Sensitivity and specificity of fine needle aspiration for the diagnosis of mediastinal lesions

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Introduction

The mediastinum can be affected by a heterogeneous group of disease that can cause significant diagnostic difficulties.

Lesions of the mediastinum can be explored by fine-needle aspiration biopsy (FNAB) obtained under radiographic guidance, either through a transthoracic, esophageal or bronchoscopic approach

Aspiration biopsy of the mediastinum is rare

Imaging and clinical parameters are often diagnostic

Accuracy is approximately 85% for all mediastinal lesions

Aspiration biopsy of **metastatic mediastinal tumors** are more common

Sensitivity and specificity

Varies with location within the mediastinum

- Anterior/pre-vascular = 80%/98%
- Posterior= 33%/95%
- Medial/vascular=100%

Varies for different classes of diseases

- Thymoma = 87%/94%
- Germ cell tumor= 100%/99%
- Cyst= 25%/100%

pattern recognition approach

- 6 identifiable patterns:
- Spindle shaped cells (Thymoma Type A)
- Lymphocyte-rich (Thymoma B1)
- Epithelioid-rich (Thymoma B2 and B3)
- Small blue cells
- Inflammatory
- Cystic
- Each pattern carries a set of differential diagnosis.

Spindle shaped cells

Differential Diagnosis

Spindle-cell thymoma (W.H.O. type A)

Spindle-cell carcinoid tumor

Schwannoma (posterior mediastinum)

Sarcoma or soft tissue tumor

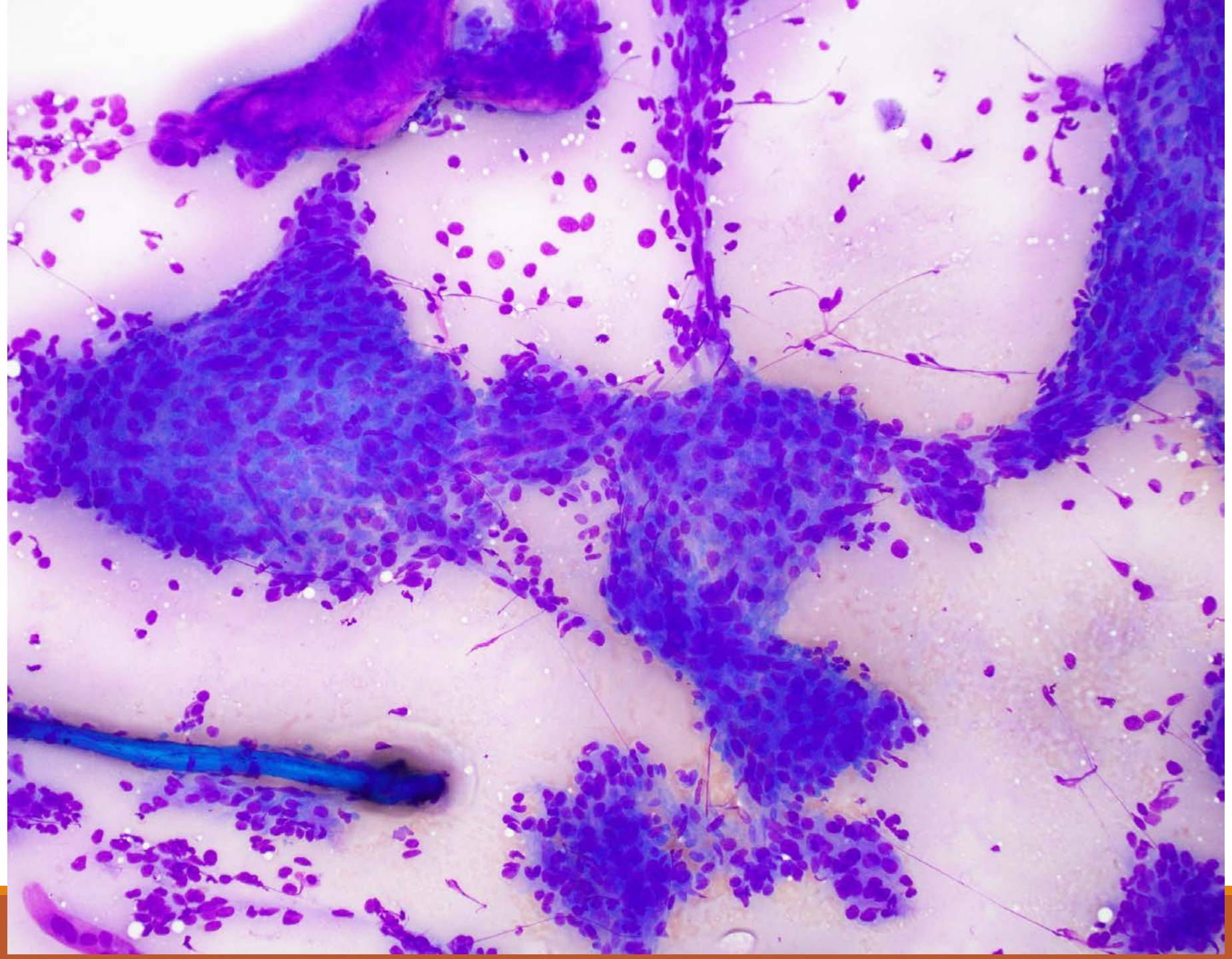
Mesenchymal component of teratoma

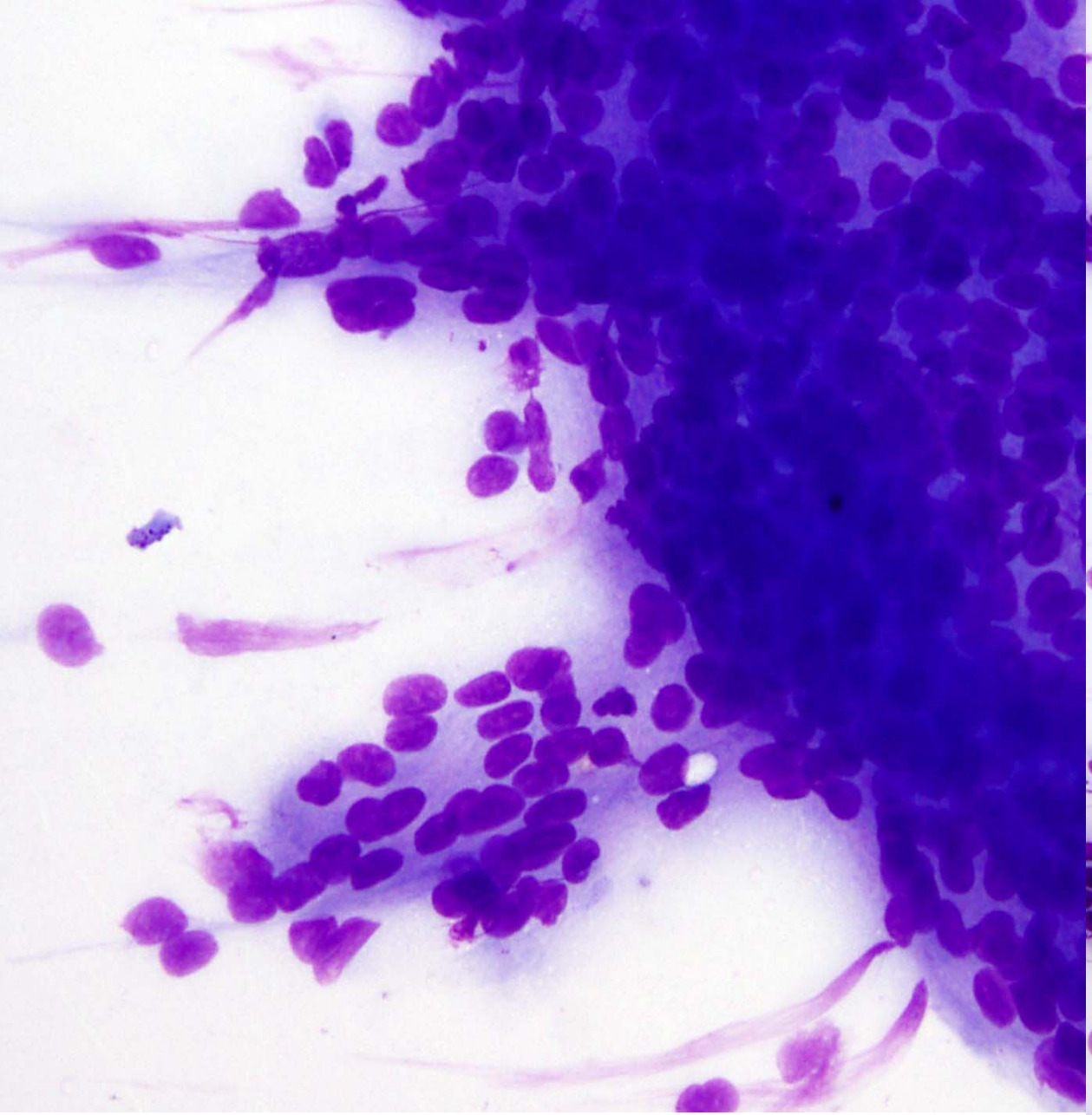
Case 1

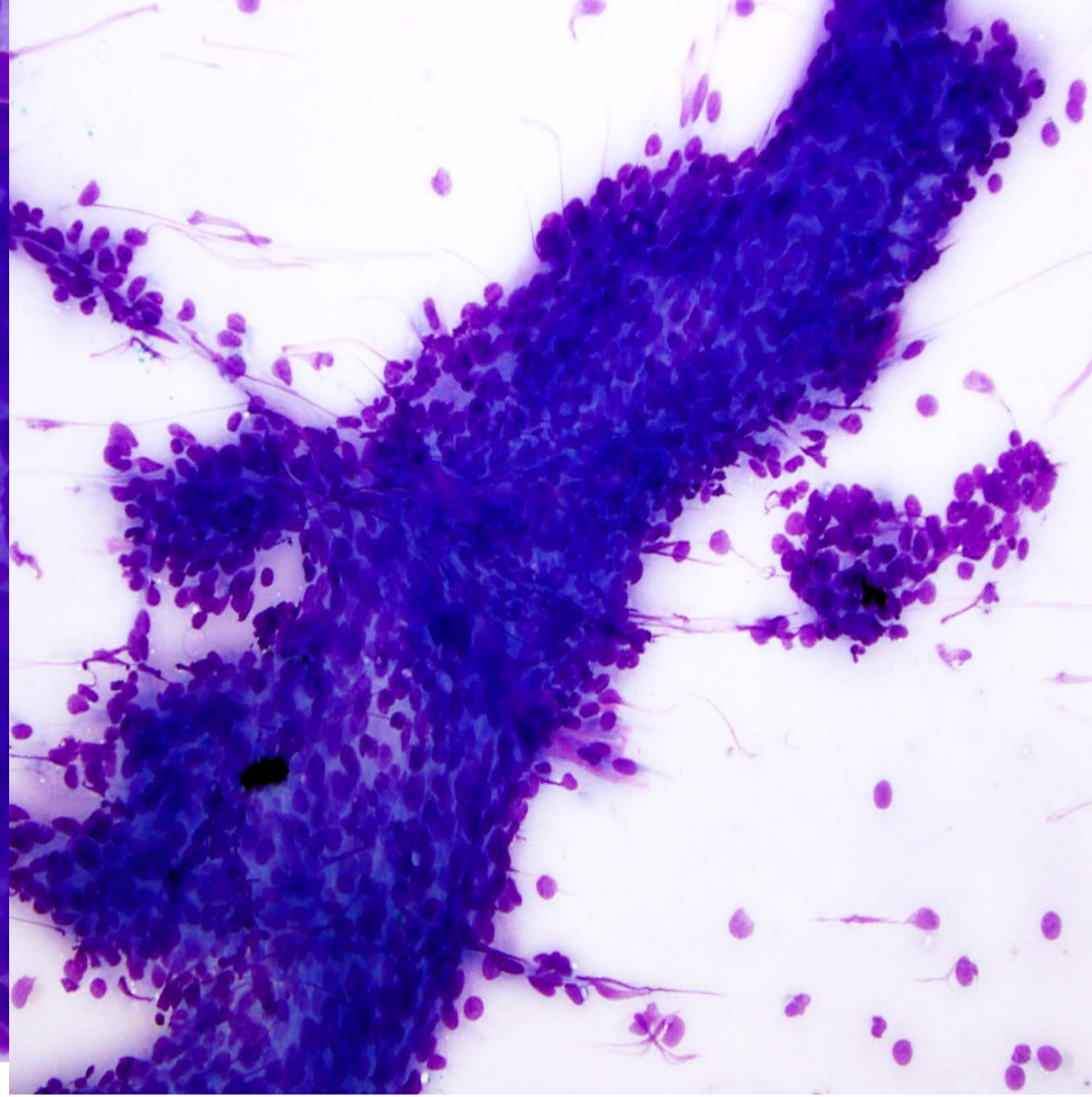
44 year old man, former smoker with a 34 packs/year.

Presents with an anterior mediastinal mass, multiple pleural nodules and pleural effusion.

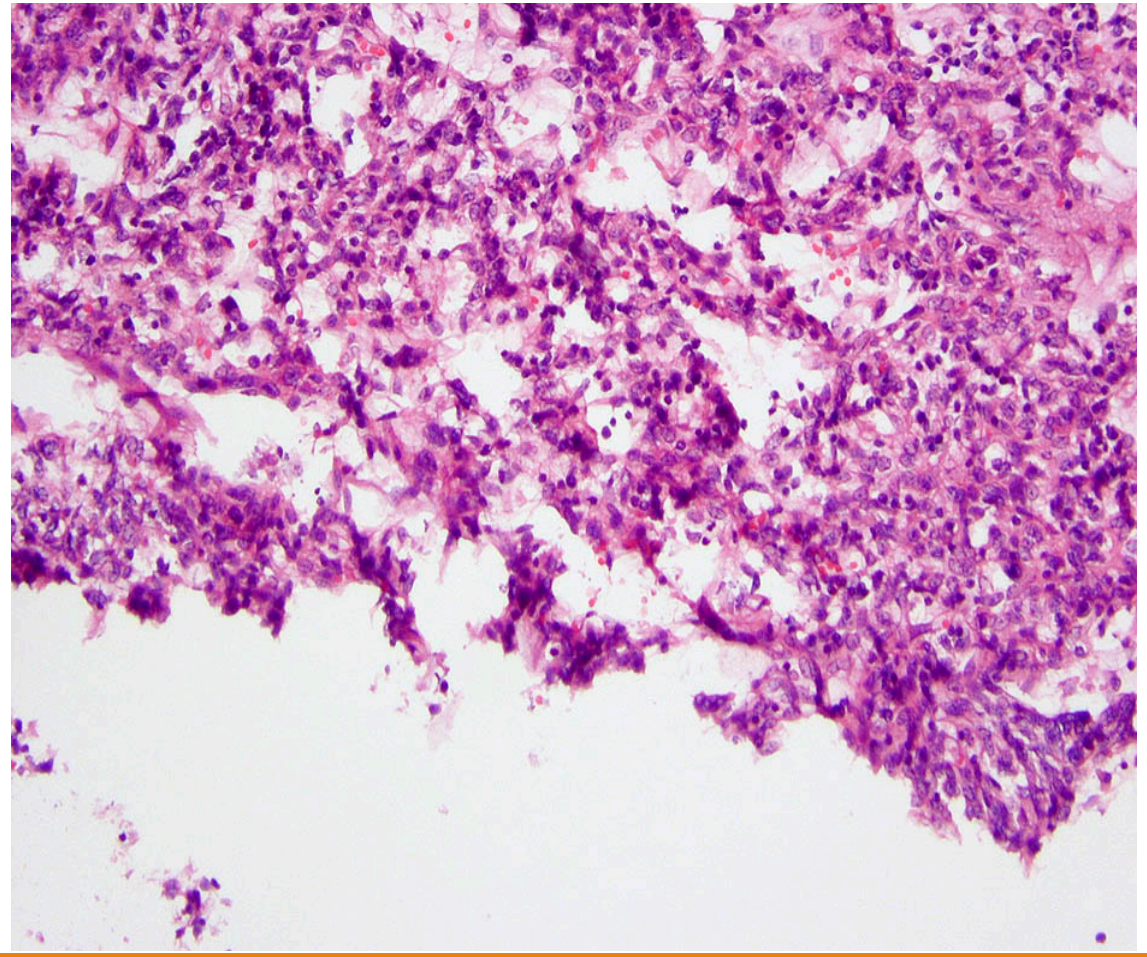
Aspiration biopsy of a pleural nodule was performed.

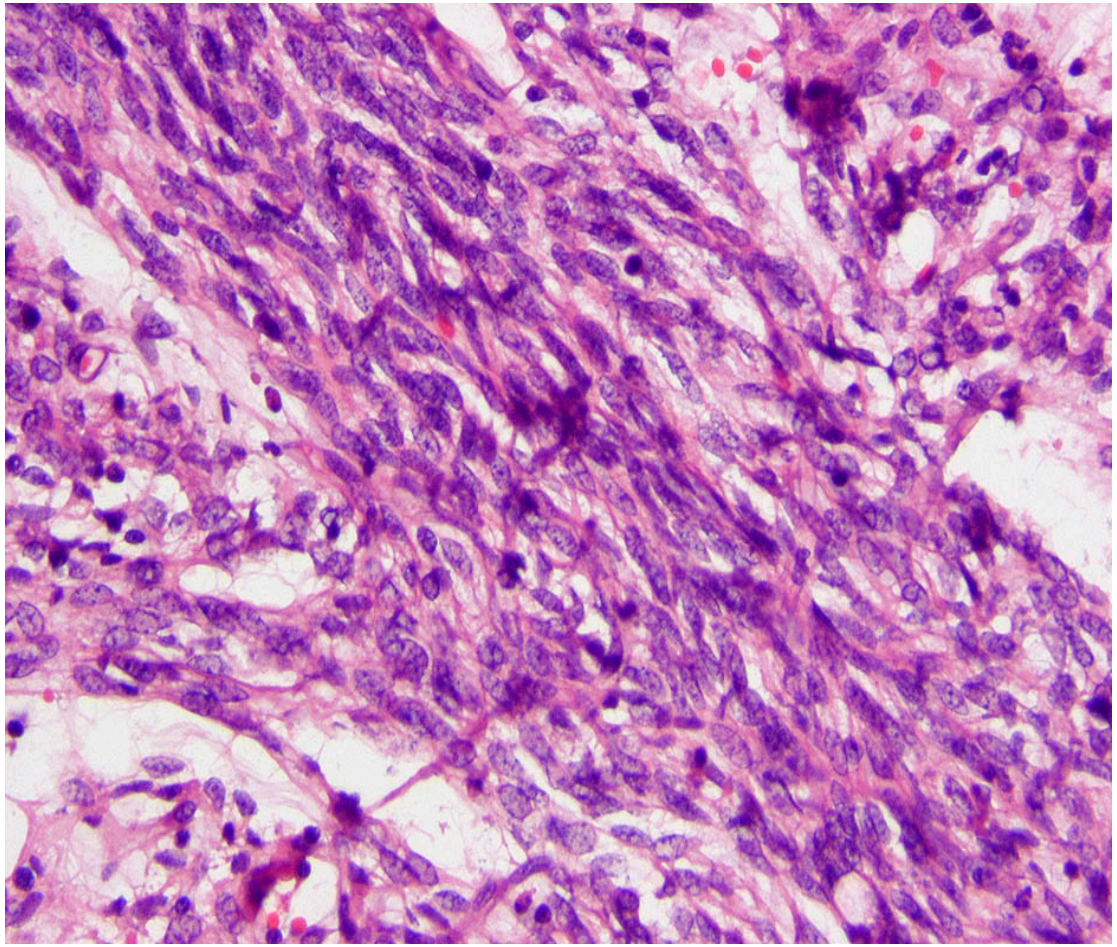






Cell block material





IHC

Positive for pan-cytokeratin and p63

Negative for WT-1, Calretinin, TTF-1, cytokeratin 7, neuroendocrine markers, CD34, STAT6, and other organ specific markers.

Thymoma type A

Cohesive tissue fragments.

Elongated cells embedded in a metachromatic matrix (Diff-Quick)

Presence of lymphocytes in the background

Absence of lymphocytes do not exclude the diagnosis

Thymoma type A

Tumor cells are positive for pan-cytokeratin

Can be positive for CD56 (but negative for other NE markers)

If present, lymphocytes are immature thymic lymphocytes (CD5, CD99, TdT positive)

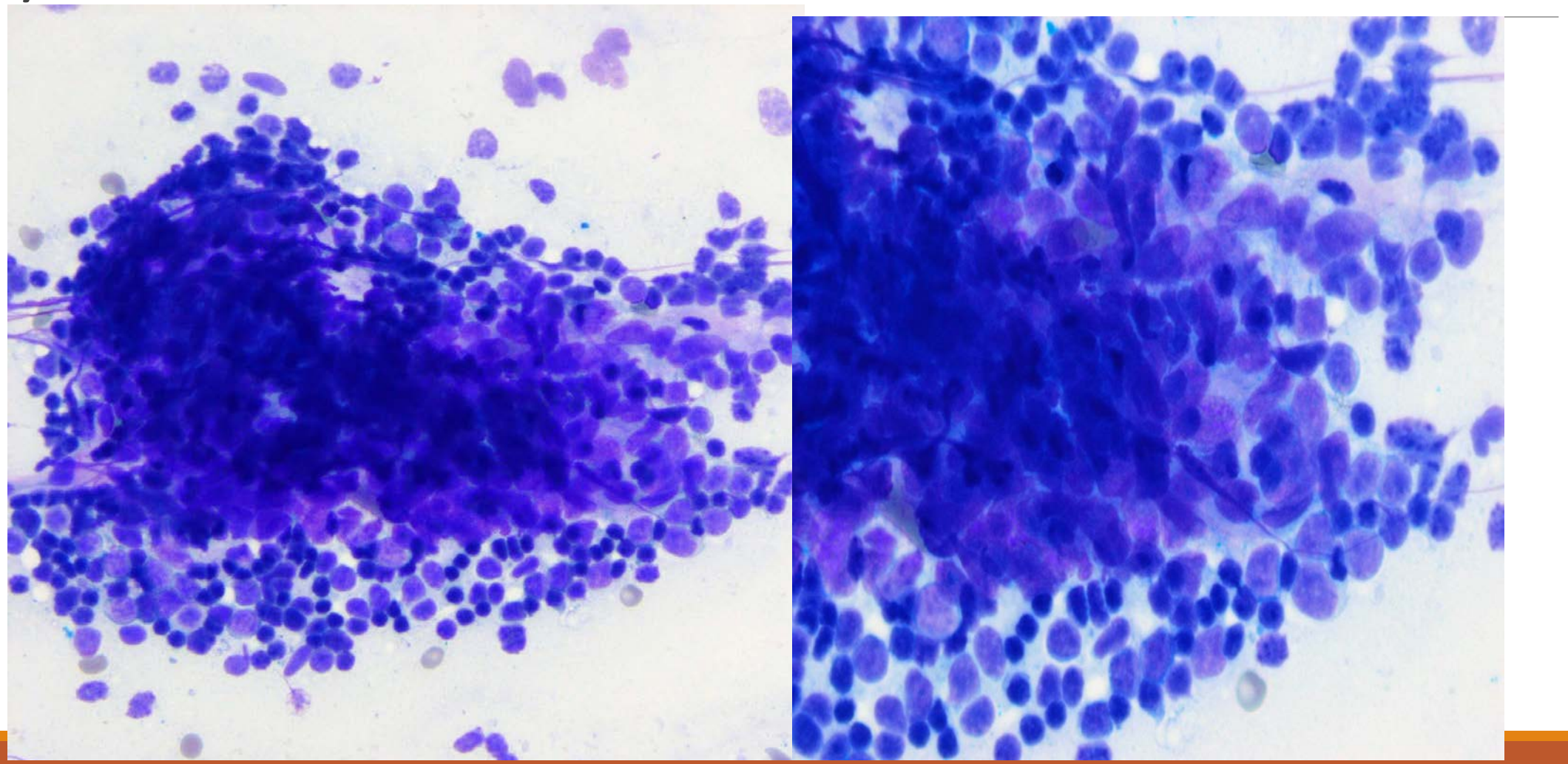
Lymphocyte-rich tumors

Lymphoma

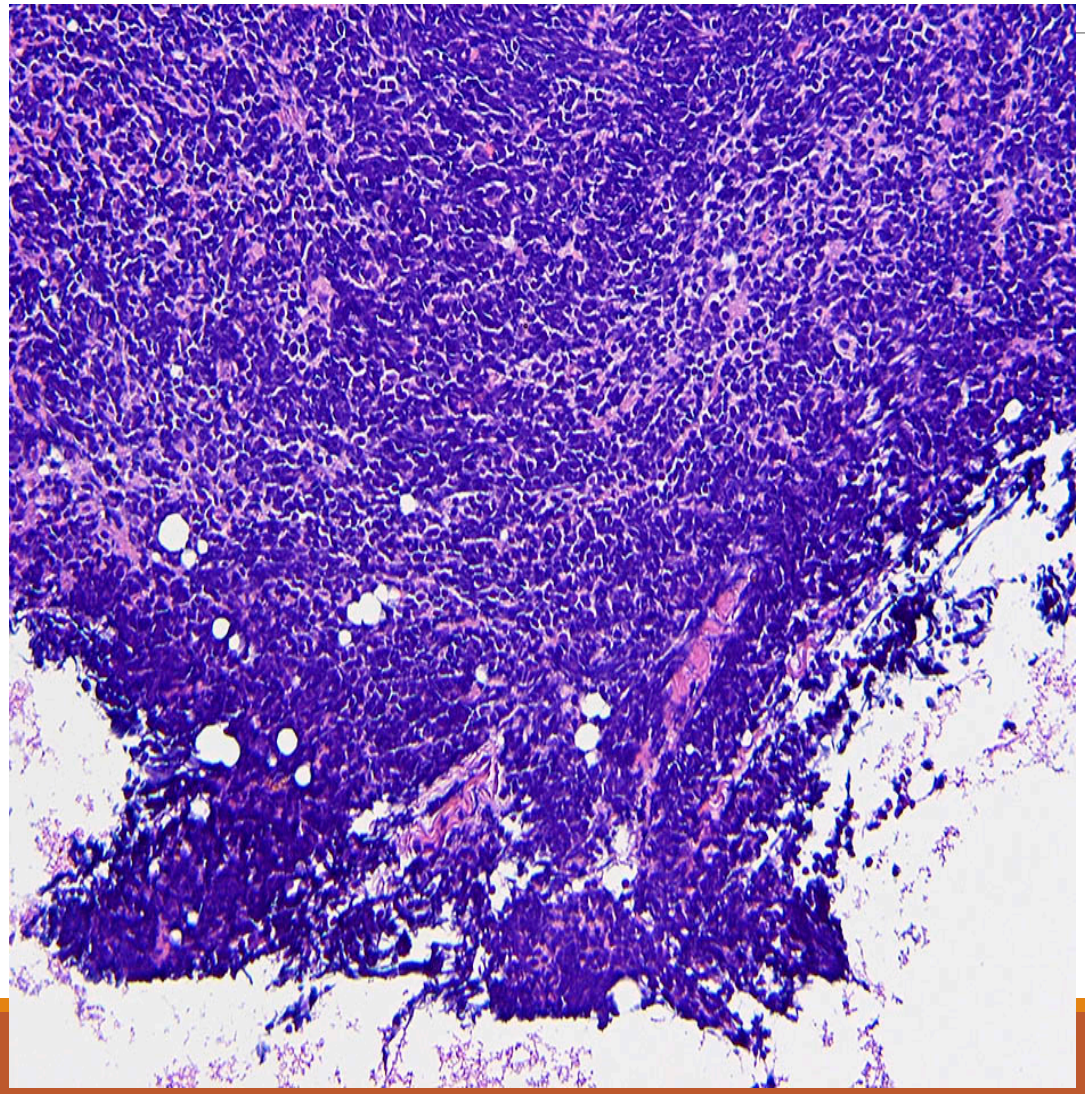
Thymoma (W.H.O. type B1)

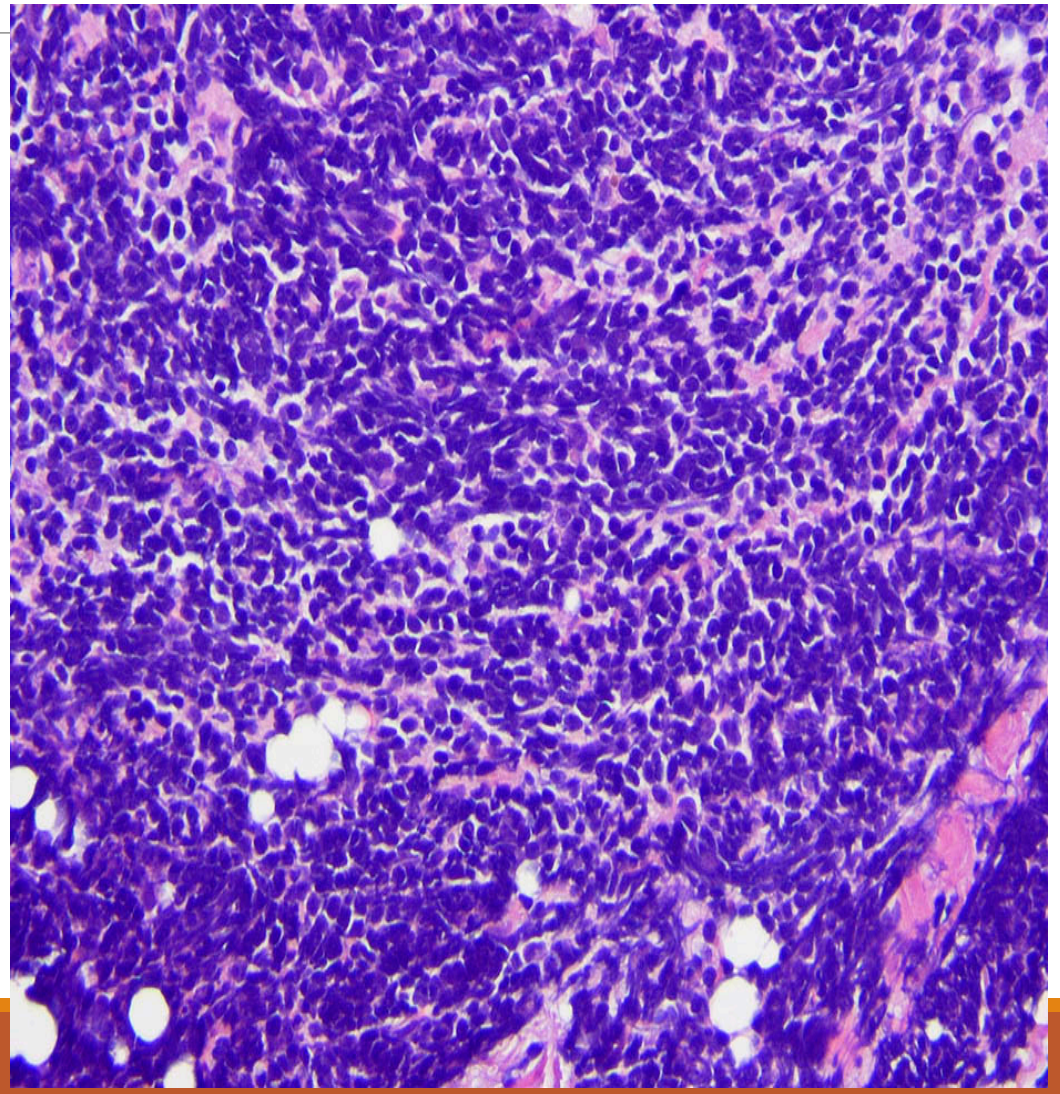
Thymic hyperplasia

Case 2 FNA of a mediastinal mass on a 78 year old man

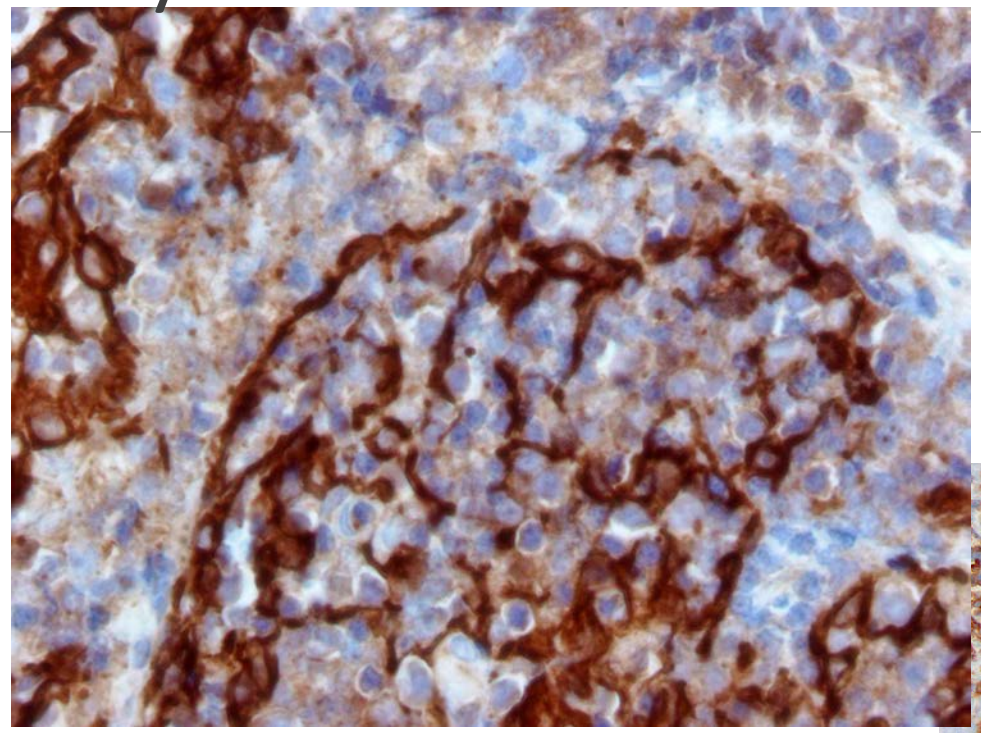


Excision



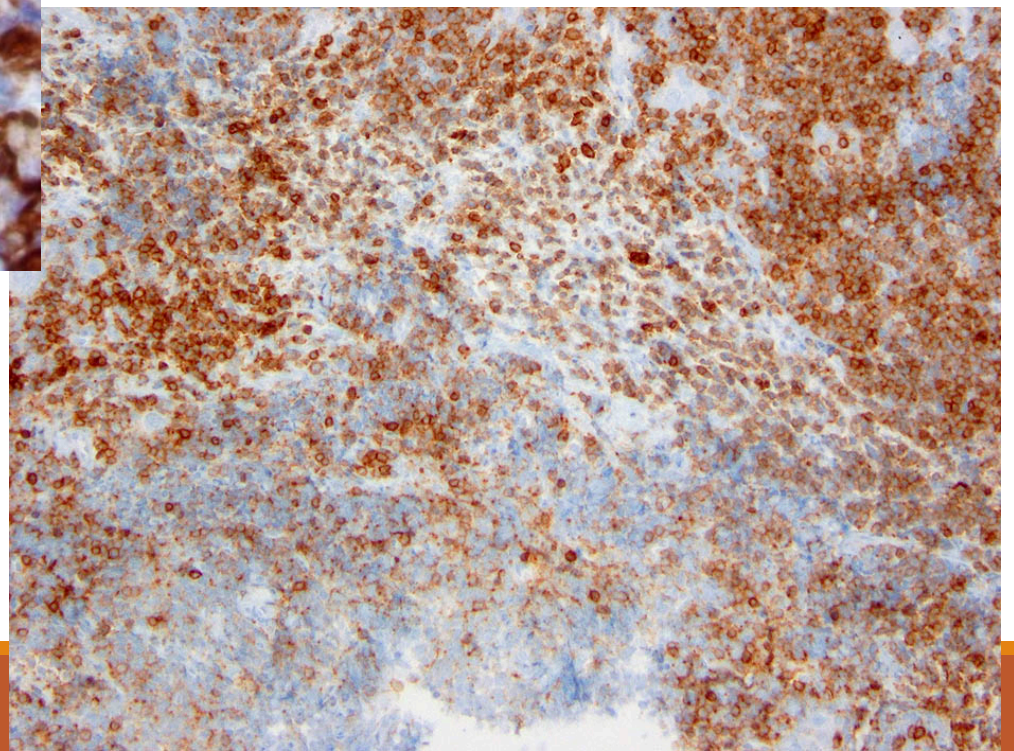


B1 Thymoma



Cytokeratin AE1/AE3

CD5



B1 thymoma

Predominance of heterogeneous lymphocytes

Small discrete clusters that resembles “lymphoid tangles” containing cells with open chromatin, nucleoli can be prominent or not

Flow cytometry shows a predominance of T lymphocytes

Immunohistochemical stains for keratin show a network of keratin positive cells, lymphocytes are immature T cells (CD3, CD5, CD4, CD8, TdT, CD99, CD1a positive)

Thymic Hyperplasia

Follicular hyperplasia is most common

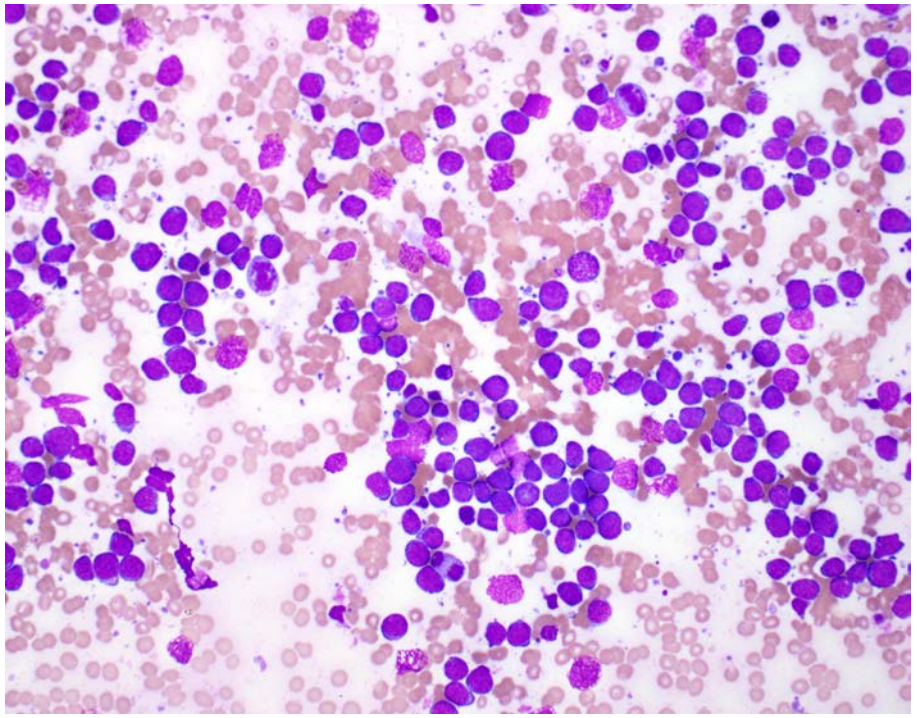
Often associated with autoimmune disorder or history of chemotherapy

Can be very difficult to differentiate in an aspiration biopsy from a B1 Thymoma

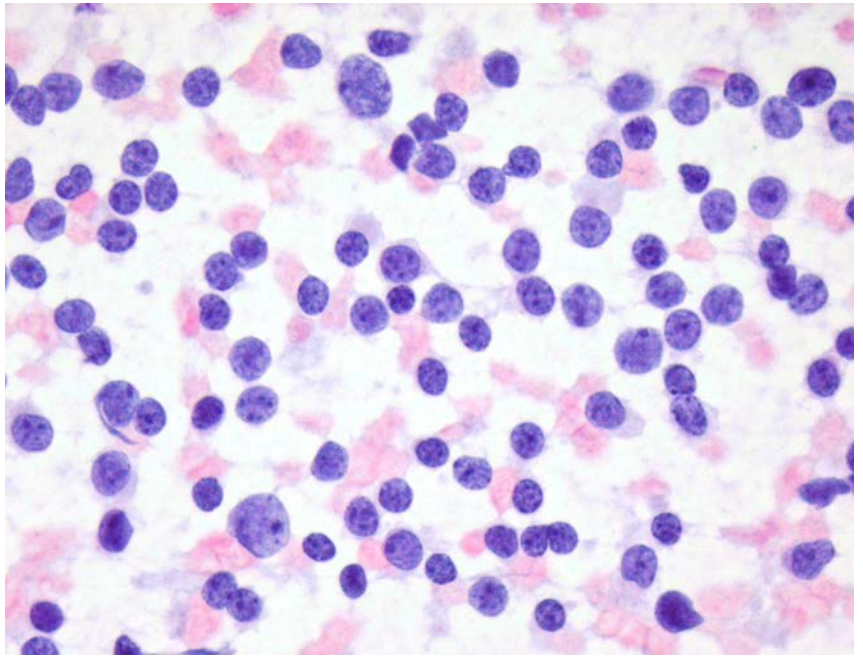
MRI is the best pre-surgical test for the diagnosis

Lymphoma

LARGE B-CELL LYMPHOMA



ACUTE LYMPHOBLASTIC LYMPHOMA



Epithelioid-rich pattern

Metastatic carcinoma

Thymoma, type B2-B3

Thymic carcinoma

Carcinoid tumor

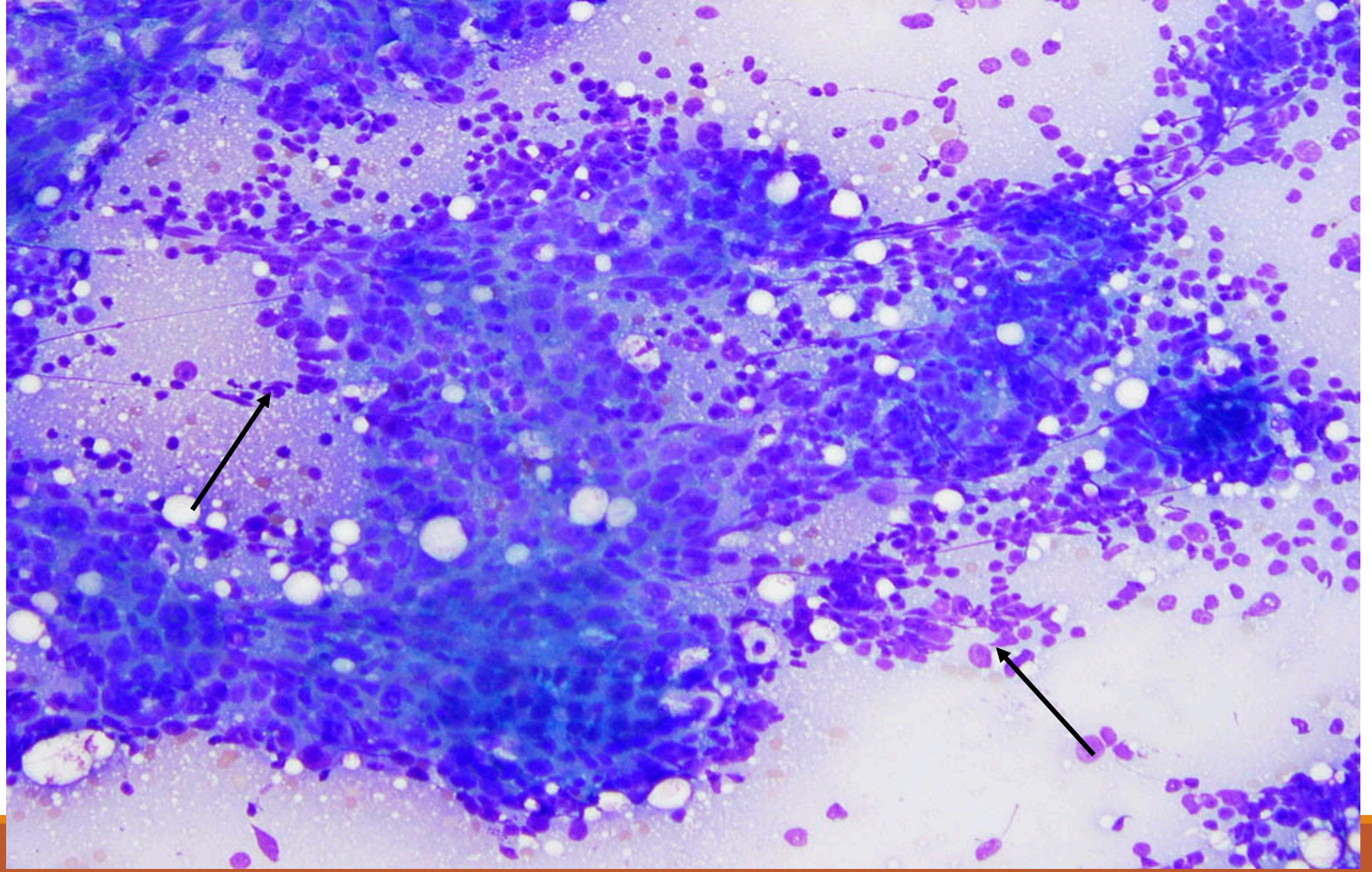
Germ cell tumor

Case 3

57 year old woman, presented with chronic cough.

A CT-Scan showed a large mediastinal mass with pericardial effusion

An aspiration biopsy of the mediastinal mass was performed



IHC work up

Thymoma- keratin and p40+, immature lymphocytes TdT +

Thymic carcinoma- keratin, p40, CD5, CD117+

Metastatic carcinoma and germ cell tumor- Clinical history and target IHC

Metastatic squamous cell carcinoma

FNA – Thymoma Type B2-B3

Moderate to highly cellular smears

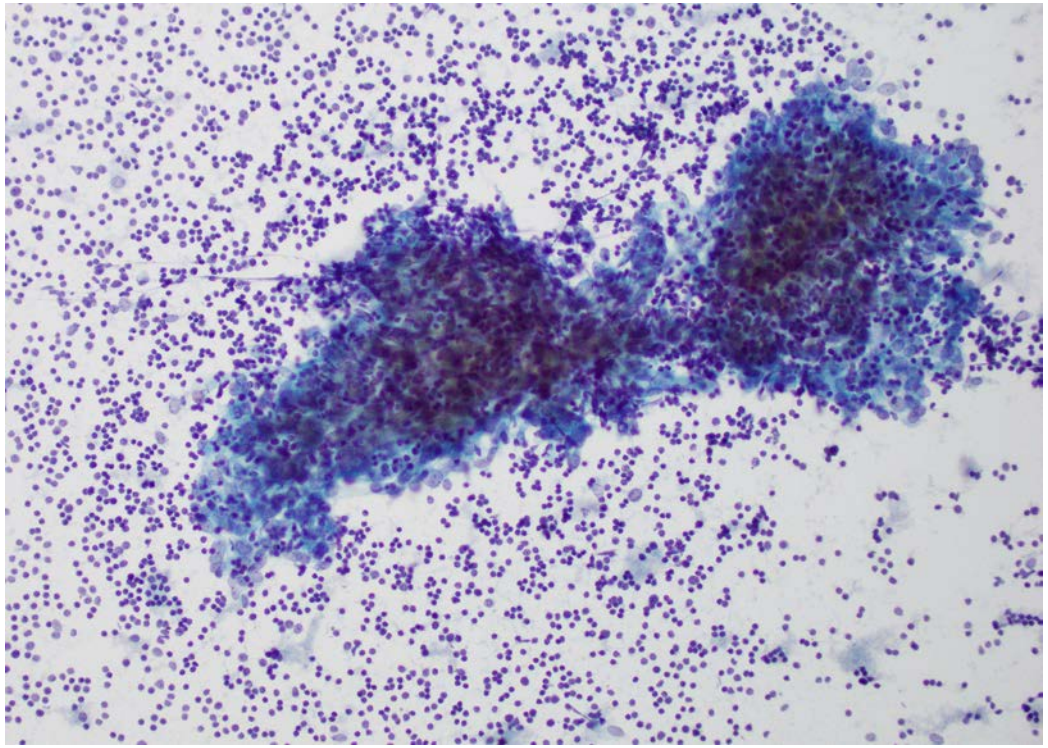
Duo population of epithelial and lymphoid cells (**classical cytologic features**)

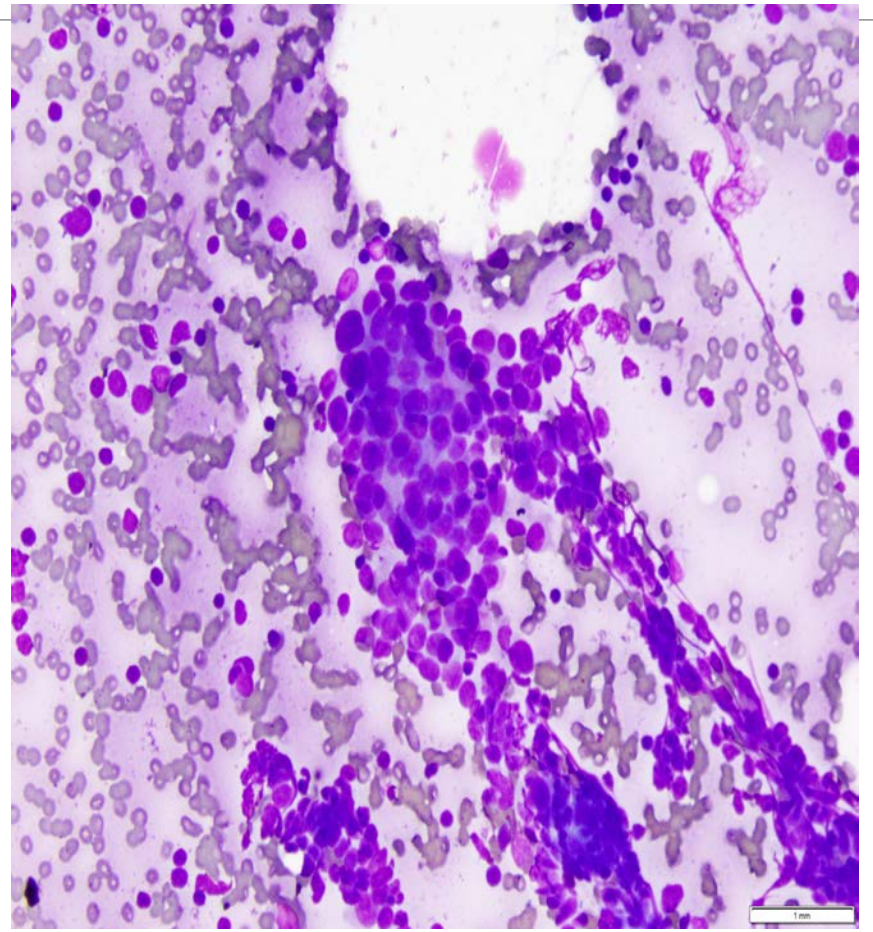
Epithelial arranged in cohesive tri-dimensional clusters

Open chromatin with delicate or prominent nucleoli

Can be confused with carcinoma!

Thymoma B2 and B3





Thymic carcinoma

Positivity for CD5 and CD117 in epithelial cells (40-60% of thymic carcinomas).

Lymphocytes are not immature T-cells

Diverse differentiation that resembles carcinomas arising anywhere else

Examples: squamous cell carcinoma, basaloid carcinoma, clear cell carcinoma, mucoepidermoid-carcinoma, adenocarcinomas, sarcomatoid, and NUT carcinoma

metastatic squamous cell carcinoma

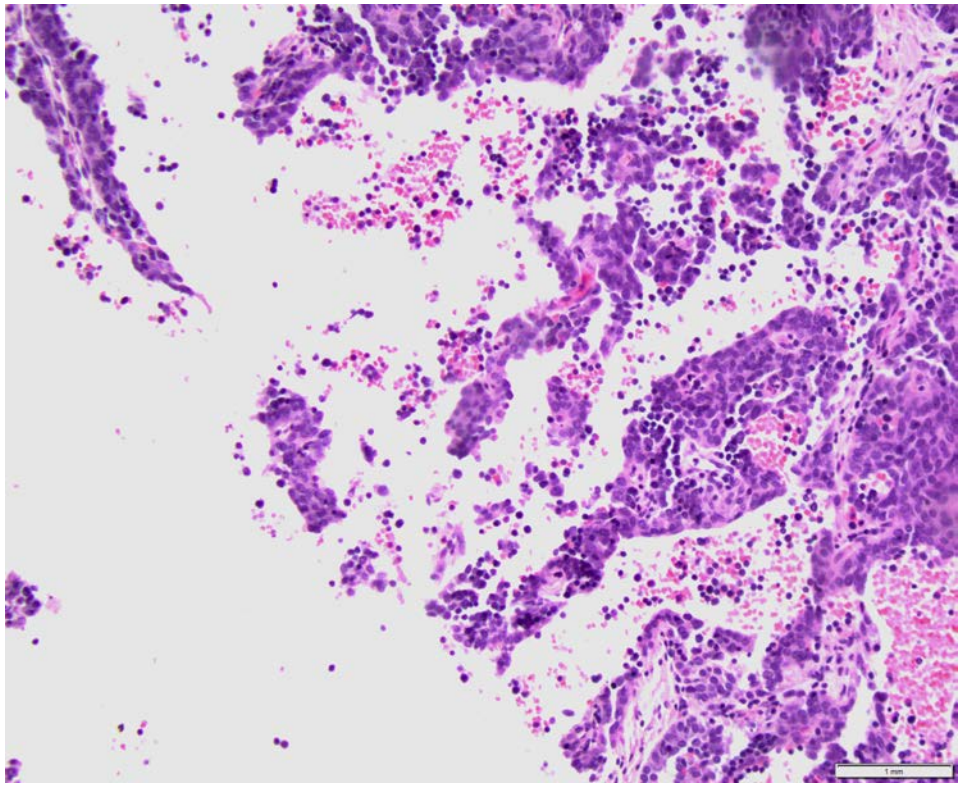
Almost impossible to differentiate a Thymic carcinoma (SQCC) from a SQCC from another site (lung)

CD5 and CD117+ is seen in about 60% of TC, but CD117 can be seen focally in other SQCC

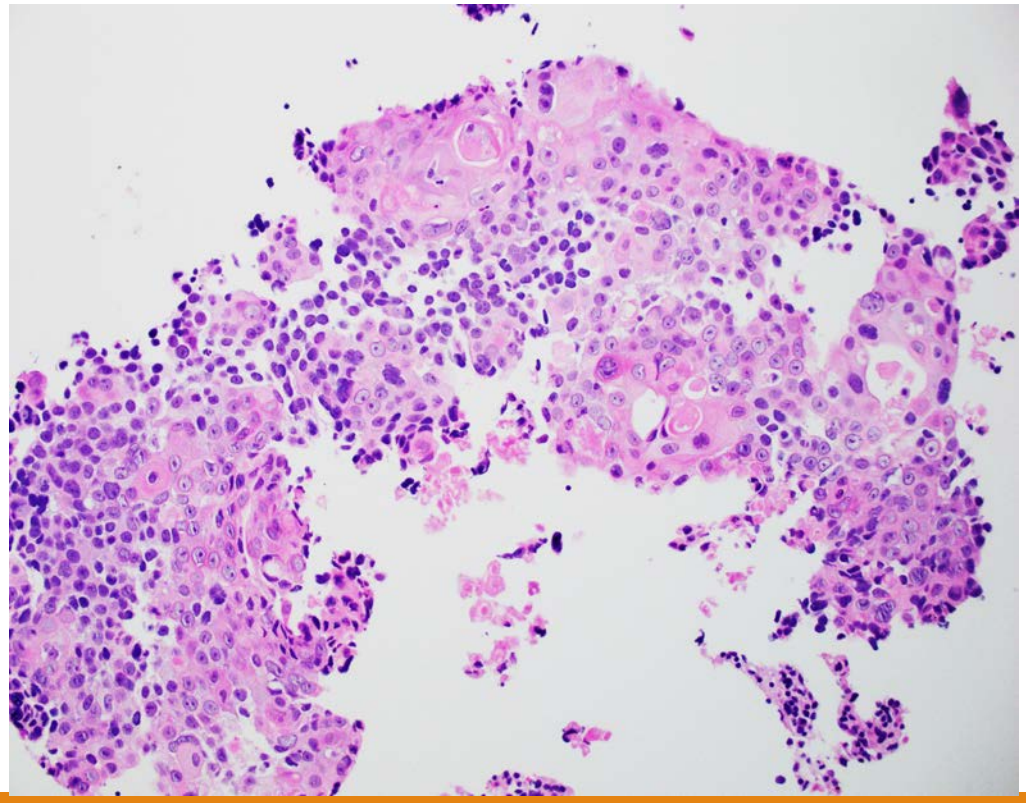
Correlate with history and Imaging studies

Pitfalls

THYMOMA



THYMIC CARCINOMA



Take home message

- Thymomas often metastasizes to the pleura
- Thymoma should always enter into the differential diagnosis when an anterior mediastinal mass is present.
- Thymic tumors are positive for p63, p40, and cytokeratins.
- Always look for thymic lymphocytes (TdT, CD99, CD1a positive)

Take home messages for thymoma

Thymomas can have different cytologic patterns, which is similar to histologic classification

There is no need to classify thymomas into subtypes in cytology

Correct diagnosis and disease stage are enough for clinical management

Case 4

22 year old man, non-smoker

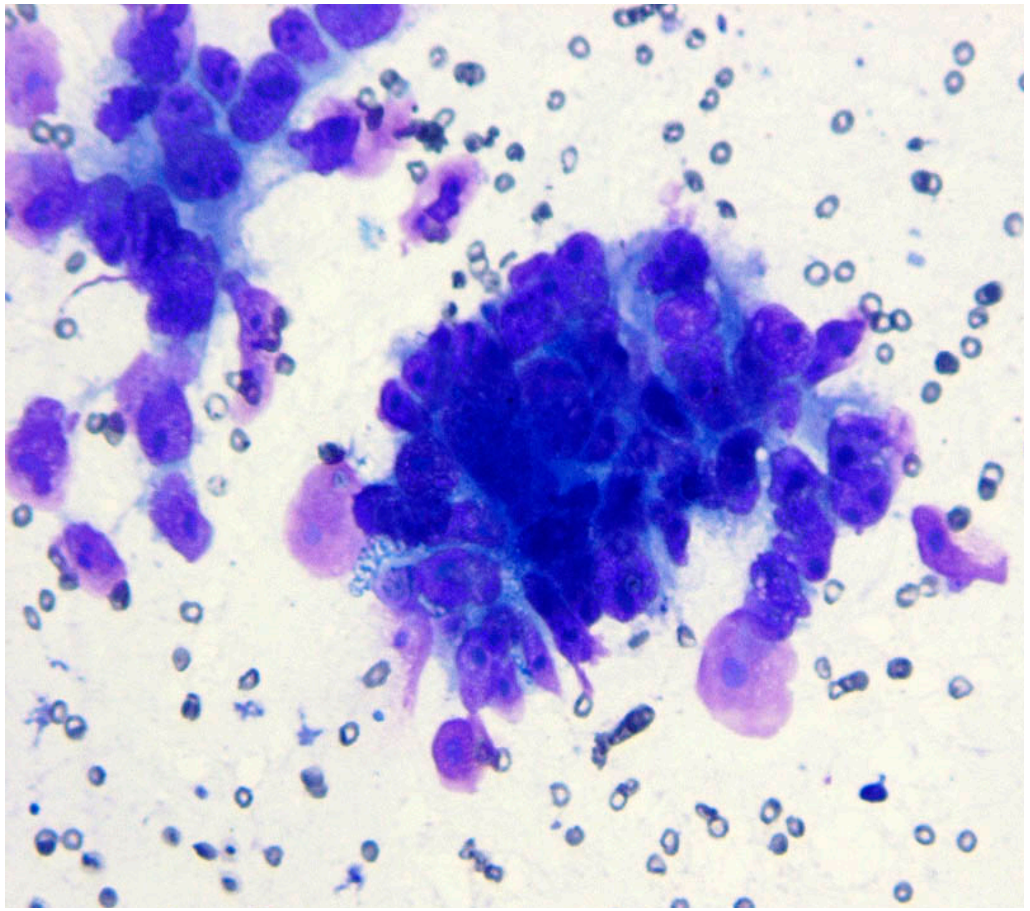
Presented with fever, cough, and malaise

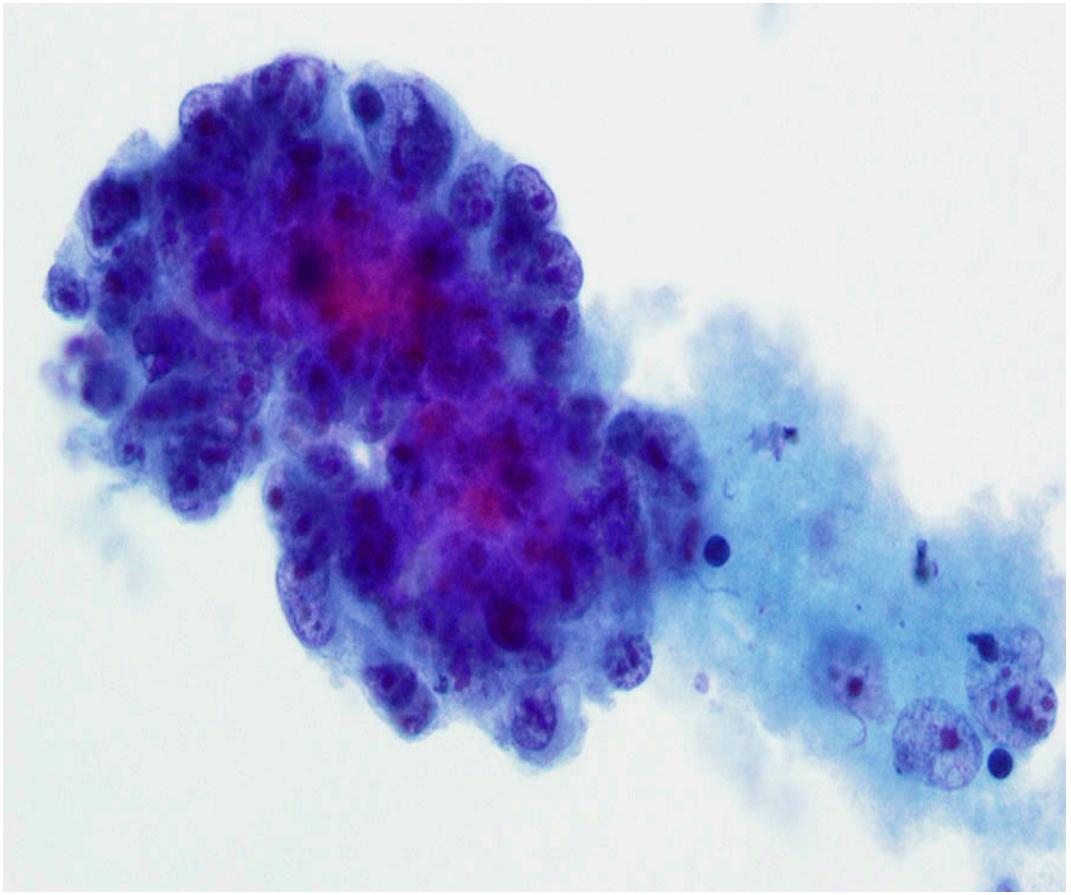
A Chest X-Ray was performed to rule out pneumonia

A large mediastinal mass was found incidentally

An aspiration biopsy of the mass was performed

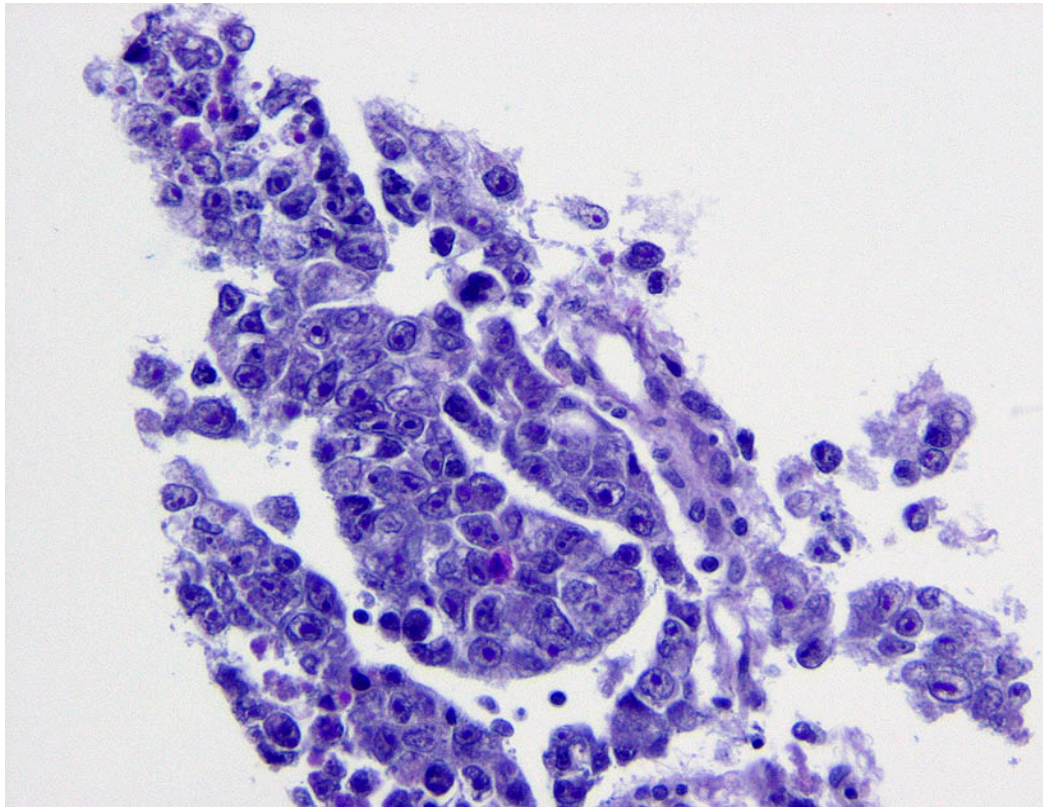
FNA of a mediastinal mass



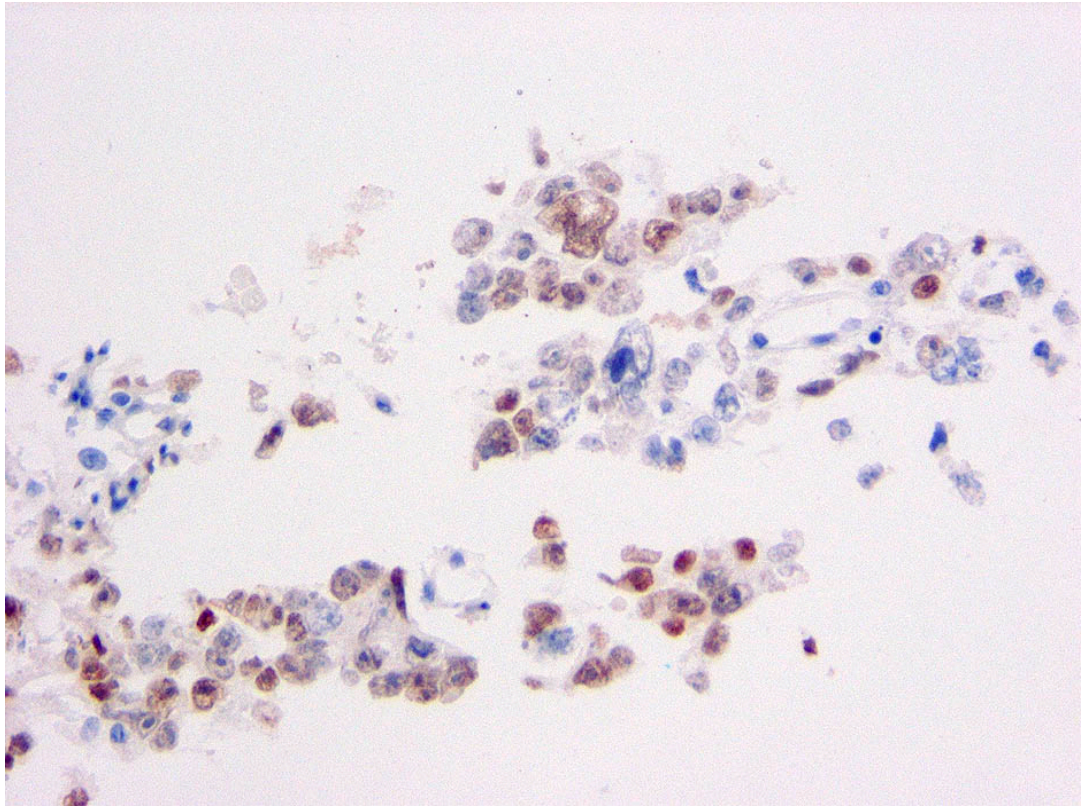


Embryonal carcinoma

CELL BLOCK



POSITIVE FOR OCT 4



Germ Cell Tumors

Rare

Mediastinal germ cell tumors account for less than 5% of all germ cell tumors

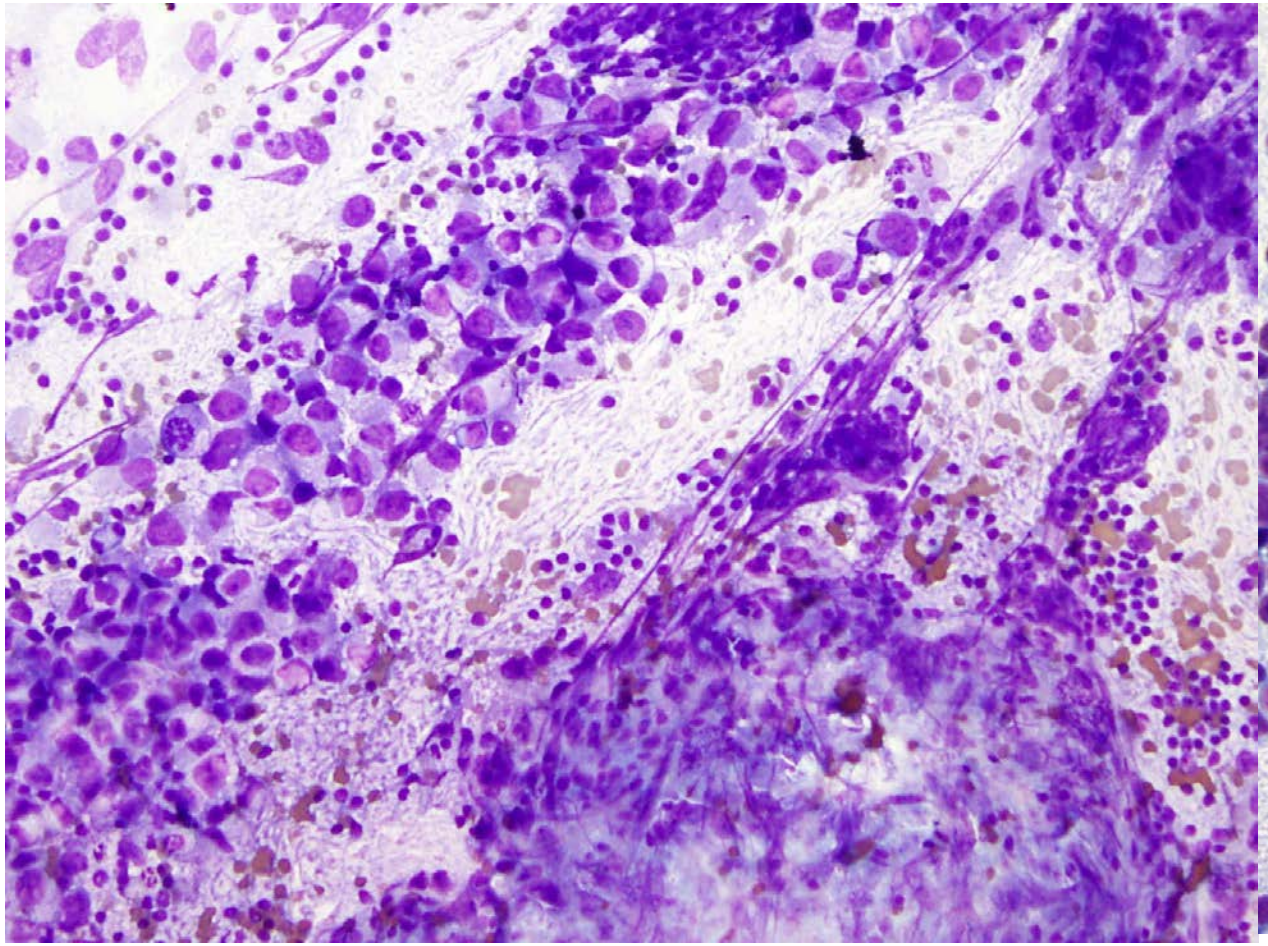
The components of a germ cell tumor is important for the management of the patient

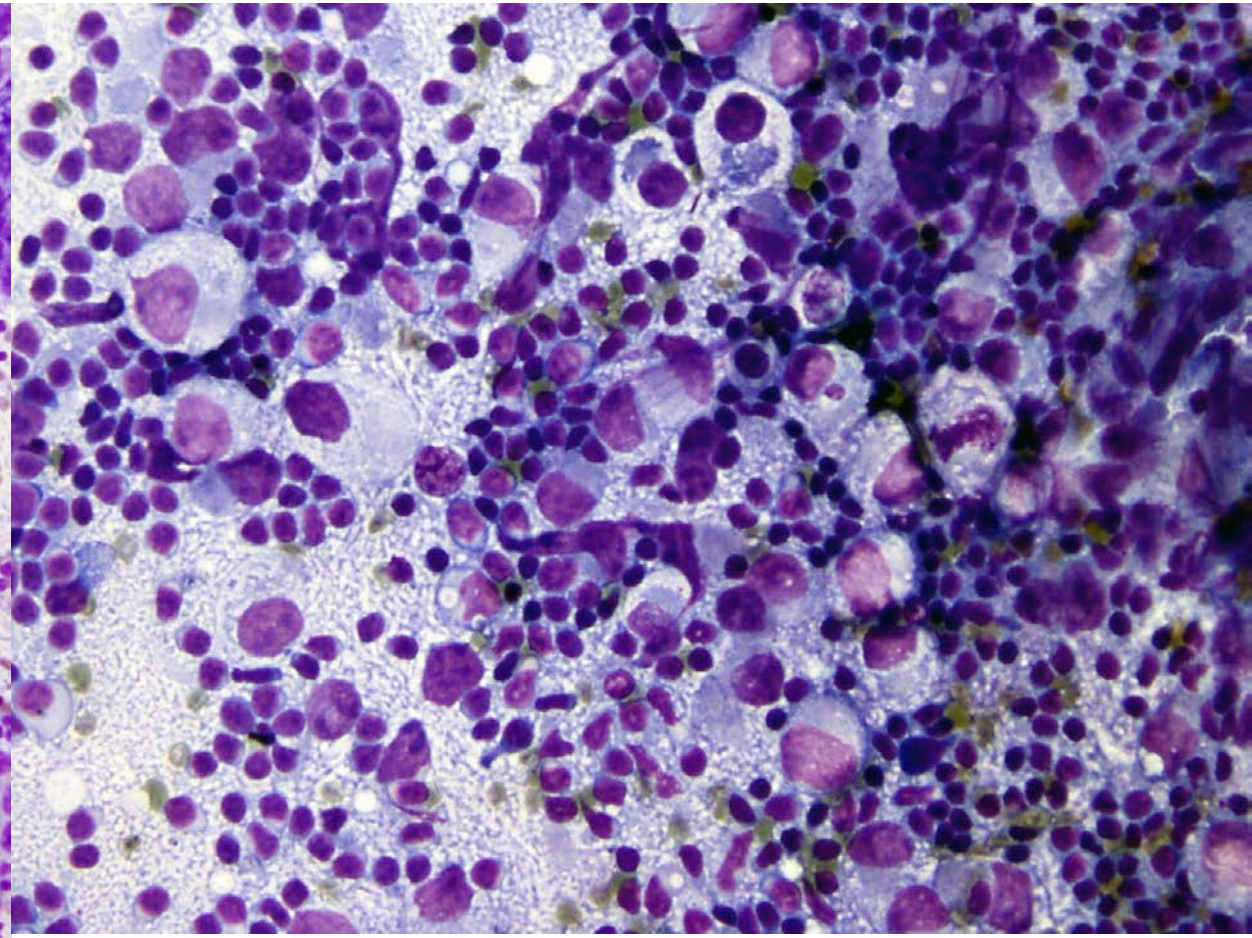
Not all components of a GCT may be sampled in an aspiration biopsy.

There is good correlation with serum markers.

Germ cell tumor type	Cytokeratin	OCT4 (OCT3/4)	SALL4	CD117	CD30	AFP	b HCG	Glypican3
Seminoma	Neg*	+	+	+	Neg	Neg	Neg	Neg
Embryonal carcinoma	+	+	+	-/+	+	+/-	Neg	Neg
Yolk sac tumor	+	Neg	+	+/-	Neg	+	Neg	+
Choriocarcinoma	+	Neg	+ (mononuclear trophoblast)	Neg	Neg	Neg	+	+ (syncytiotrophoblast)
Teratoma	+ (epithelial component)	Neg	-/+ (focal staining in enteric glands; and primitive neuroepithelium and blastema-like stroma of immature teratoma)	-/+	Neg	-/+ ***	Neg	+/-

FNA mediastinal mass in 20 year old man





IHC

Tumor cells are positive for:

SALL 4

D2-40

CD117

Seminoma, mediastinal

Pure seminoma is rare

Often part of a mixed germ cell tumor

Post-pubertal occurrence

40% metastasize to lymph nodes and lung

Histologic diagnosis	Therapeutic option
Seminoma	Chemotherapy
Yolk sac tumor	Chemotherapy, followed by resection of remaining tumor mass
Embryonal carcinoma	Chemotherapy, followed by resection of remaining tumor mass
Choriocarcinoma	Chemotherapy, followed by resection of remaining tumor mass
Mixed germ cell tumor	Chemotherapy, followed by resection of remaining tumor mass
Mature teratoma	Surgical resection
Immature teratoma	Surgical resection

Pitfalls for the diagnosis of germ cell tumors

Mix germ cell tumors are more common

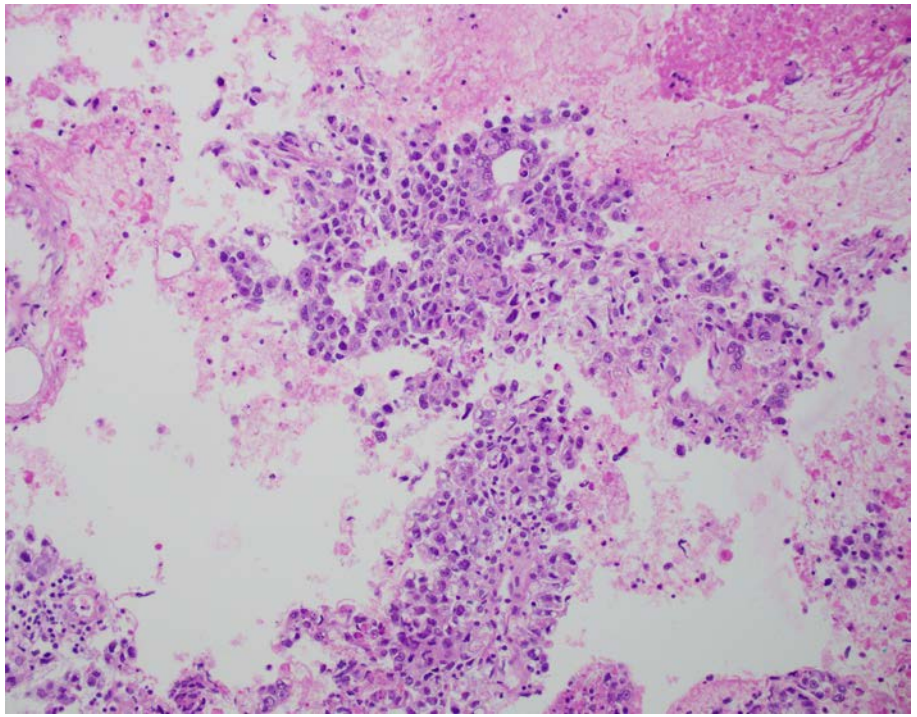
Always correlate with serum markers that may indicate another component

Embryonal carcinoma and Yolk Sac tumors mimic high grade carcinomas.

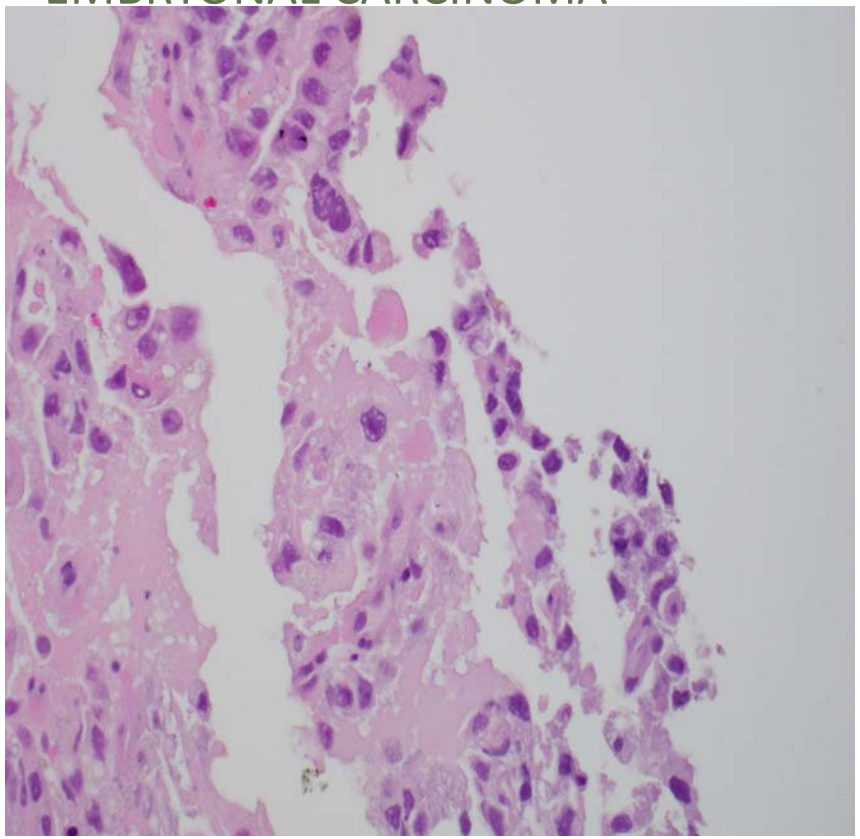
Clinical correlation is very helpful!

Germ cell tumor

YOLK SAC TUMOR



EMBRYONAL CARCINOMA

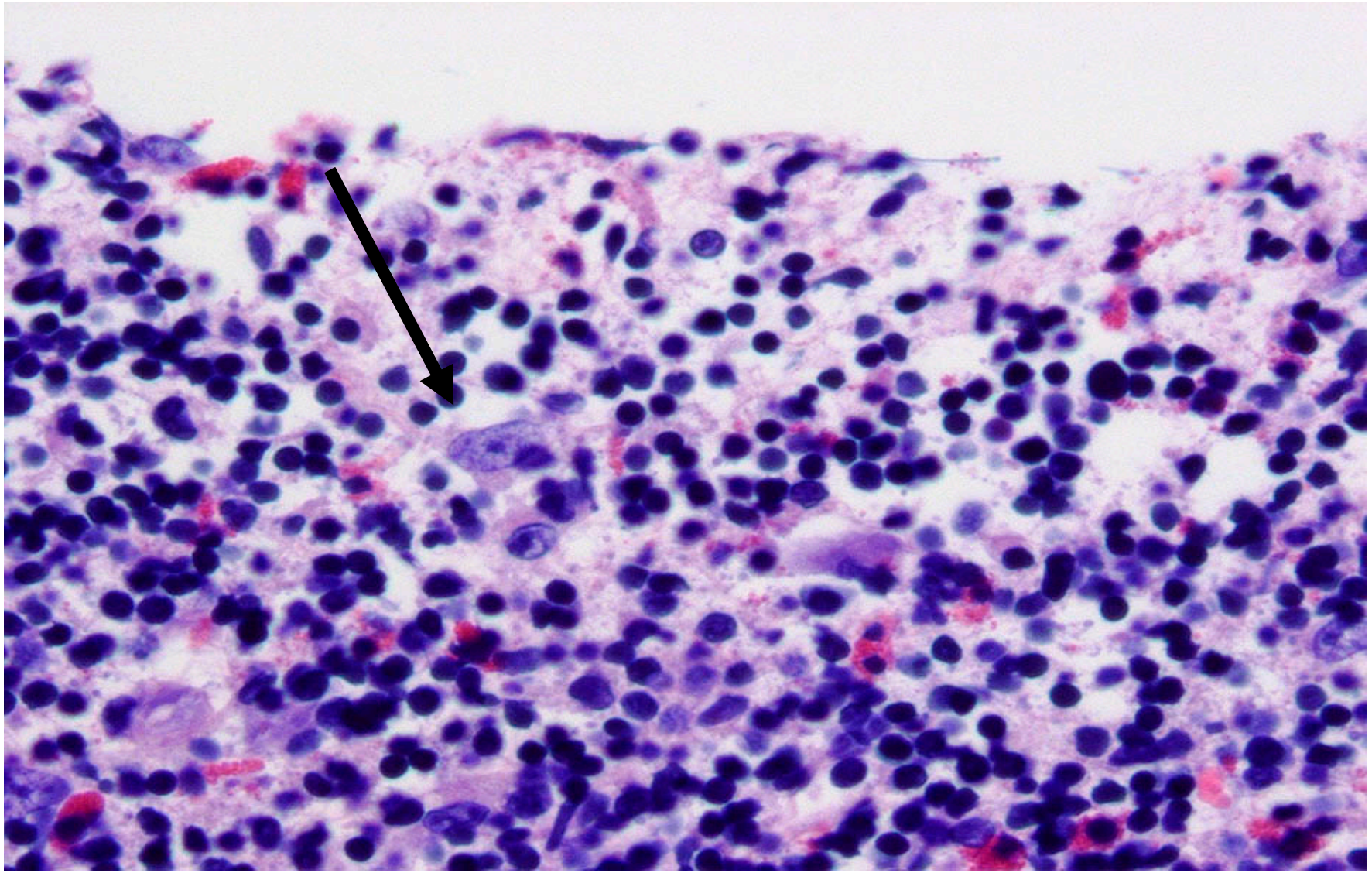


Inflammatory pattern

Hodgkin lymphoma

Sarcoidosis

Other granulomatous inflammation



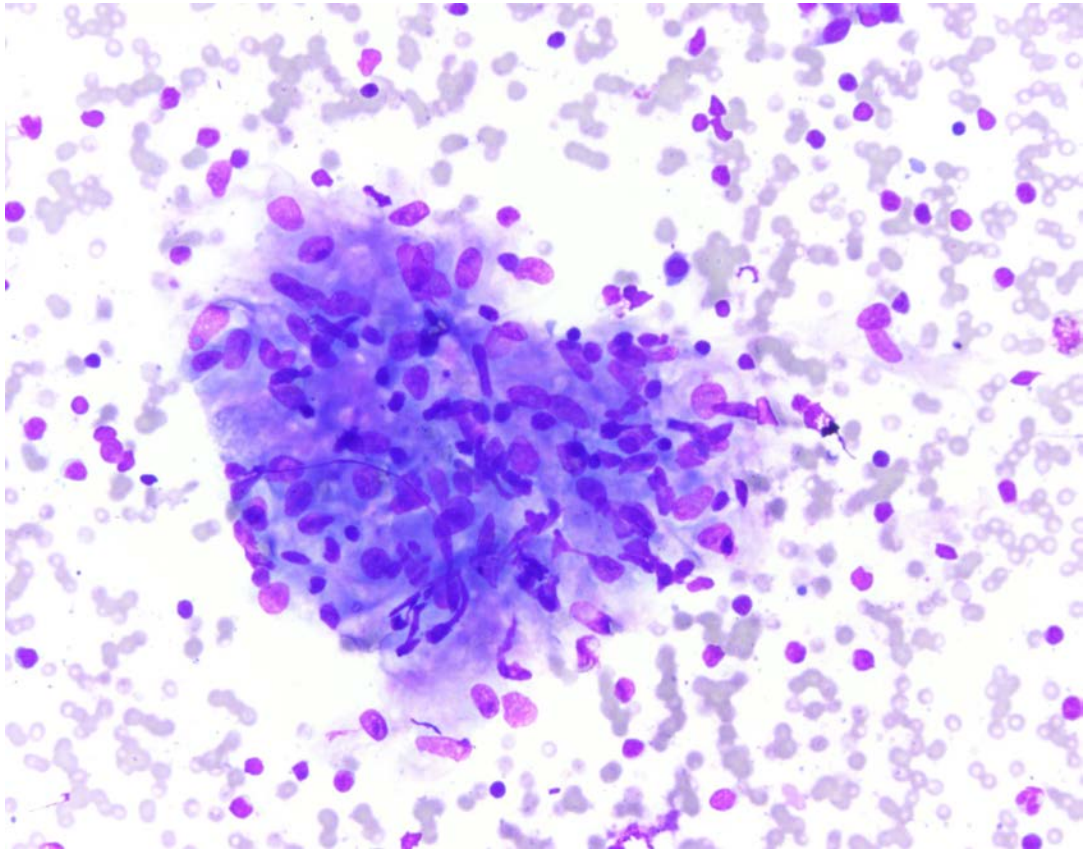
Hodgkin’s lymphoma of the mediastinum

Classical Hodgkin’s lymphoma is the most common type in the mediastinum

It can arise from the thymus or in mediastinal lymph nodes

The tumor can be associated with cystic changes or thymic hyperplasia

Granulomatous inflammation



granuloma

Infectious

Sarcoidosis

Component of lymphoma (Hodgkin)

Component of germ cell tumor (seminoma)

Small blue cell pattern

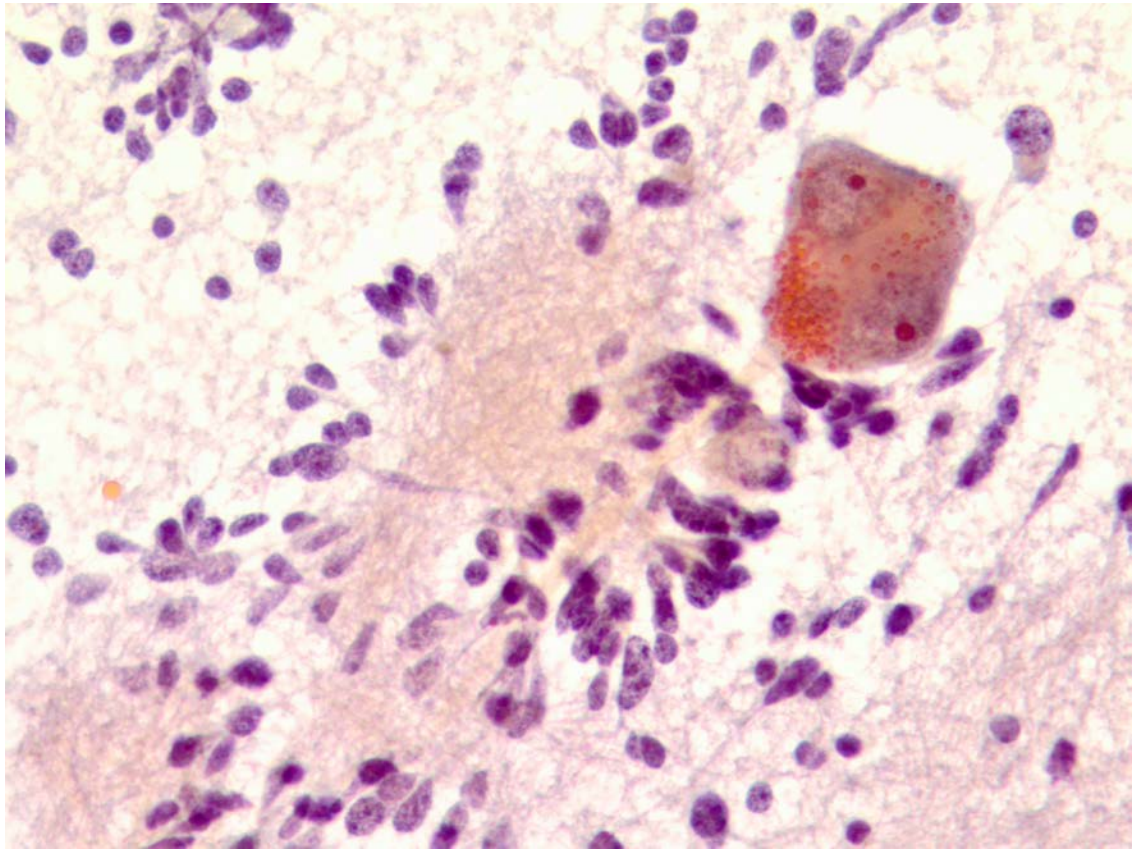
Small cell carcinoma

Ewing sarcoma

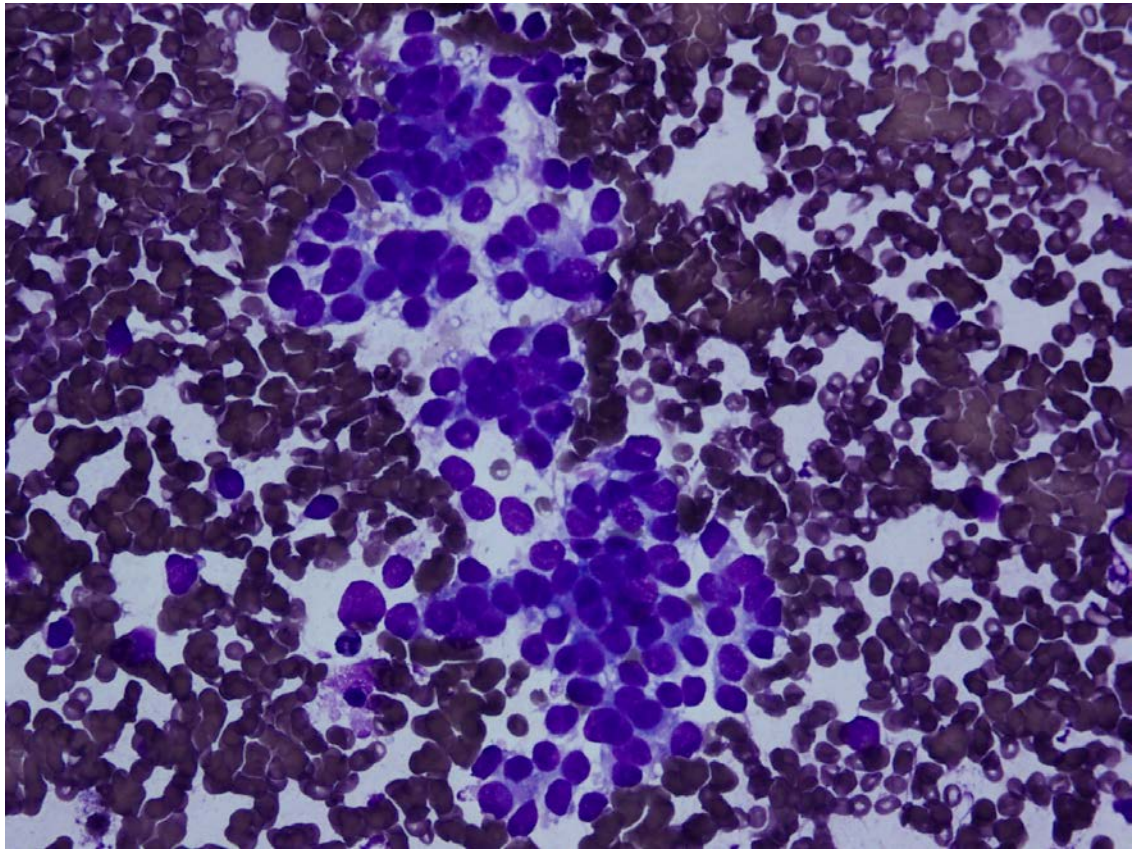
Neuroblastoma

Immature neuroepithelium of teratoma

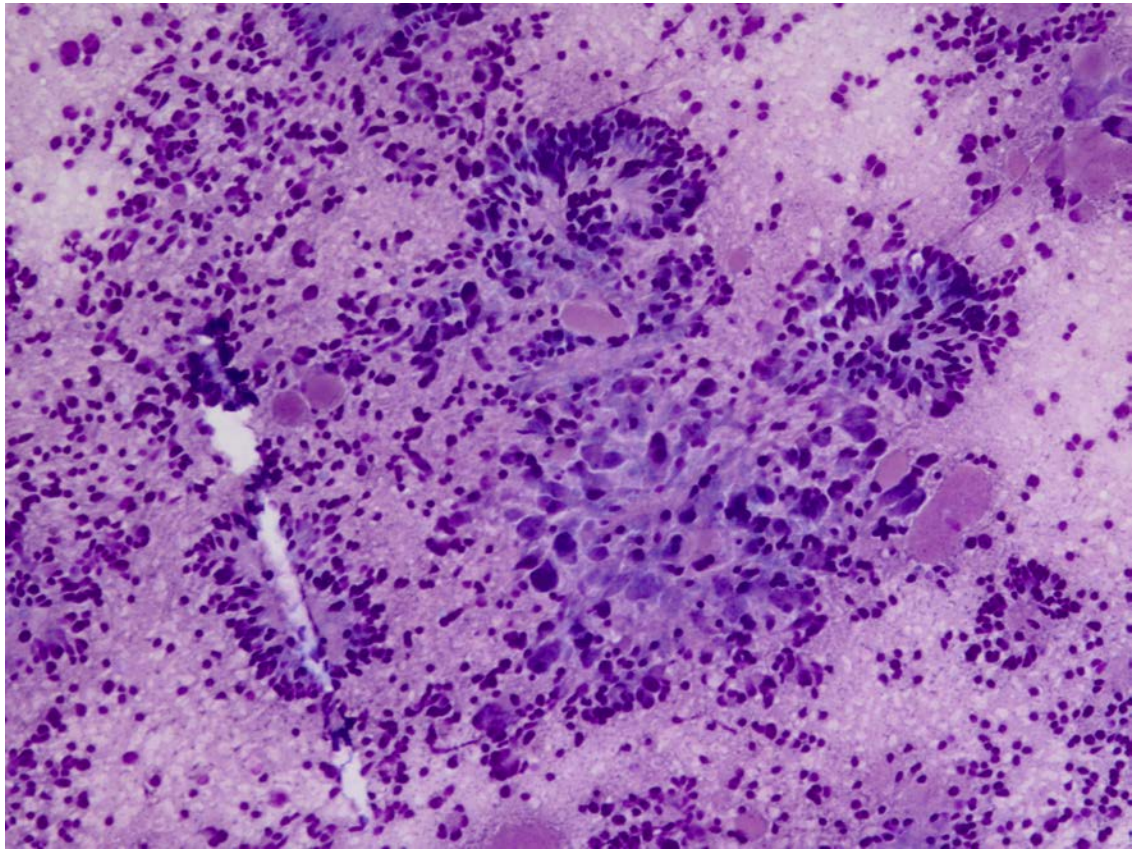
ganglioneuroblastoma



Ewing sarcoma



neuroblastoma



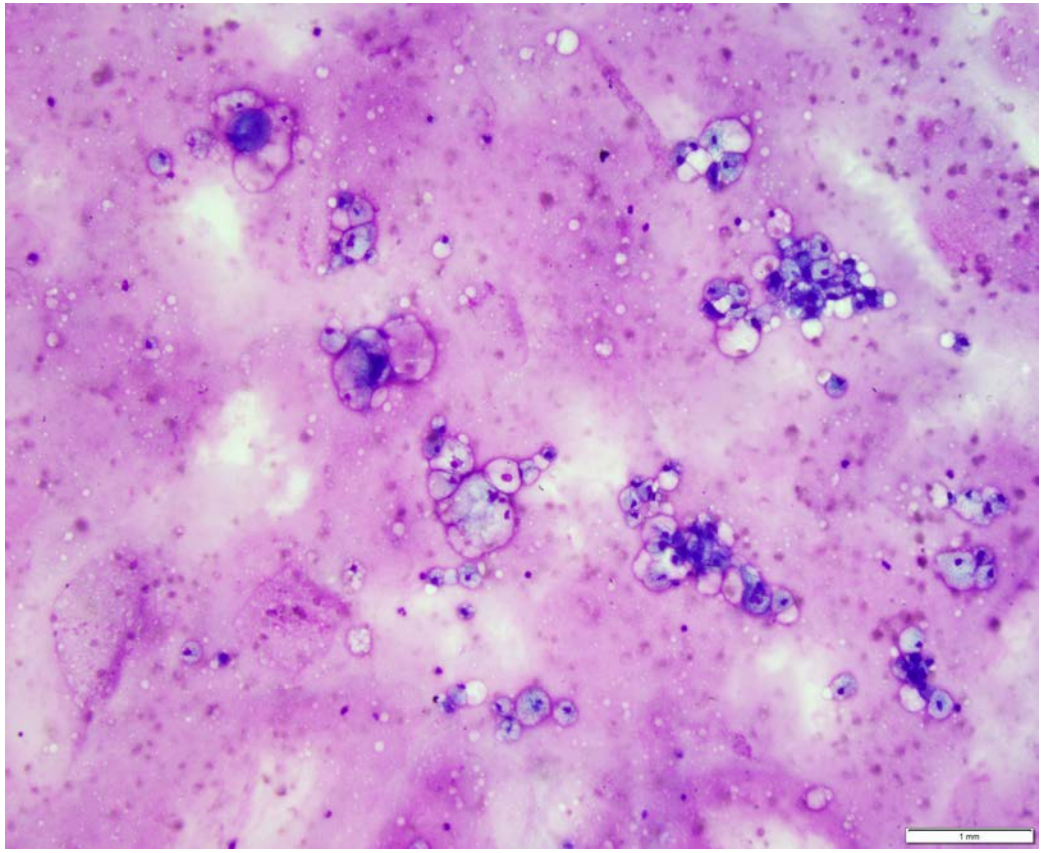
Cystic pattern

Difficult to diagnosis before surgery!

Cystic lesions- thymic cyst, mesothelial cysts, bronchogenic cysts

More likely diagnosed as unsatisfactory or non-diagnostic

Cyst content



Thymic cyst

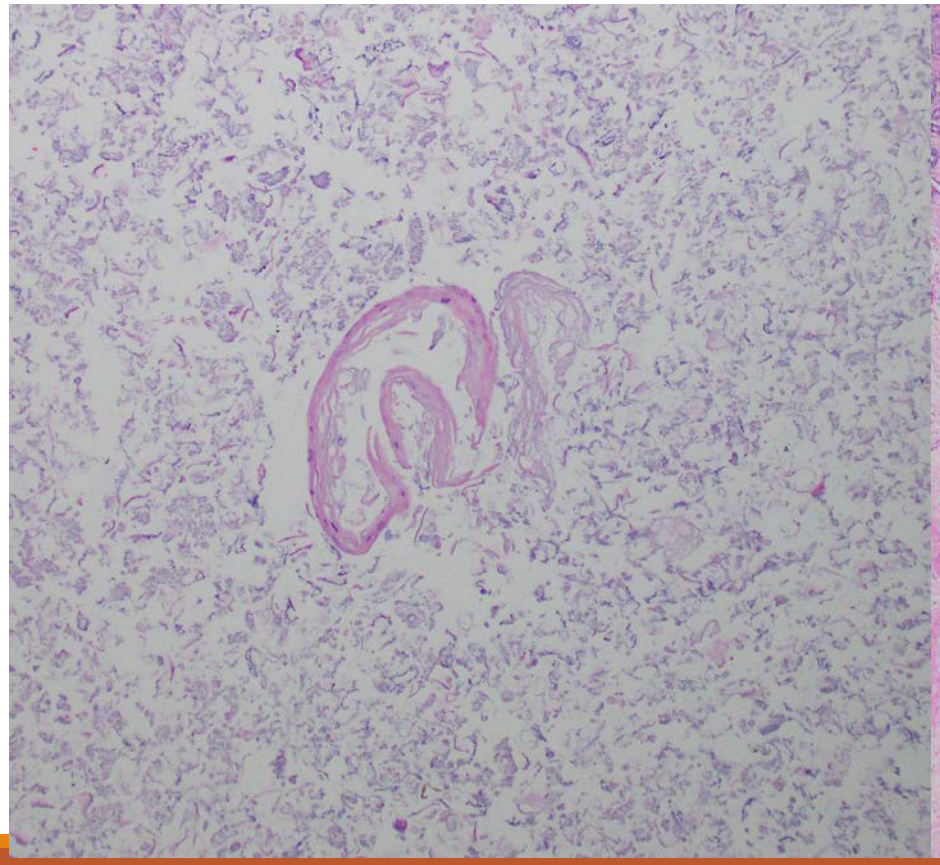
Benign process thought to be acquired or reactive.

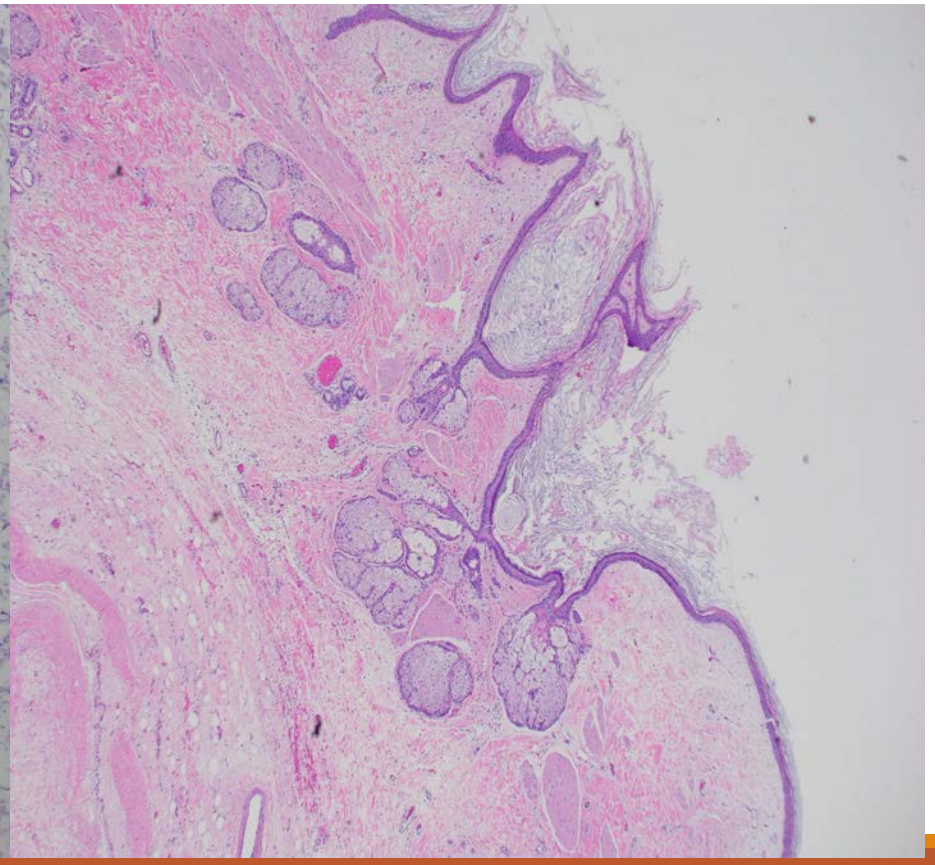
Can be lined by cuboidal, flat, squamous or ciliated epithelium

Biopsy is generally not diagnostic, needs radiographic correlation

Often associated with neoplastic process, that are NOT necessarily located within the thymus

teratoma





Thank you!