

Diagnosis and Management of Mediastinal Disease

Textbook review: anatomy, pathology, staging, and surgical approaches: Shield's General Thoracic Surgery 8th edition

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Lecture roadmap

- Anatomy: compartments, lymph nodes, nerves
- Epidemiology and clinical presentation
- Diagnostic work-up: imaging, markers, tissue
- Thymic tumors and myasthenia gravis
- Germ cell, lymphoma, neurogenic tumors, cysts
- SVC syndrome, mediastinitis, pneumomediastinum

I

Anatomy of the mediastinum

Classic four-compartment model: superior, anterior, middle, posterior

Superior

Thoracic inlet to the plane between sternal angle and lower T4 vertebra.

Anterior

Sternum to anterior pericardium; holds thymus, fat, and lymphatic tissue.

Middle

Pericardium, carina, proximal main bronchi, phrenic nerves, and lymph nodes.

Posterior

Esophagus, descending aorta, azygos vein, sympathetic trunk, thoracic duct.

ITMIG's CT-based model: prevascular, visceral, paravertebral

Compartment	Posterior boundary	Major contents
Prevascular (anterior)	Anterior pericardium	Thymus, fat, lymph nodes, left brachiocephalic vein
Visceral (middle)	Line 1 cm behind anterior vertebral margin	Heart, great vessels, trachea, carina, esophagus, thoracic duct, nodes
Paravertebral (posterior)	Chest wall lateral to transverse processes	Paravertebral soft tissues, spine

Examples of masses in each ITMIG compartment

- **Prevascular:** biopsy-proven thymoma with pleural dissemination
- **Visceral:** esophageal cancer; intracardiac angiosarcoma
- **Paravertebral:** calcified ganglioneuroma

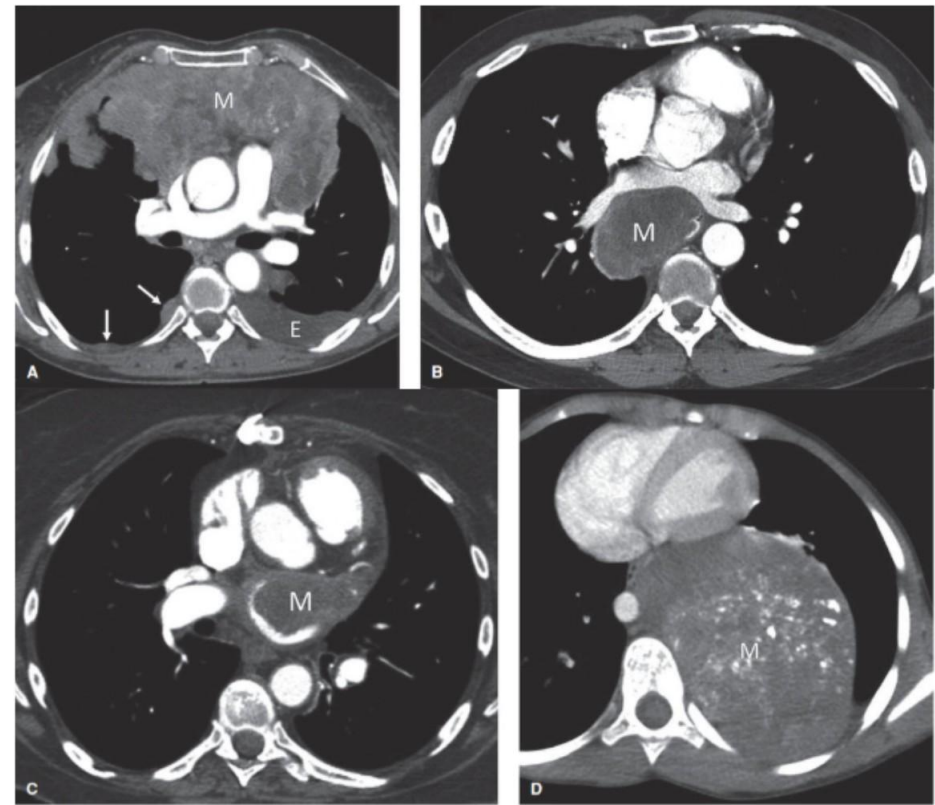


FIGURE 158.1 Representative examples of mediastinal masses within the ITMIG-defined compartments. **A:** Contrast-enhanced CT with a large heterogeneous mass (*M*) in the prevascular compartment consistent with a biopsy-proven thymoma. The great vessels are displaced posteriorly. Also seen is a left pleural effusion (*E*) and right-sided pleural nodules (*arrows*) reflective of dissemination. **B:** Contrast-enhanced CT demonstrating a low attenuation mass (*M*) located between the left atrium and thoracic spine confirming its location within the visceral compartment. This was an esophageal cancer on endoscopic biopsy. **C:** Contrast-enhanced CT showing a low attenuation mass (*M*) within the left atrium. This intracardiac and hence visceral compartment mass was an angiosarcoma. **D:** Contrast-enhanced CT demonstrating a large calcified mass (*M*) in the left mediastinum. This mass displaced the heart anteriorly and the central portion of the mass is located within the paravertebral compartment. This was a ganglioneuroma. (Reprinted from Carter BW, Tomiyama N, Bhora FY, et al. A modern definition of mediastinal compartments. *J Thorac Oncol* 2014;9(suppl 2):S97–S101. With permission.)

IASLC map: 14 stations, 2-9 are mediastinal

Superior & aortic

Stations 2–4 (upper/lower paratracheal) and stations 5–6 (subaortic AP window and para-aortic).

Inferior mediastinal

Station 7 (subcarinal), station 8 (paraesophageal), and station 9 (pulmonary ligament).

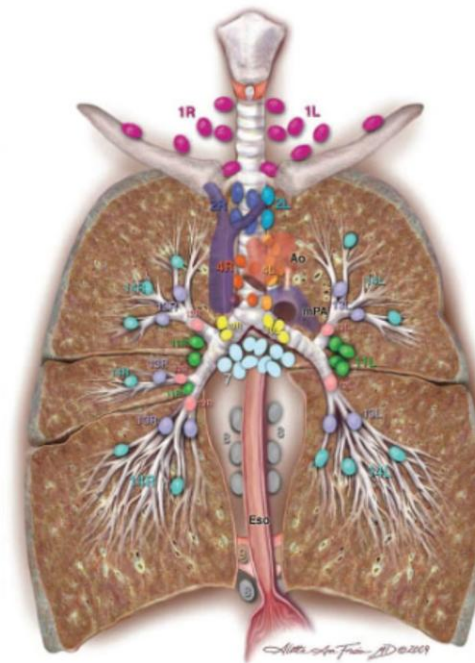
N1 stations (10–14)

Hilar, interlobar, lobar, segmental, and subsegmental nodes outside the mediastinal pleura.

Tracheobronchial nodal stream: primary flow directs from station 10 to 7, ascending to 4 and 2 paratracheal chains.

Map harmonization: 2009 IASLC unified the Asian (Naruke) and Western (Mountain-Dresler) maps into precise CT boundaries.

IASLC lymph node map



Supraclavicular zone

1 Low cervical, supraclavicular, and sternal notch nodes

SUPERIOR MEDIASTINAL NODES

Upper zone

2R Upper Paratracheal (right)
 2L Upper Paratracheal (left)
 3a Prevascular
 3p Retrotracheal
 4R Lower Paratracheal (right)
 4L Lower Paratracheal (left)

AORTIC NODES

AP zone

5 Subaortic
 6 Para-aortic (ascending aorta or phrenic)

INFERIOR MEDIASTINAL NODES

Subcarinal zone

7 Subcarinal

Lower zone

8 Paraesophageal (below carina)
 9 Pulmonary ligament

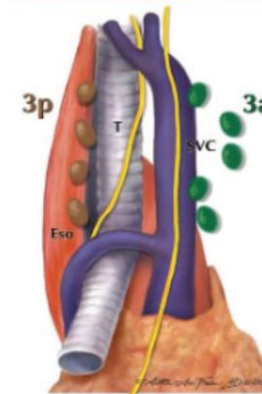
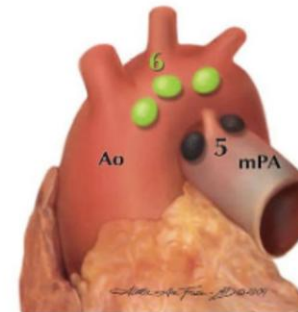
N1 NODES

Hilar/Interlobar zone

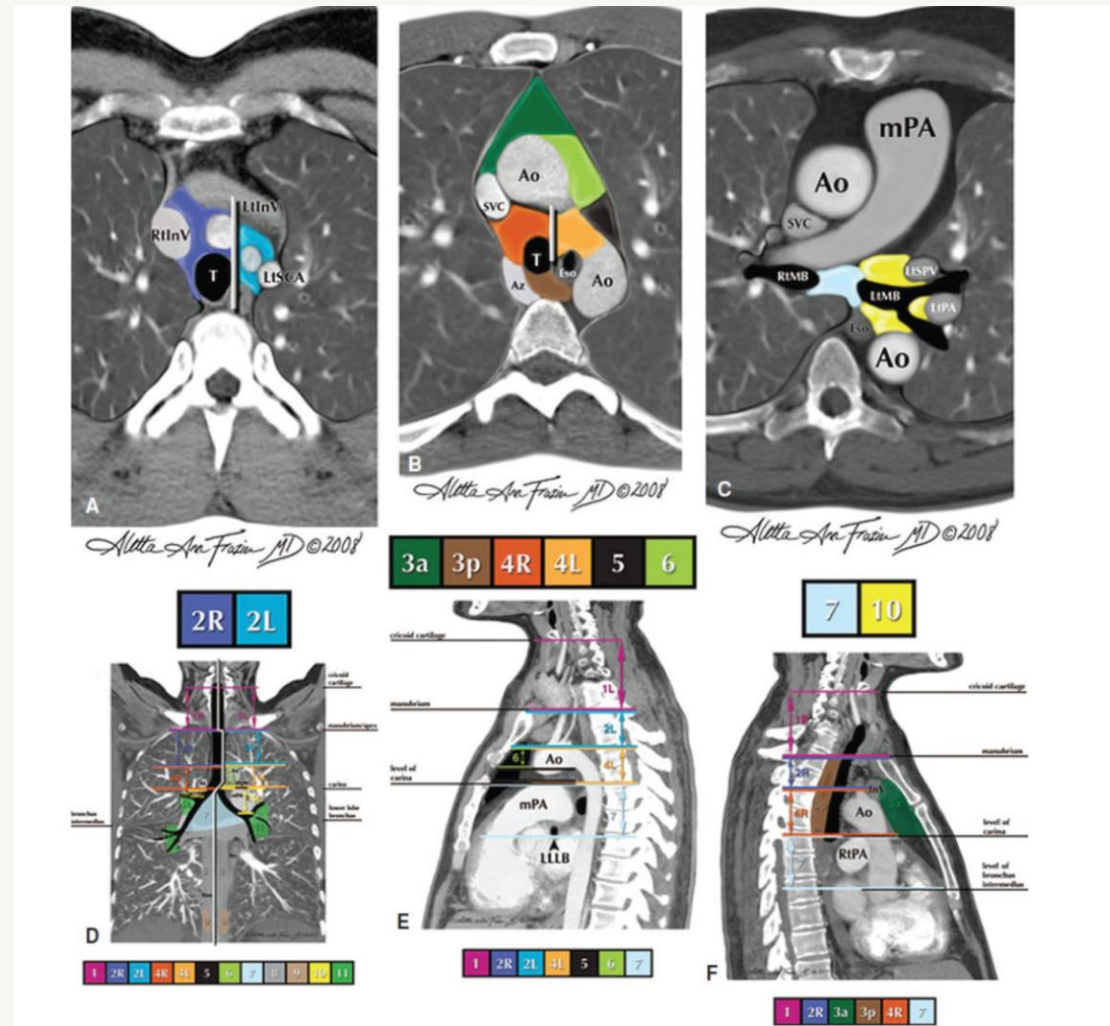
10 Hilar
 11 Interlobar

Peripheral zone

12 Lobar
 13 Segmental
 14 Subsegmental



Stations on axial, coronal and sagittal CT



Phrenic, vagus and sympathetic nerves are the surgeon's hazards

Phrenic nerve

Roots C3–C5; enters behind first rib with pericardiophrenic vessels. Right phrenic runs along SVC and right atrium.

Terminal diaphragmatic branches arborize deep in muscle; incise diaphragm radially or circumferentially.

Vagus & RLN

Left recurrent laryngeal nerve loops under ligamentum arteriosum in AP window; vulnerable in station 5/anterior dissection.

Right RLN loops around right subclavian artery at thoracic inlet; right vagus descends along trachea.

Sympathetic trunk

Courses T1 to L2 over rib heads in paravertebral gutter. T1 stellate ganglion lies over neck of 1st rib.

Injury to the lower portion of stellate ganglion causes ptosis, miosis, and anhidrosis (Horner syndrome).

II

Epidemiology and presentation

Primary mediastinal masses are uncommon

27

patients / year

Mayo Clinic: 1,064 surgical resections over a 40-year period.

7

patients / year

Duke University:
approximately 7 resections annually over 55 years.

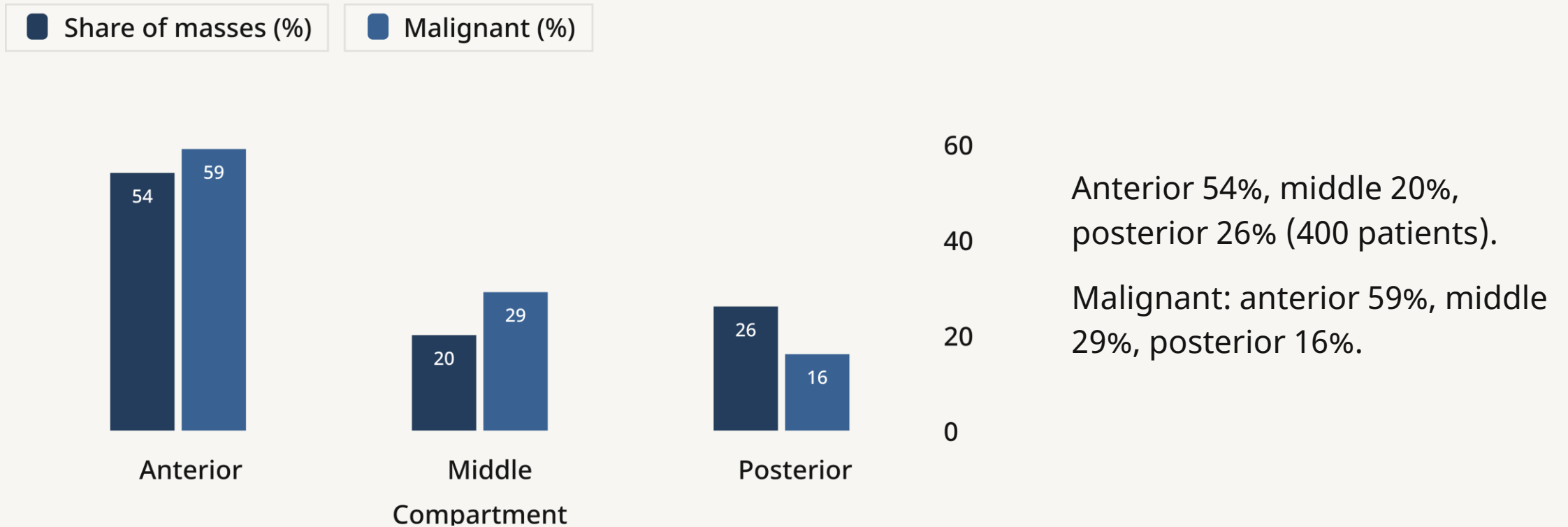
16

patients / year

Toneyama National Hospital: 16 resections annually over 50 years.

Low procedural volume per individual surgeon underscores why compartment-based pattern recognition and age-specific differentials are essential.

Half of primary masses are anterior, and malignancy tracks location



Each tumor has a favorite compartment

Prevascular	Visceral	Paravertebral
Thymoma, thymic cyst	Enterogenous (foregut) cyst	Schwannoma, neurofibroma
Germ cell tumor	Pleuropericardial cyst	Ganglioneuroma, ganglioneuroblastoma
Lymphoma	Lymphoma, granuloma	Neuroblastoma
Parathyroid adenoma, aberrant thyroid	Paraganglioma, thoracic duct cyst	Paraganglioma, pheochromocytoma

Lymphoma and mesenchymal tumors can arise in any compartment.

What surgeons actually resect

The big three: ~60%

Benign cysts (20%), neurogenic tumors (20%), and thymomas (20%) make up nearly 60% of resections.

Intermediate: ~20%

Lymphomas (~10%, primarily diagnostic biopsies) and benign/malignant teratomas (~10%).

Remainder: ~20%

Intrathoracic goiters, granulomas, primary carcinomas, and rare mesenchymal/sarcomatous lesions.

❏ **Breakdown of 214 mediastinal cysts:** 41% bronchogenic, 35% pericardial, 10% enteric (esophageal duplication), and 14% other/unclassified cysts.

Age changes the differential

Adults

- Thymic lesions, then neurogenic, germ cell, lymphoma, foregut cyst.
- Prevascular tumors: thymic 47%, lymphoma 23%, germ cell 15%, endocrine 16%.

Children

- Neurogenic, then germ cell, foregut cyst, lymphoma.
- Paravertebral sulci hold 52% of pediatric masses.

Malignant masses announce themselves

75–85%

of malignant masses are symptomatic

Only 33–46% of benign mediastinal masses produce symptoms; mobile mediastinal structures accommodate slow, benign expansion.

50–67%

of pediatric masses are symptomatic

Children have smaller airway calibers and compliant cartilages: presenting with cough, stridor, wheezing, or recurrent pulmonary infections.



Hallmarks of invasive malignancy: persistent chest pain, pleural effusion, phrenic/recurrent laryngeal nerve palsy, and superior vena cava obstruction.

III

Diagnostic approach

Chest radiograph is the first clue

Incidental detection

Most asymptomatic mediastinal masses are discovered on routine screening or preoperative chest radiography.

Paratracheal stripe

A right paratracheal stripe measuring 5 mm or wider is abnormal, indicating paratracheal adenopathy (station 2R/4R) or mass.

Azygoesophageal line

Contour disruption of the azygoesophageal recess indicates middle or posterior mediastinal pathology (subcarinal node, cyst, esophagus).

CT characterizes the anterior and middle mediastinum; MRI the posterior

- CT: anterior and middle mediastinal masses, bone assessment
- MRI: posterior masses, since most are nerve sheath tumors
- MRI shows intraspinal extension and cystic components
- Young thymus is about 30 HU and is replaced by fat with age

Attenuation and nodal patterns narrow the list

01

Fat-containing

Teratoma,
thymolipoma,
pericardial fat pad,
Morgagni hernia, or
lipoma.

02

Fluid attenuation

Thin-walled, non-
enhancing unilocular
cyst near
esophagus/carina:
bronchogenic or
enteric cyst.

03

Symmetric
adenopathy

Sarcoidosis: most
common non-
neoplastic cause;
bilateral hilar and
right paratracheal
adenopathy.

04

Central necrosis

Tuberculosis,
histoplasmosis,
lymphoma, or
metastatic
nonseminomatous
germ cell tumor.

Nuclear imaging answers specific questions

- FDG PET-CT: staging and monitoring of malignancy; diagnostic reliability not established in thymic tumors
- PET in thymic tumors: advanced or recurrent disease only
- Octreotide for neuroendocrine tumors; MIBG for paraganglioma and neuroblastoma
- Sestamibi for ectopic parathyroid; thymoma can be falsely positive

Serum markers support, but do not replace, tissue

GCT markers

Serum AFP, beta-hCG, and LDH must be drawn in all young patients with an anterior mass before any intervention.

Marker patterns

Nonseminoma: elevated AFP and/or hCG.

Pure seminoma: normal AFP; hCG may be modestly elevated in <10% of cases.

Anti-AChR Ab

Serum anti-acetylcholine receptor binding antibodies are present in nearly 100% of thymoma patients with myasthenia gravis.

Immunohistochemistry is paramount on core biopsies: cytokeratins (AE1/AE3, CK19), CD5/CD117 for thymic carcinoma, CD30/CD15/CD20 for lymphoma, and OCT4/SALL4 for germ cell tumors.

Tissue can be obtained by several routes

Chamberlain

Anterior mediastinotomy via 2nd left/right costal cartilage; classic approach for anterior masses.

Mediastinoscopy

Standard cervical route for pretracheal and paratracheal nodes (stations 2R, 2L, 4R, 4L, and 7).

VATS / Robotic

Minimally invasive pleural approach offering wide visualization and generous tissue biopsy.

EBUS-TBNA

Endobronchial ultrasound transbronchial needle aspiration for accessible paratracheal and subcarinal adenopathy.

Guiding principle:

Choose the least invasive approach that provides adequate architectural tissue for histology and immunohistochemistry.

Biopsy first, or go straight to resection?

- Localized, resectable, likely thymoma: resect without biopsy
- Biopsy of a presumed thymoma risks seeding; avoid it when resection is planned

- Suspected lymphoma or germ cell tumor: biopsy first, since treatment is non-surgical
- Invasive tumor needing neoadjuvant therapy: biopsy first

IV

Thymic epithelial tumors

WHO classification: epithelial cells versus lymphocytes

Type	Histologic features
Type A	Spindle cells, few lymphocytes
Type AB	Type A foci mixed with lymphocyte-rich foci
Type B1, B2, B3	Increasing epithelial-to-lymphocyte ratio and atypia
Type C	Thymic carcinoma

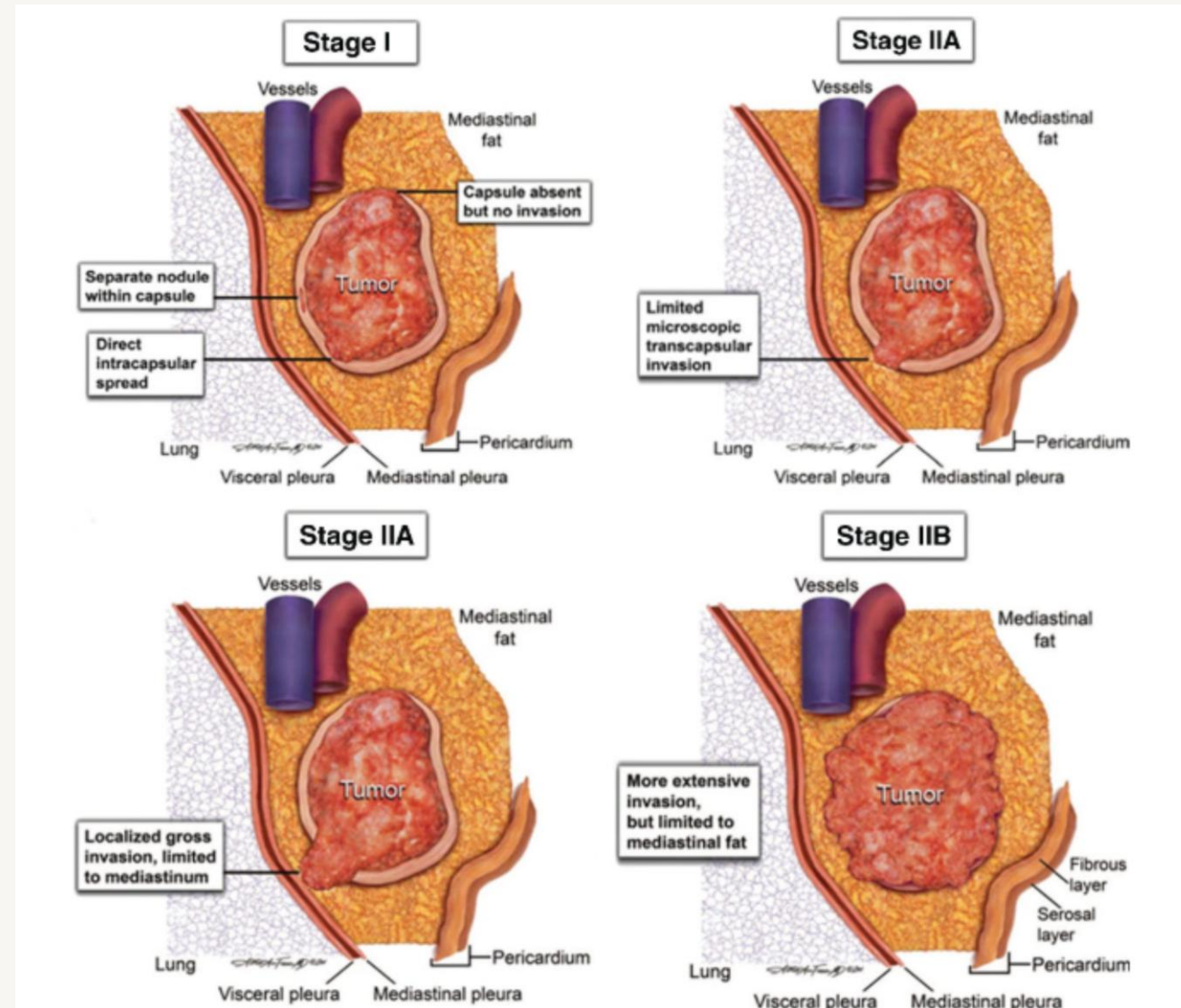
Masaoka-Koga staging rests on invasion

ITMIG recommends Masaoka-Koga as the standard

Stage	Description
I	Grossly and microscopically encapsulated
IIA	Microscopic transcapsular invasion
IIB	Gross invasion into surrounding fat, not pleura or pericardium
III	Invasion of adjacent structures (pleura, pericardium, lung, vessels)
IVA	Pleural or pericardial implants
IVB	Lymph node or hematogenous metastasis

Masaoka-Koga stages I to IIB: from capsule to mediastinal fat

Figure 166-2-1:
Progression from intact capsule (Stage I) to microscopic transcapsular invasion (Stage IIA) and gross invasion into mediastinal fat (Stage IIB)



Stages III to IVB: from adjacent organs to distant spread

Figure 166-2-2:
Direct organ invasion (Stage III: pericardium, great vessels, lung),
pleural dissemination (Stage IVA),
and lymph node/distant spread (Stage IVB).

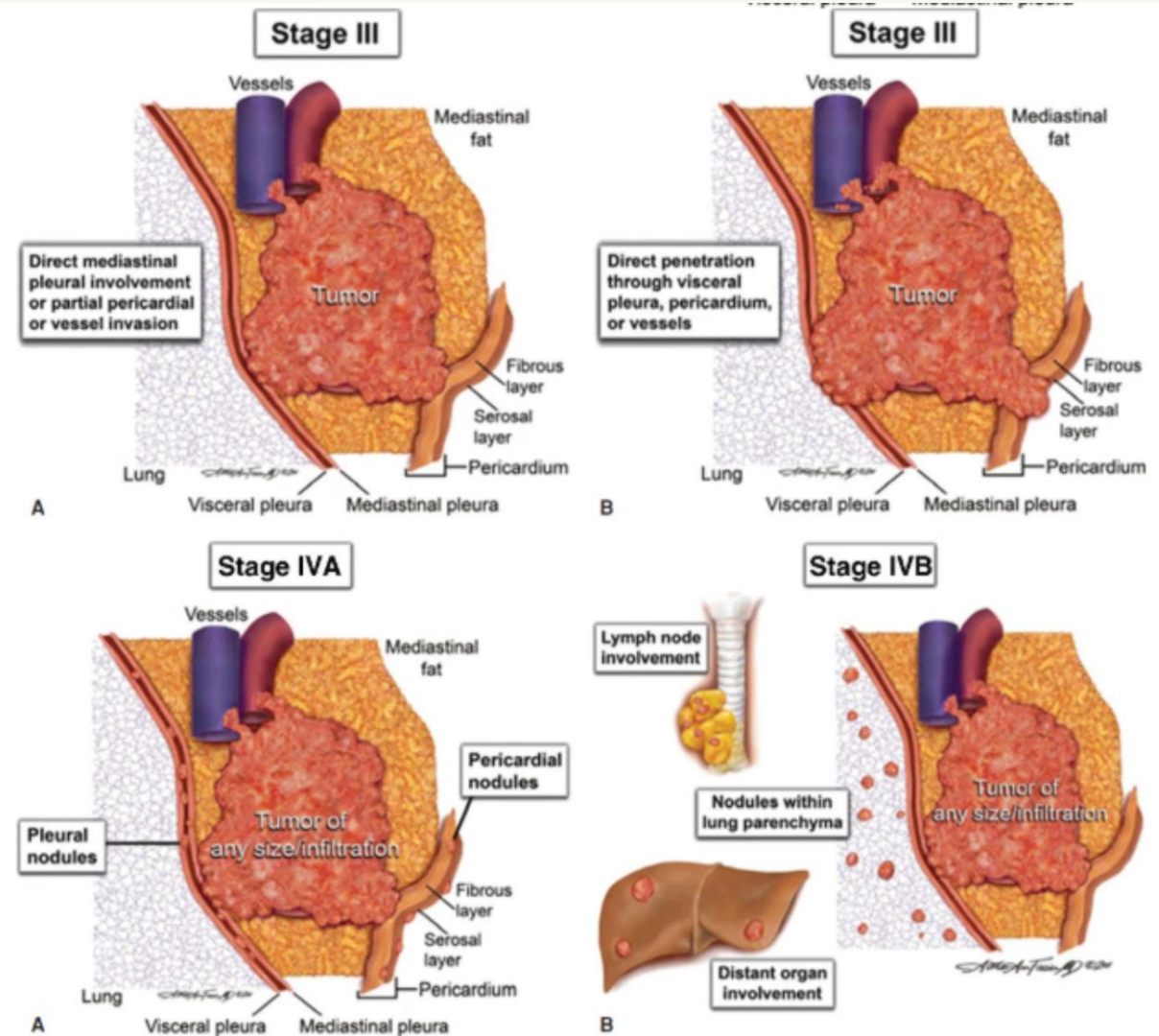


FIGURE 166.2 Schematic representation of Masaoka-Koga staging system.

Clinical stage I to IVA on CT

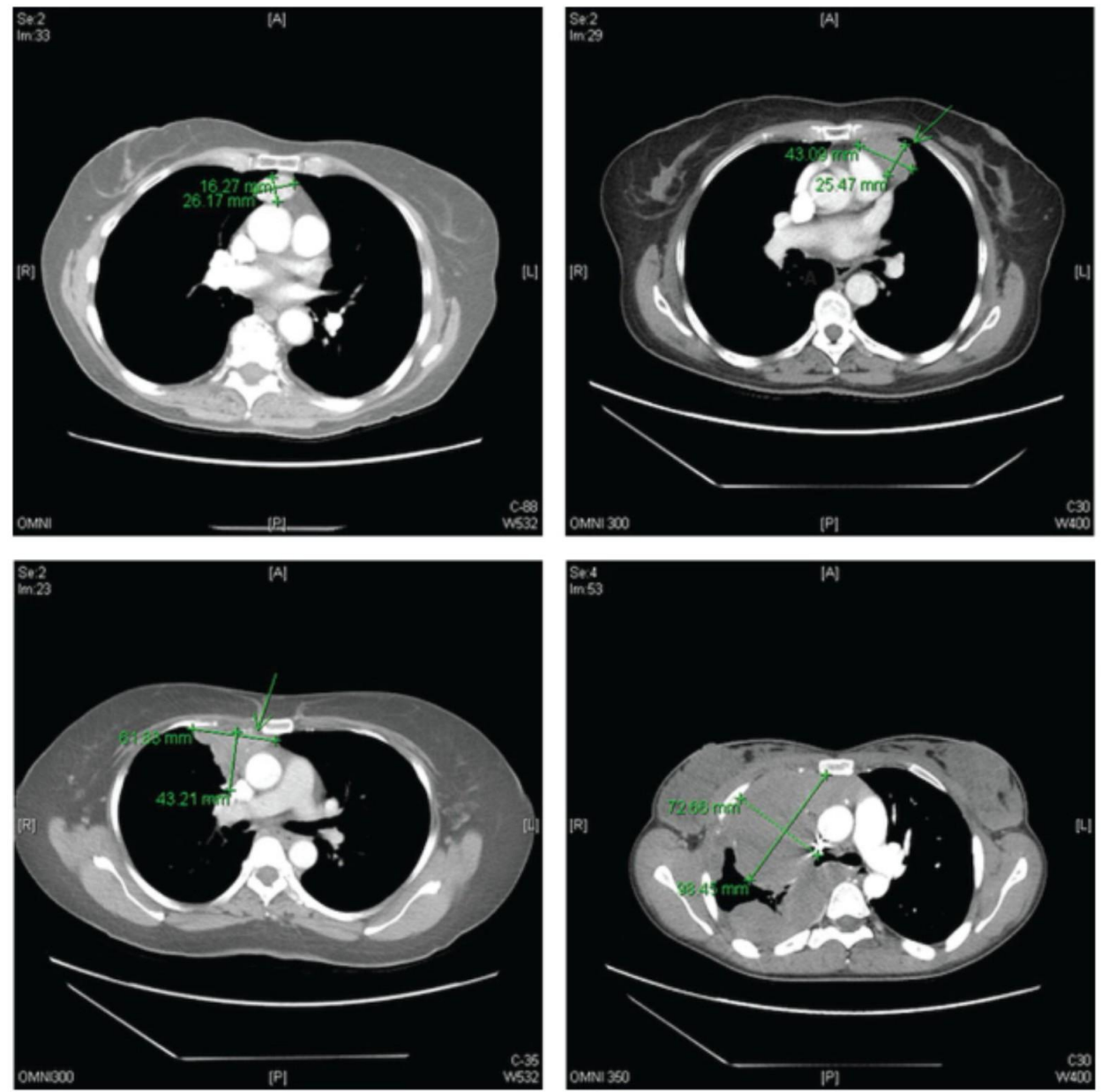


FIGURE 166.1 Radiologic appearance of thymic tumors and their clinical Masaoka-Koga stages Top left: clinical stage I. Top right: clinical stage II. Bottom left: Clinical stage III. Bottom right: clinical stage IVA.

ITMIG/IASLC TNM groups invasion by resectability

Database: 10,808 patients, 105 institutions

T category

T1a: Capsule or fat; **T1b:** mediastinal pleura;
T2: pericardium.

T3: Lung, chest wall, phrenic nerve,
brachiocephalic vein, hilar vessels.

T4: Aorta, arch vessels, main PA, myocardium,
trachea, esophagus.

N category

N1: Anterior
perithymic nodes.

N2: Deep intrathoracic
or cervical nodes.

M category

M1a: Pleural or
pericardial nodules.

M1b: Lung parenchyma
or extrathoracic.

Complete resection is the cornerstone

- **Resectable disease:** surgery without prior biopsy
- **Minimally invasive for stage I-II:** similar R0 rates to open, shorter hospital stay
- **Invasive tumors:** sternotomy with en bloc resection of involved structures
- **Stage I after R0:** no evidence for adjuvant radiation

Thymoma is chemosensitive: induction for unresectable disease

62–100%

clinical response rate

CAP (cyclophosphamide, doxorubicin, cisplatin) and EP (cisplatin, etoposide) established high chemosensitivity in prospective multicenter trials.

Long-term survival: CAP induction series achieved 77% 5-year disease-free survival and 95% overall survival; Japan trial documented a 14% pathologic complete response rate.

22–92%

subsequent complete (R0) resection

Downstaging converts unresectable, locally invasive Stage III/IVA tumors into candidates for definitive en bloc surgical resection.

Chemoradiation raises response but also toxicity

Efficacy gains

Cisplatin-etoposide with concurrent 40–45 Gy radiation yielded R0 resection in 8 of 10 patients, with 4 pathologic complete responses (40% pCR).

Sequential CAP followed by 54 Gy achieved 53% 5-year overall survival in unresectable disease.

Serious toxicity & risks

In prospective phase II concurrent chemoradiation trials, serious grade 3/4 adverse events exceeded 40%, with perioperative mortality reaching 9%.

Long-term concerns: late mediastinal fibrosis, coronary artery disease, valvular damage, and doxorubicin cardiotoxicity.

Stage drives prognosis

100%

5-year OS: Stage I

Stage I encapsulated thymomas exhibit <2% recurrence rate following complete surgical resection.

7.0 yr

median OS: Thymic Carcinoma

High recurrence (35% at 5 years) and distant metastatic propensity necessitate systemic therapy.

7.5 yr

median OS: Neuroendocrine (NET)

Aggressive behavior with 39% 5-year recurrence, frequently presenting with local invasion or metastases.

Multivariate analysis: Masaoka-Koga stage and complete R0 resection status remain the two independent drivers of recurrence-free and overall survival.

V

Myasthenia gravis and thymectomy

MG is antibody-mediated loss of acetylcholine receptors

Receptor degradation

Anti-AChR antibodies cause complement-mediated lysis, accelerated cross-linking/internalization, and direct functional blockade of postsynaptic acetylcholine receptors.

Safety factor of neuromuscular transmission is reduced, producing characteristic fatigable skeletal muscle weakness.

Thymic involvement

Implicated since Weigert (1901); thymic medullary myoid cells express AChR subunits, serving as the autoantigen source driving loss of self-tolerance.

Seronegative generalized MG represents 12–17% of cases; antibodies against muscle-specific kinase (MuSK) or LRP4 may be identified.

Classification and outcome scales

**MGFA Clinical
Classification**

Osserman and Genkins, modified by MGFA: class I to V.
Class I ocular; II mild; III moderate; IV severe; V intubation.

Quantitative MG score

Best-studied objective measure.

MG composite score

A 3-point change is clinically meaningful.

Medical therapy comes first

Cholinesterase inhibitors

Pyridostigmine: first-line symptomatic relief; enhances acetylcholine concentration at the motor endplate.

Corticosteroids

Oral prednisone: primary immunosuppressive agent; induces rapid clinical remission in 70–80% of patients.

Steroid-sparing agents

Azathioprine: proven efficacy matching prednisone. Mycophenolate mofetil is used widely despite mixed trial data.

Crisis optimization

Plasmapheresis (PLEX) or intravenous immunoglobulin (IVIG) to clear circulating antibodies prior to thymectomy.

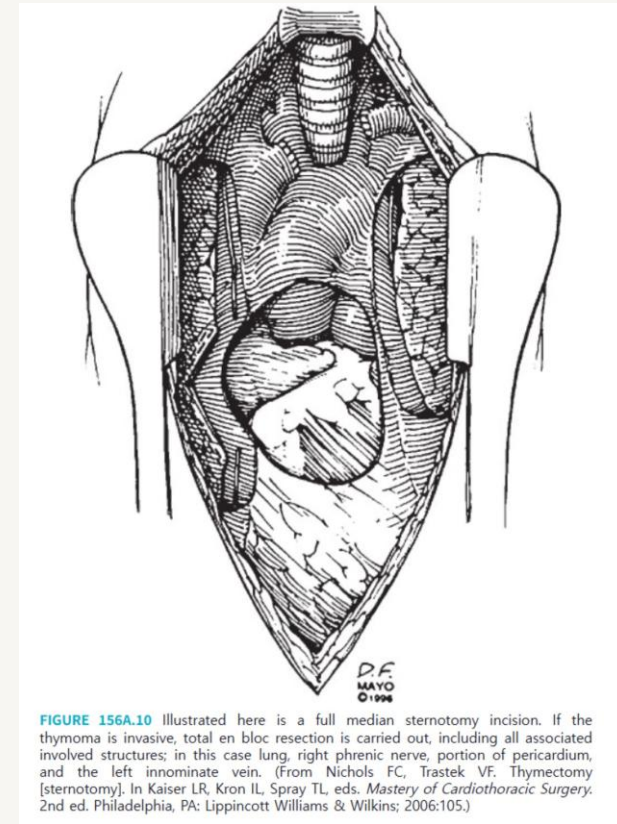
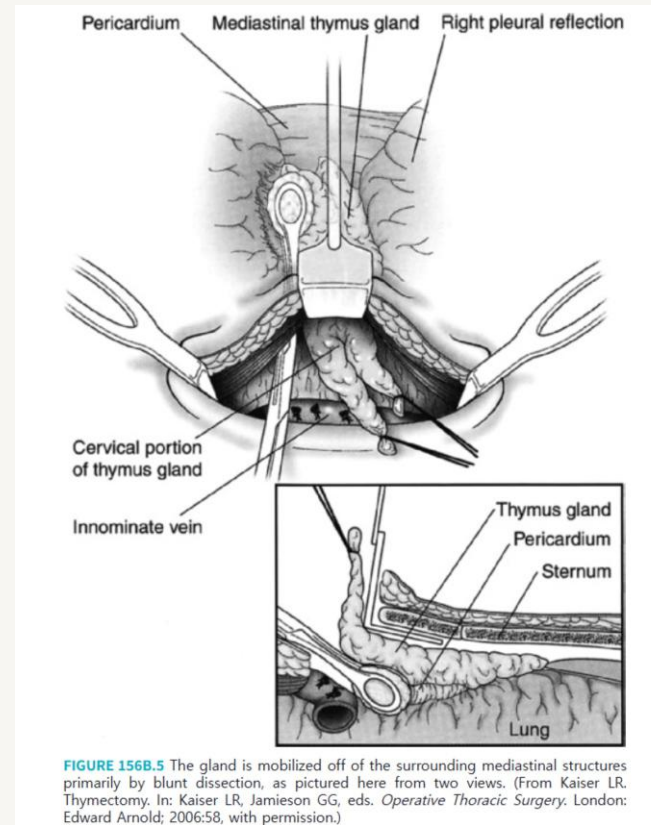
Thymectomy approaches range from neck to full sternotomy

Better long-term results correlate with thorough removal of all thymic-bearing tissue.

Approach	Key feature
Transcervical	Cervical incision; thymus removed intact, upper and lower poles
VATS / robotic	Left, right, bilateral or subxiphoid; shorter recovery
VATET	Bilateral thoracoscopy plus cervical exploration
Extended transsternal	Sternotomy with collar incision (T-incision), widest clearance

Transcervical and transsternal thymectomy

- **Cervical:** gland mobilized bluntly off the pericardium
- **Sternotomy:** en bloc resection with involved structures if invasive



Robotic port placement and the en bloc specimen

- Robotic: left and right arms, camera and assistant port
- Goal in all approaches: complete clearance of thymus and mediastinal fat

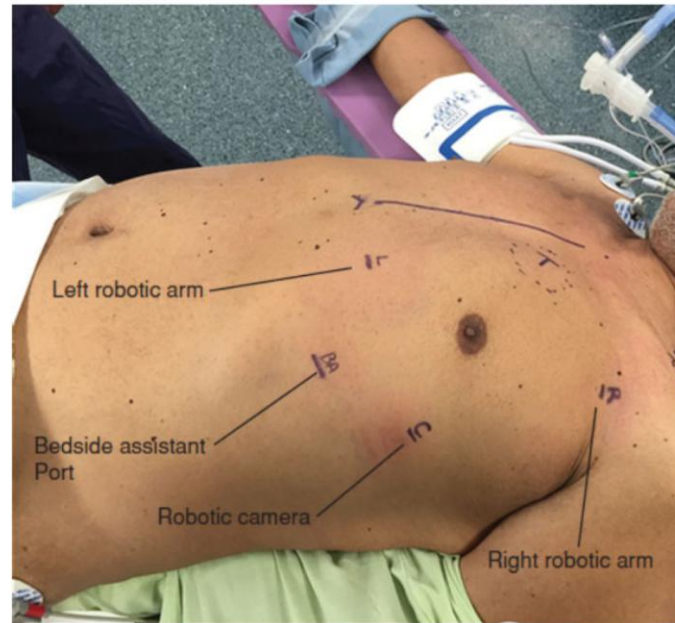


FIGURE 156C.8 Patient positioning and initial port placement. (From D'Cunha J, Andrade RS, Maddaus MA. Thoracoscopic thymectomy. *Operative Techniques in Thoracic and Cardiovascular Surgery* 2010;15(2):102–113. With permission.)

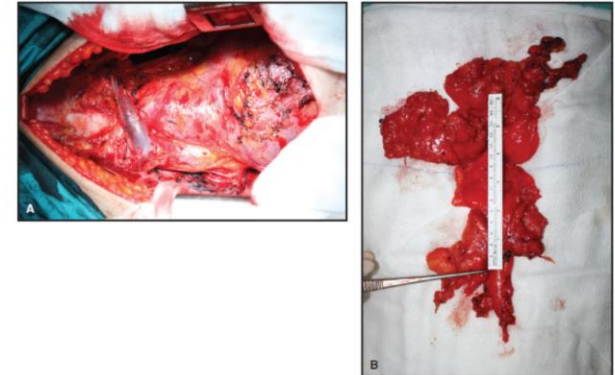


FIGURE 156D.6 Final dissection view of mediastinum (A) and en bloc thymic and mediastinal tissues (B).

Results of thymectomy for nonthymomatous MG

28–42%

Robotic series: complete remission

Extended transsternal

(89 patients): 34% complete remission, 33% pharmacologic, 13% improved

VATS versus open

(139 patients) compared in single-institution series

Blalock

began thymectomy after a cystic thymoma improved MG

The MGTX trial defined the role of thymectomy

- International randomized trial completed after years of enrollment
- Settled the indication in nonthymomatous MG
- Thymoma-associated MG: resect the tumor regardless

VI

Other mediastinal tumors and cysts

Germ cell tumors: 10-20% of mediastinal tumors

- Arise from primordial germ cells that fail to migrate to the urogenital ridge
- Malignant forms: young men, over 90% male
- Subtypes: teratoma, seminoma, nonseminoma
- Nonseminoma: yolk sac tumor, choriocarcinoma, embryonal carcinoma, mixed

Mature teratoma: surgery is curative

Diagnostic hallmarks

Pathognomonic CT features: well-demarcated anterior mediastinal mass containing distinct fat-fluid levels, soft-tissue elements, and dense calcifications / teeth.

Tumor markers (AFP, beta-hCG) are strictly normal; elevation signifies an occult malignant nonseminomatous component.

Immature teratomas contain incompletely differentiated neuroepithelial or primitive mesenchymal blastemal elements, requiring careful pathologic evaluation for malignant transformation.

Surgical management

Complete surgical excision is curative; approaches include VATS, robotic resection, or median sternotomy.

In an 18-year comparative series, VATS operative time was 106 minutes versus 205 minutes for open thoracotomy, with zero recurrences following R0 resection.

Malignant germ cell tumors: markers, testes, cisplatin

Seminoma

Radiosensitive, chemosensitive.

Nonseminoma

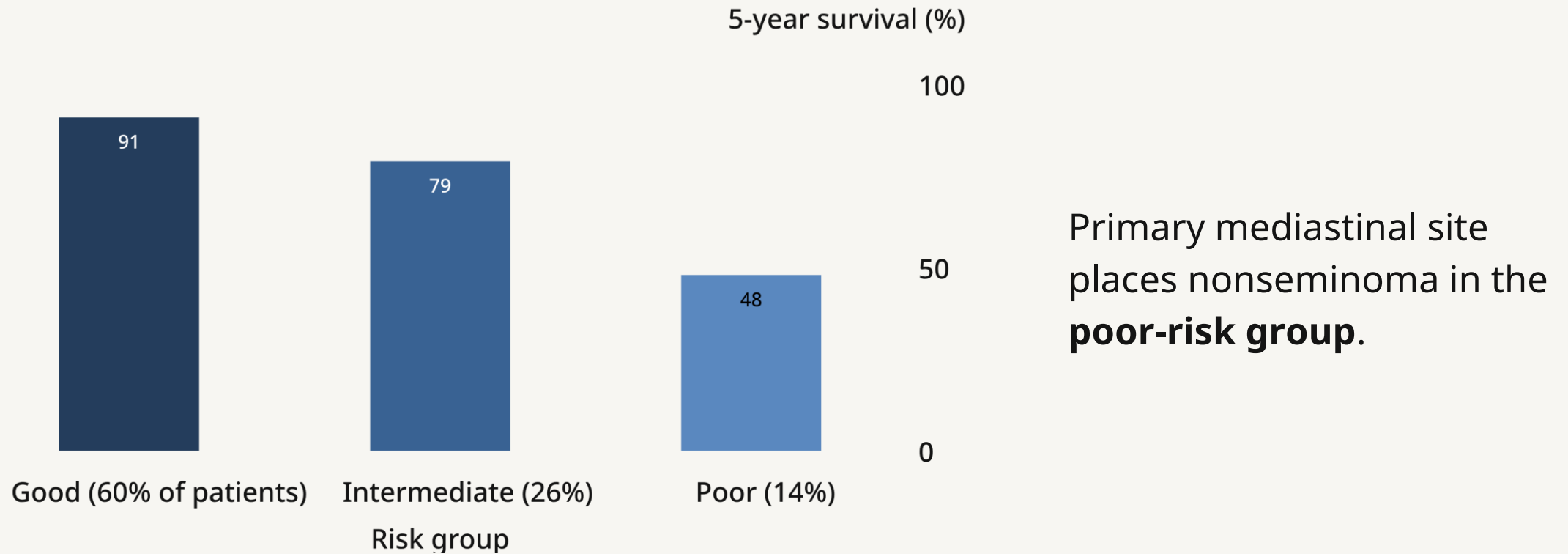
Elevated AFP and hCG;
cisplatin-based chemotherapy
then residual resection.

Testes

Always examine and ultrasound
the testes.

Better outcome: marker normalization, complete resection, no residual viable tumor.

Primary mediastinal nonseminoma carries a poor prognosis



Lymphoma needs tissue, not surgery

- Hodgkin: Reed-Sternberg cells derive from germinal-center B cells.
 - RS cells are only about 1% of the node, so obtain a generous biopsy.
- Classical HL: CD30 positive; thymic HL has thick sclerosis.
 - Treatment is chemotherapy with or without radiation; the surgeon's role is diagnosis.

Neurogenic tumors dominate the paravertebral sulcus

>90%

of posterior mediastinal masses

Neurogenic neoplasms account for 12–21% of all primary mediastinal masses, overwhelmingly localized to the paravertebral sulcus.

Peripheral nerve sheath origin: Schwannoma (neurilemoma), neurofibroma, and malignant peripheral nerve sheath tumor (MPNST).

Adult vs. Child

malignancy divergence

In adults, >90% of neurogenic tumors are benign; in children, approximately 50% are malignant embryonal neoplasms.

Sympathetic ganglion origin: Ganglioneuroma (benign), ganglioneuroblastoma (intermediate), and neuroblastoma (malignant).

Neurogenic tumor management: complete resection

Standard Thoracic Excision

Benign schwannomas and ganglioneuromas rarely recur; simple complete enucleation or excision via VATS is standard of care.

Irregular margins, bone erosion, or hypervascularity on imaging should raise clinical suspicion for malignant MPNST.

Dumbbell (Hourglass) Tumors

Occur in approximately 10% of neurogenic tumors; mass extends through the intervertebral neural foramen into the spinal canal.

Single-stage combined approach: neurosurgical laminectomy in prone position first to decompress and mobilize the intraspinal component, followed by thoracoscopic or open resection to avoid spinal cord traction injury.

Foregut cysts: bronchogenic, esophageal, pericardial

Bronchogenic

Unilocular, ciliated epithelium, near carina.

Develop at 4-8 weeks, so rarely communicate with the bronchus.

Esophageal

Esophageal duplication: double muscle layer in the wall.

Locations: paratracheal, carinal, hilar, paraesophageal.

Cysts become symptomatic: resect

75%

symptomatic rate

Up to 75% of bronchogenic cysts produce symptoms (chest pain, tracheobronchial compression, secondary infection, or hemoptysis).

67%

long-term symptom development

Among initially asymptomatic cysts, two-thirds develop symptoms or serious complications during watchful waiting.

Surgical strategy: Elective VATS or robotic excision. If densely adherent to the carina, pulmonary artery, or bronchus, excise the cyst wall and cauterize the remaining mucosal remnant to prevent airway disruption.

Endocrine masses: intrathoracic goiter and parathyroid

Intrathoracic goiter

- Most of the mass below the thoracic inlet; female to male 4:1, 5th-6th decade.

Ectopic parathyroid

- In about 15% of hyperparathyroidism operations.
- 85% of primary hyperparathyroidism is a solitary adenoma.
- Secondary hyperparathyroidism: hyperplasia, often multiple glands.

VII

Vascular, inflammatory conditions and approaches

SVC syndrome: treat the cause and secure the diagnosis

- Malignancy still causes about 60%, mostly lung cancer
- Benign causes rising: catheters, pacing leads, congenital repairs
- Supportive: head elevation, diuretics, steroids, anticoagulation
- Establish a tissue diagnosis before treating when malignancy is suspected



FIGURE 162.1 Photograph of a patient who developed superior vena cava syndrome 4 days after implantation of a single-lead VVI pacemaker. **A:** Note the characteristic swollen facies with congestion at initial presentation and **(B)** the reduction in swelling after thrombolysis and balloon dilatation. (Reprinted with permission from Macmillan Publishers Ltd: Vats HS, Hocking WG, Rezkalla SH. Suspected clopidogrel resistance in a patient with acute stent thrombosis. *Nat Clin Practice Cardiovasc Med* 2006;3(4):226–230. Copyright © 2006.)

Acute mediastinitis follows sternotomy or perforation

Most acute mediastinitis arises from poststernotomy infection or aerodigestive perforation

Broad antibiotics covering gram-positive, gram-negative, aerobes and anaerobes; consider antifungals

Source control and drainage are central

Descending necrotizing mediastinitis is lethal without early drainage

- 60-70% odontogenic origin; also peritonsillar and retropharyngeal abscess
- Spreads along pretracheal, perivascular and prevertebral planes
- Polymicrobial: Prevotella, Peptostreptococcus, Fusobacterium, oral streptococci
- Estrera criteria: oropharyngeal infection, mediastinitis on imaging, necrosis at operation

Primary pneumomediastinum is usually benign

The Macklin Effect

Sudden increase in alveolar pressure (Valsalva, severe cough, asthma, strenuous exercise) causes terminal alveolar rupture.

Gas dissects along bronchovascular sheaths toward the pulmonary hilum and freely enters the mediastinal interstitial tissue planes, often tracking into cervical subcutaneous spaces.

Clinical Management

Crucial rule-out: Always exclude secondary esophageal rupture (esophagram) or major tracheobronchial injury (bronchoscopy) in febrile or toxic patients.

Spontaneous primary pneumomediastinum is self-limiting: analgesia, resting, and supportive oxygen. Safe discharge under 24 hours is documented in uncomplicated patients.

Take-home points

- Compartment and age narrow the differential
 - Tissue diagnosis, except in resectable thymoma
 - Stage and complete resection drive thymic outcomes
- Lymphoma and germ cell tumors need chemotherapy first
 - Thymectomy in nonthymomatous MG: MGTX defined the role
 - Infection and SVC syndrome are urgent