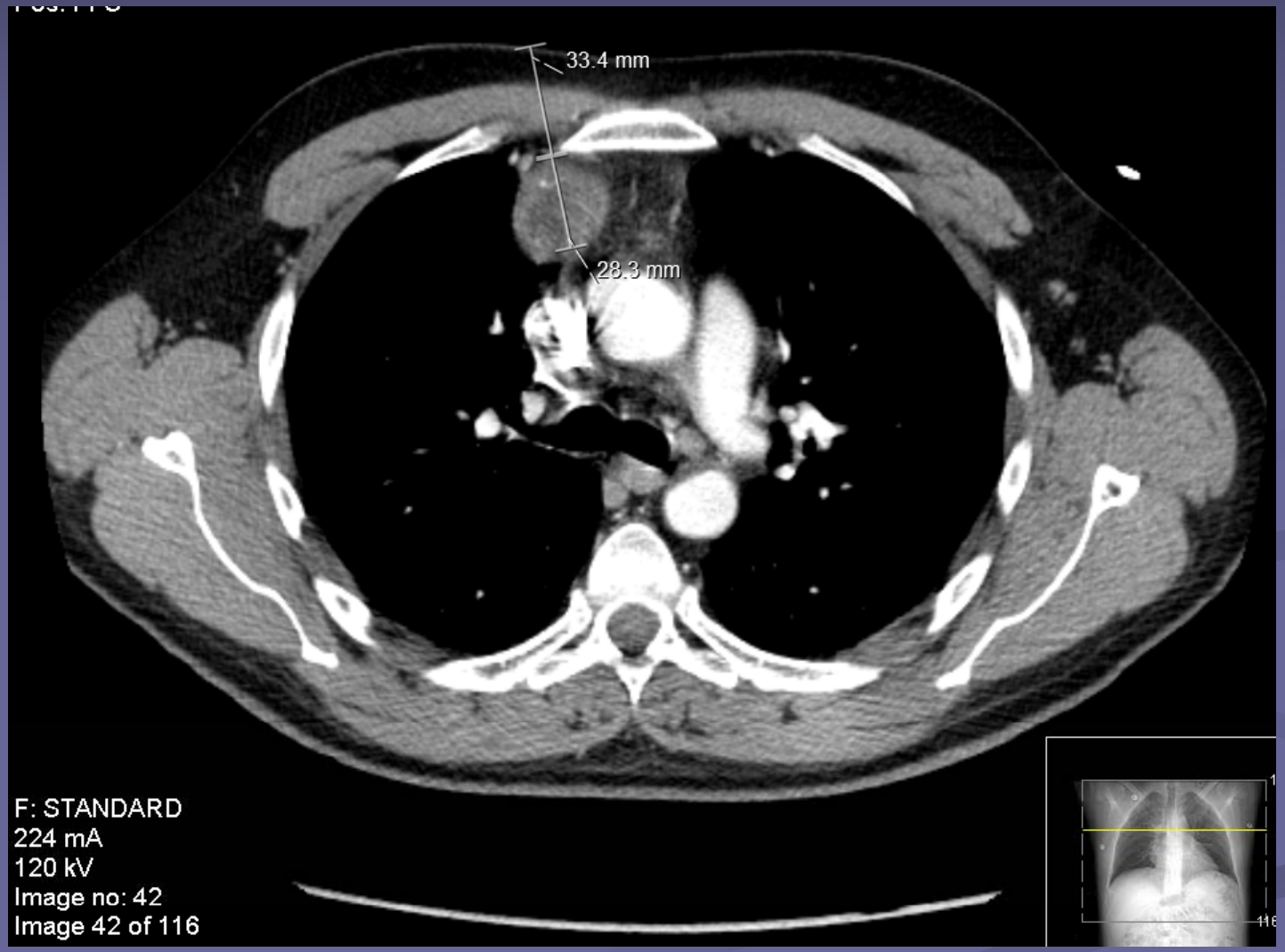

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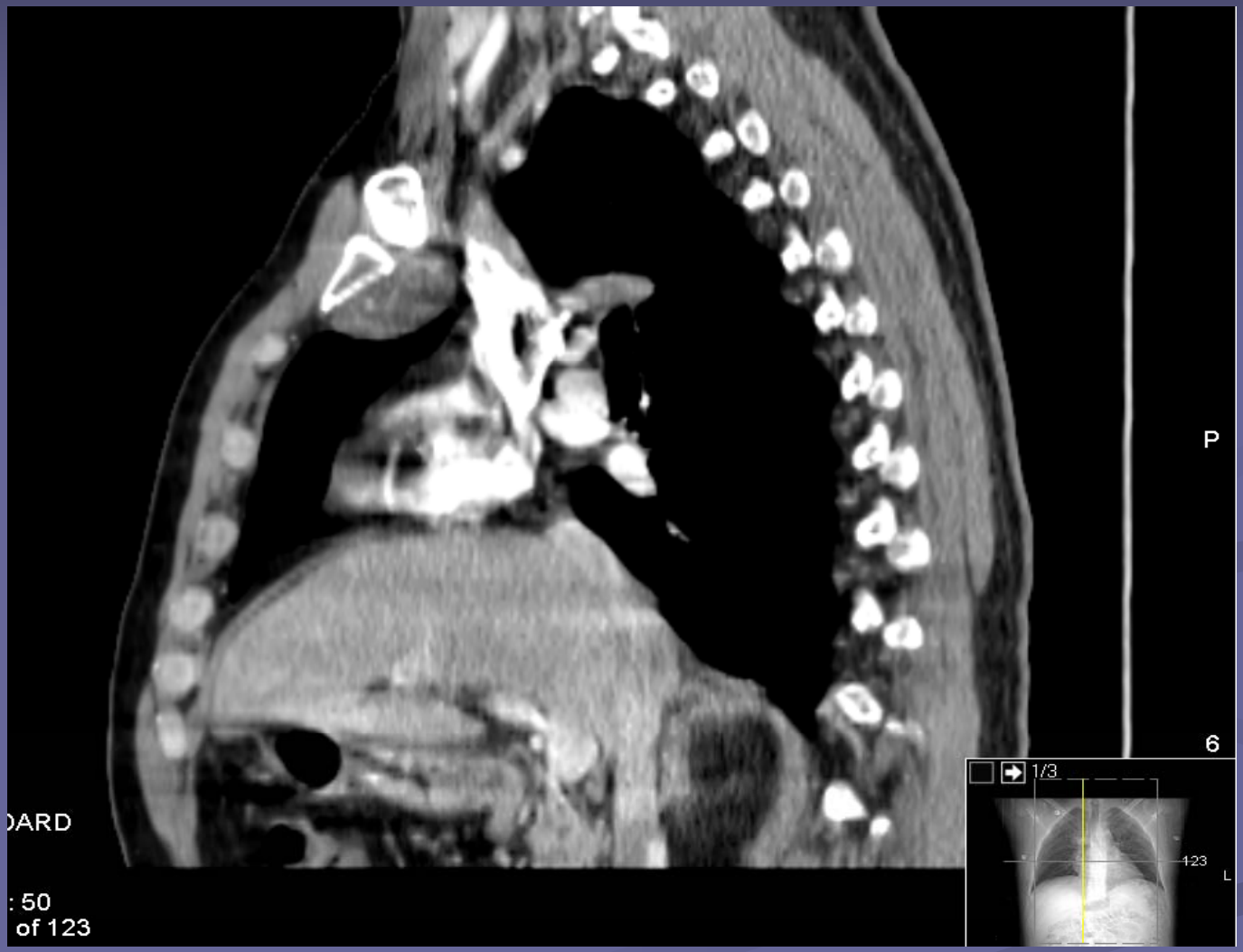
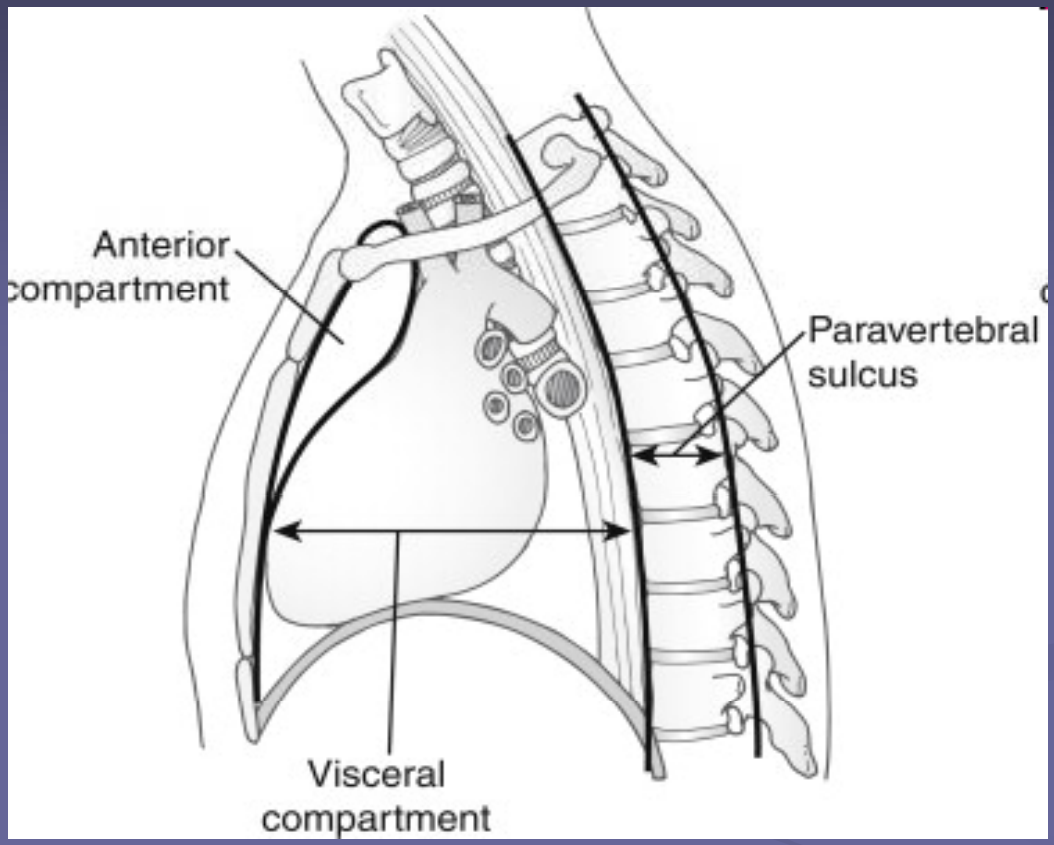


- Screening studies: AFP 5.5; HCG <1.2
- CT guided biopsy 11/28/12: fibrovascular adipose tissue
- OR 12/5/12: Sternotomy, resection mediastinal mass
- D/c home on post operative day #4
- Pathology: Angiomyolipoma

Tumors of the Anterior Mediastinum



Three-compartment division of the mediastinum as proposed by Shields.
(From Shields TW. General thoracic surgery. 2nd ed. Philadelphia: Lea & Febiger; 1983, with permission.)

Components of Mediastinal Compartments* as Proposed by Shields

Anterior	Visceral (middle)	Paravertebral (posterior)
Thymus	Pericardium/heart	Sympathetic chain
Internal thoracic vessels	Great vessels	Proximal intercostals: nerve, artery, and vein
Internal thoracic lymph nodes	Trachea	Posterior paraesophageal lymph nodes
Prevascular lymph nodes	Proximal right and left main-stem	Intercostal lymph nodes
Fat and connective tissue	Esophagus	
	Phrenic nerve Thoracic duct Proximal azygos vein Pretracheal lymph nodes (levels 2, 4, and 7) Pleuropericardial lymph nodes Fat and connective tissue	

**The nodal basin draining the anterior chest wall and female breast lie in the anterior compartment, whereas the majority of those draining the lung and important in lung cancer staging lie in the visceral compartment.*
From Shields TW. General thoracic surgery. *2nd ed. Philadelphia: Lea & Febiger; 1983, with permission.*

TABLE 75.3. Usual Location of Mediastinal Lesions.

	Mediastinal compartment		
Type of lesion	***Anterior***	***Visceral***	***Paravertebral sulci***
Primary			
More common	Thymoma Benign and malignant germ cell tumors Lymphoma	Foregut cyst Pleuropericardial cyst Lymphoma Mediastinal granuloma	Neurilemoma (schwannoma) Neurofibroma Neuroblastoma Malignant schwannoma Ganglioneuroma Ganglioneuroblastoma Foregut cyst Paraganglioma
Less common	Mesenchymal tumors Thymic cyst Parathyroid adenoma	Paraganglioma Neurenteric cyst Thoracic duct cyst	Pheochromocytoma Mesenchymal tumors Lymphoma Extramedullary hematopoiesis
Secondary	Thyroid goiter Bony tumors	Thyroid goiter Metastatic carcinoma Foramen of Morgagni hernia Hiatal hernia Pancreatic pseudocyst	Bony tumors

Source: Adapted from Shields,[78] with permission.

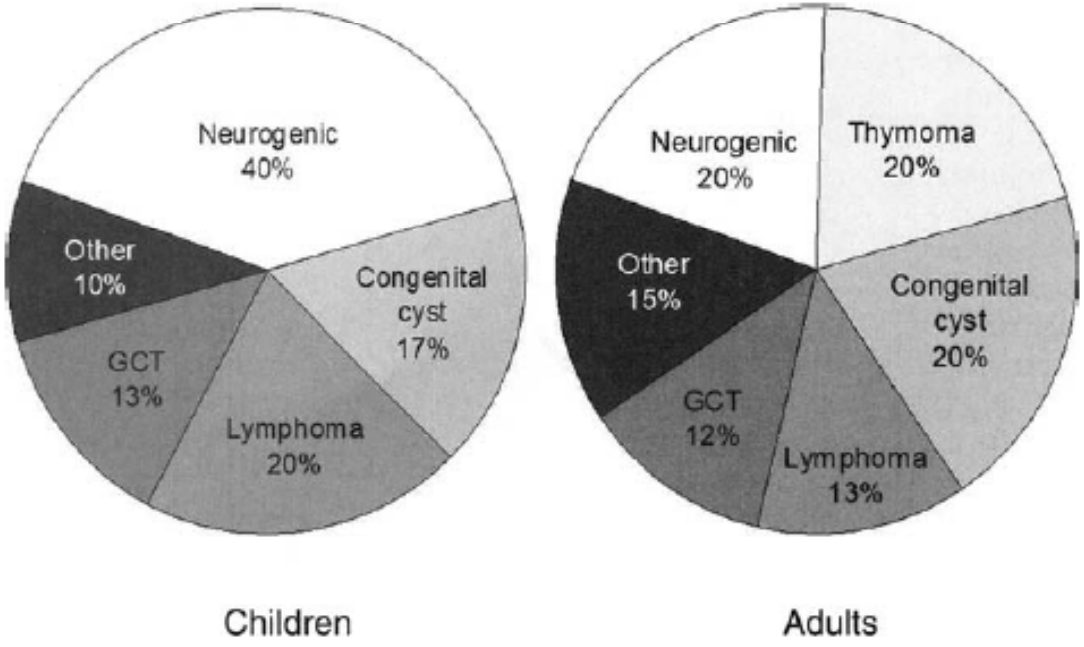
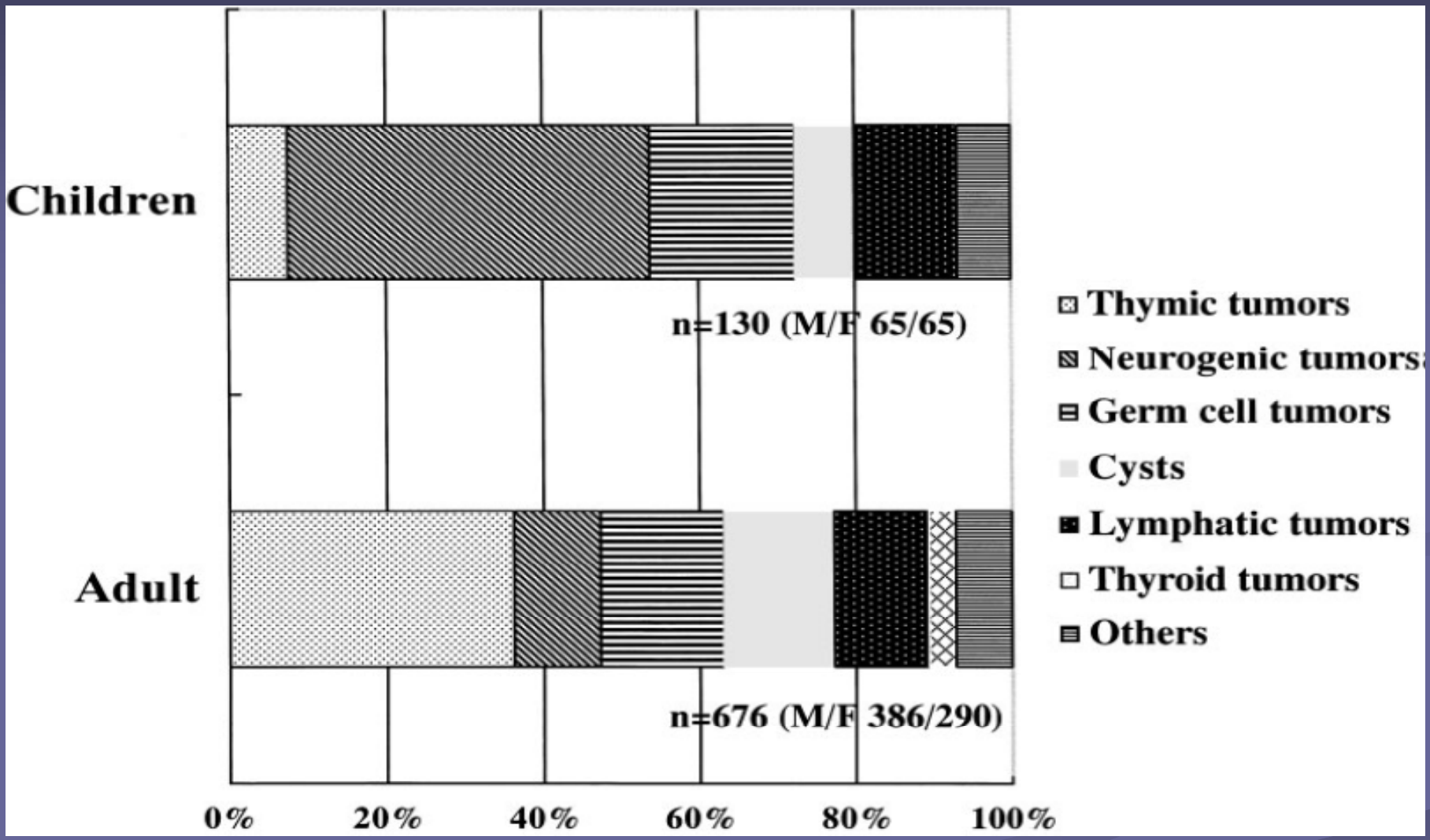


FIGURE 75.3. Common primary mediastinal lesions by patient age. Note that almost half of mediastinal lesions in children are neurogenic tumors, and that thymomas, among the most common in adults, are rare in children. Neurogenic tumors in children under 2 years are most likely neuroblastomas; in children aged 2 to 10 years they are most likely to be ganglioneuromas; and in adults they are most often neurilemomas. GCT, germ cell tumor. (Reprinted from Block,[195] with permission.)



Comparison of adult vs. children for histologic types of mediastinal tumors.

Shin-Ichi Takeda and all., Clinical Spectrum of Primary Mediastinal Tumors: A Comparison of Adult and Pediatric Population sat a Single Japanese Institution; Journal of Surgical Oncology 2003;83:24–30

- Mediastinal lesions are symptomatic in 50%-75% of patients.
- 50% of all mediastinal lesions are incidental discoveries on chest x-ray or CT scan.
- Symptoms can be caused by local mass effects, systemic effects of tumor derived hormones and peptides, or infection.

TABLE III. Symptoms With Reference to Malignancy (Adults vs. Children)

Symptom	Adults 676 cases			Children 130 cases			*P* value (adults vs. children)
	Benign 361	Malignant 315	Total 676	Benign 82	Malignant 48	Total 130	
Asymptomatic	244	78	322	56	13	69	0.88
Symptomatic	117	237	354	26	35	61	0.88
Chest pain	35	37	72	9	2	11	0.56
Dyspnea	4	25	29	7	13	20	<0.01
Cough	10	19	29	6	9	15	<0.02
SVC syndrome	2	42	44	0	3	3	0.07
Chest oppression	7	16	23	0	3	3	0.42
Fever	11	4	15	2	5	7	<0.05
Hoarseness	7	24	31	0	0	0	<0.02
Horner	0	4	4	1	2	3	0.54
MG	38	69	108	0	0	0	<0.0001
Others	5	3	8	3	15	18	<0.0001

SVC, superior vena cava; MG, myasthenia gravis.

TABLE 75.4. Mediastinal Tumors and Associated Clinical Syndromes.

Tumor	*Syndrome*
Thymoma	Autoimmune and immune deficiency
	Myasthenia gravis
	Red blood cell aplasia
	White blood cell aplasia
	Aplastic anemia
	Hypogammaglobulinemia
	Polymyositis
	Dermatomyositis
	Progressive systemic sclerosis
	Hemolytic anemia
	Systemic lupus erythematosus
	Rheumatoid arthritis
	Collagen vascular disease
	Endocrine disorders
	Panhypopituitarism
	Addison's disease
	Hyperthyroidism
	Miscellaneous
	Megaesophagus
	Myocarditis
Lymphoma	Anemia
	Myasthenia gravis
Neurofibroma	von Recklinghausen's disease
Thymic carcinoid	Multiple endocrine neoplasia (I and II)
Neurenteric cysts	Vertebral anomalies
Nonseminomatous germ cell tumors	Klinefelter's syndrome

Source: Adapted from Davis et al.,[77] with permission.

TABLE 75.5. Syndromes Caused by Tumor-Derived Products.

Syndrome	*Tumor product*	*Tumor*
Cushing's syndrome	ACTH	Carcinoid
Palpitations/ hypertension	Norepinephrine Epinephrine (rare)	Paraganglioma Pheochromocytoma Chemodectoma Ganglioneuroma Neuroblastoma
Hypoglycemia	Insulin-like hormone	Mesothelioma Teratoma Fibrosarcoma Neurosarcoma
Diarrhea	Vasoactive intestinal polypeptide	Ganglioneuroma Neuroblastoma Neurofibroma
Hypercalcemia	PTH Parathyroid-like hormone	Parathyroid adenoma Hodgkin's disease
Thyrotoxicosis	Thyroid hormone	Substernal thyroid
Gynecomastia	β-HCG	Nonseminomatous germ cell tumor
Precocious puberty	Testosterone	Nonseminomatous germ cell tumor

Source: Adapted from Davis et al.,[17] with permission.

CT is equal or superior to MRI in the diagnosis of anterior mediastinal tumors except for thymic cyst. CT should be the modality of choice following chest radiography

Percentage of correct diagnosis by CT for all diseases

Disease entity	Number of proved cases	Number (%) of cases diagnosed correctly	Number of diagnoses made with a high degree of confidence	
			No. made	No. (%) correct
Thymoma	48	40 (83)	37.5	27 (72)
Thymic carcinoma	12	4.5 (38)	4.5	2 (44)
Thymic cyst	12	5.5 (46)	5.5	2 (36)
Mature teratoma	20	11.5 (58)	8.5	7 (82)
Malignant germ cell Tumor	13	4.5 (35)	4	2 (50)
Malignant lymphoma	22	12 (55)	8	7.5 (94)
Total	127	78 (61)	68	47.5 (70)

Note: numbers and percentages of cases diagnosed correctly are actually averages of values for the two observers.

Percentage of correct diagnosis by MRI for all diseases

Disease entity	Number of proved cases	Number (%) of cases diagnosed correctly	Number of diagnoses made with a high degree of confidence	
			No. made	No. (%) correct
Thymoma	48	40.5 (84)	45.5	32 (70)
Thymic carcinoma	12	1.5 (13)	1.5	0 (0)
Thymic cyst	12	8.5 (71)	9.5	6 (64)
Mature teratoma	20	7.5 (38)	3	2 (67)
Malignant germ cell Tumor	13	3.5 (27)	1.5	1.5 (100)
Malignant lymphoma	22	9.5 (43)	8.5	6.5 (76)
Total	127	71 (56)	69.5	48 (69)

Note: numbers and percentages of cases diagnosed correctly are actually averages of values for the two observers.

- *Noriyuki Tomiyama at all, J Europ Radiology 2009*

Thymomas are the most common neoplasm of the anterior mediastinum with an incidence of 0.15 cases per 100,000

Table 4—*World Health Organization Classification of Thymomas

Class of Thymoma	Cytologic Features
Type A	Spindle cell, medullary
Type AB	Mixed
Type B1	Lymphocyte rich, lymphocytic, predominantly cortical, organoid
Type B2	Cortical
Type B3	Epithelial, atypical, squamous, well-differentiated thymic carcinoma

From Wilkins et al.[18]

There is a strong association between histologic subtype and invasiveness as well as prognosis.

Nakagawa K et all, J Thorac Cardiovasc Surg 2003

The Masaoka clinical staging system is based on the degree of invasion of the tumor through the capsule into the surrounding structures

Table 5—*Masaoka Staging System of Thymoma

Stage	Degree of Invasion	5-yr Survival Rate, %
1	Complete encapsulation macroscopically and no capsular invasion microscopically	96–100
2	Invasion into the surrounding fatty tissue or mediastinal pleura macroscopically or invasion into the capsule microscopically	86–95
3	Invasion into neighboring organs macroscopically	56–69
4a	Pleural or pericardial dissemination	11–50
4b	Lymphogenous or hematogenous metastasis	

*From Shamji et al.[21]

- Surgical resection remains the standard of care for both noninvasive and invasive thymomas as it provides the best prognosis.

- There is no consensus regarding the role for postoperative radiation therapy in patients with stage II disease.

- In locally invasive or bulky disease, preoperative cisplatin-based chemotherapy, with or without postoperative radiotherapy, may offer the best prognosis.

The following features are associated with poor prognosis:

- metastasis;
- large tumor size (> 10 cm);
- tracheal or vascular compression;
- epithelial or mixed histology;
- presence of a hematologic paraneoplastic syndrome

Gamondes JP, et all Eur J Cardiothorac Surg 1991

- Thymic carcinomas are a heterogeneous group of aggressive, invasive epithelial malignancies
- They are classified as low grade or high grade, with squamous cell-like and lymphoepithelioma-like variants
- Thymic carcinomas are cytologically malignant, with typical features of cellular necrosis, atypia, and mitoses

Hernandez-Ilizaliturri FJ, et al Am J Clin Oncol 2004

Morphologic features that portenda poor prognosis include the following:

- infiltration of the tumor margin;
- absence of a lobular growth pattern;
- presence of high-grade atypia and necrosis;
- 10 mitoses per high-power field.

Patients with unresectable disease were treated with cisplatin, vincristine, doxorubicin, andetoposide. The overall response rate was 42% with 1-year and 2-year survival rates of 80% and 56%

Yoh K et al, Cancer 2003

- Fewer than 5% of all germ cell tumors are found in the mediastinum.
- Arise from primordial germ cells that migrate from the urogenital ridge into the mediastinum and thymus gland during embryogenesis
- Almost all are found in the anterior compartment.

- 50% of all mediastinal germ cell tumors are benign (teratomas);
  - peak incidence during the second through fourth decades of life.

- Benign tumors are classified as epidermoid cysts, dermoid cysts (teratodermoids), or mature teratomas.
  - Pluripotent stem cells
  - Contain multiple tissue elements derived from one or more of the three embryonic germ cell layers.

- Malignant tumors are further classified as:
  - Seminomas and embryonal tumors
  - Much more common in men than women
- 30% to 50% of malignant mediastinal germ cell tumors are seminomas.

- Seminomas:
  - almost exclusively found in men between the ages of 20 and 40 years
  - extensive local invasion
- Extrathoracic disease is uncommon, with metastatic spread occurring first through regional lymphatics.
- Definitive diagnosis is made by FNA or open biopsy.

- NSGCT includes embryonal cell carcinomas, teratocarcinomas, choriocarcinomas, and yolk sac (endodermal sinus) tumors.
  - aggressive, are more likely to metastasize to extrathoracic sites
  - less sensitive to therapy.
- Most NSGCTs produce -HCG, AFP, or both, and more than 90% of patients have elevated levels in their serum.
- Primary therapeutic modality is platinum-based chemotherapy.

Table 13.3. Staging of mediastinal germ cell tumors

Stage I	Distinct tumor without direct or microscopic invasion of surrounding structures
Stage II	Tumor within the mediastinum with direct and/or microscopic invasion of surrounding structures
Stage IIIA	Tumor with intrathoracic metastases
Stage IIIB	Tumor with extrathoracic metastases

Tissue diagnosis is often, but not always, required before proceeding with therapy.

Circumstances in which biopsy is indicated include:

(1) suspicion of a tumor that is treated primarily with nonoperative therapy (e.g., lymphoma, NSGCT, or seminoma);

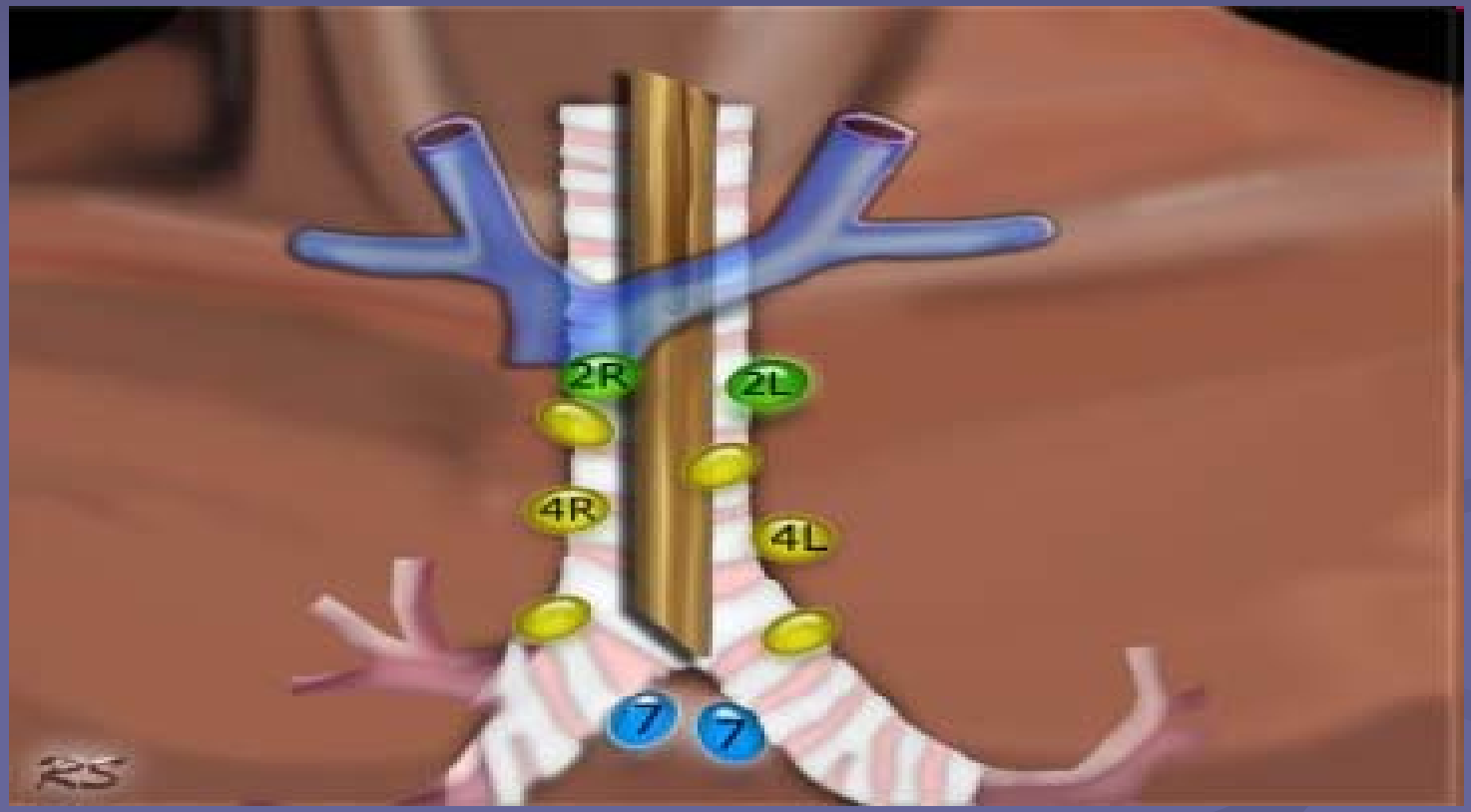
(2) Evidence of local invasion that would require resection and reconstruction of vital structures (e.g., involvement of the SVC by a large anterior mediastinal mass);

(3) evidence of metastatic disease rendering resection inappropriate.

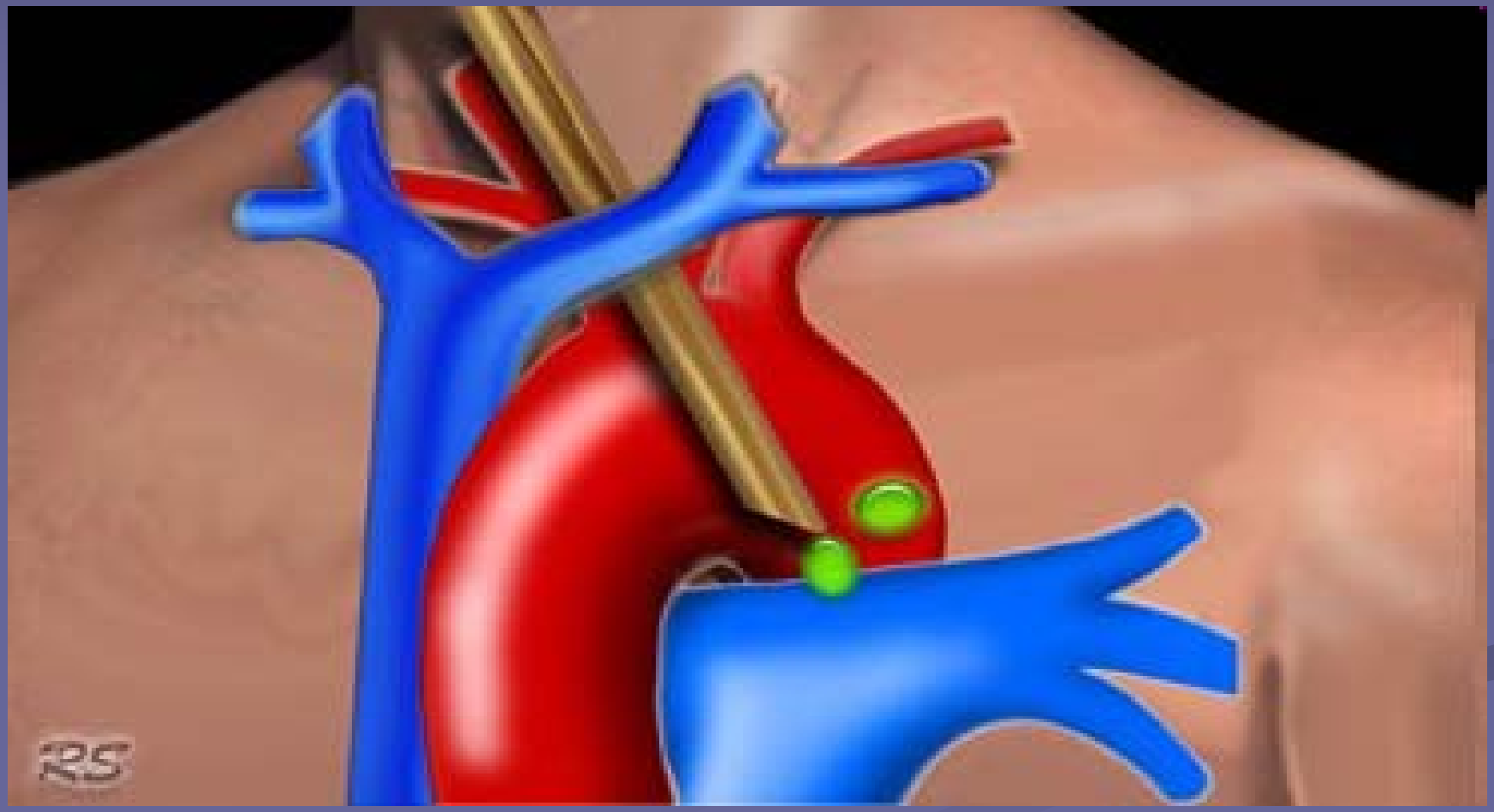
Surgical approaches to biopsy:

1. Chamberlain Procedure (Anterior Mediastinotomy)
2. Transcervical biopsy (Cervical Mediastinotomy)
3. Thoracoscopic Biopsy
4. Extended Mediastinoscopy

Conventional mediastinoscopy



Extended mediastinoscopy is an alternative for the anterior-second interspace mediastinotomy which is more commonly used for exploration of mediastinal nodal stations.



Endoscopic Ultrasound with Fine Needle Aspiration

- The pure mediastinal germ cell seminomas are extremely radiosensitive and are treated with radiation therapy.
  - After radiation, about 80% of patients with pure seminoma are cured.
  - Residual masses greater than 3 cm should be resected.
- Nonseminomas usually treated with three-drug chemotherapy (bleomycin, etoposide, and cisplatin).
  - Surgical resection is reserved for a residual mass after treatment, with normalization of serum markers.

Indiana University: 62% overall survival with a median follow-up of 34 months.

Kesler KA, et al. Ann Thorac Surg 2008;85:371-8

Nonseminomatous GCTs carry a poorer prognosis; patients with these tumors have a 5-year overall survival rate of 48%, compared to 86% in patients with seminomas

Walsh GL et al, Ann Thorac Surg 2000

References

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- 2. Sellke FW, del Nido PJ, Swanson SJ, ed. *Sabiston and Spencer surgery of the chest*, ed 7. Philadelphia: WB Saunders; 2005.
- 3. Detterbeck FC, Boffa DJ, Tanoue LT: The new lung cancer staging system. *Chest* 2009; 136:260-271.
- 4. Shields TW, Locicero J, Reed CE, et al ed. *General thoracic surgery*, ed 7. Philadelphia: Lippincott Williams & Wilkins; 2009.

A stage I thymoma has been diagnosed in a 41-year-old woman. Through which of the following surgical approaches should a thymectomy not be performed?

A Transcervical collar incision

B Median sternotomy

C Partial sternal split

D VATS

E Posterolateral thoracotomy through the sixth intercostal space

All of the following mediastinal tumors are found in the anterior mediastinum except:

A Thymoma

B Thyroid mass

C Lymphoma

D Teratoma

E Ganglioneuroma

The most common neoplasm in the anterior mediastinum is:

A Lymphoma
B Thymoma
C Mediastinal cyst
G Germ cell tumor
E Mesenchymal