

# Endocrine system. THYROID NEOPLASMS

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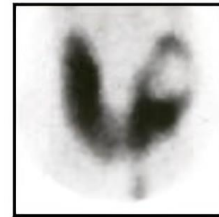
7-5-2026

# THYROID NEOPLASMS

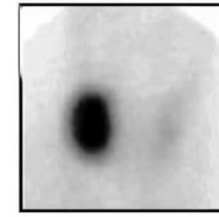
- Thyroid tumors range from circumscribed, benign adenomas to highly aggressive, anaplastic carcinomas.
- Fortunately, the overwhelming majority of solitary nodules of the thyroid prove to be either :
  - ✓ benign adenomas.
  - ✓ localized, non-neoplastic conditions ,e.g:
    - ❖ dominant nodule in multinodular goiter.
    - ❖ simple cysts.
    - ❖ foci of thyroiditis.

## Benign vs malignant

- Thyroid nodule most likely to be malignant if:
  - ✓ Nodules in younger patients .
  - ✓ Nodules in males .
  - ✓ Nodules that doesn't take up radioactive iodine in imaging studies (cold nodules).



Cold



Hot

# Neoplastic thyroid lesions

## **Benign:**

follicular adenoma.

## **Malignant:**

Papillary carcinoma (accounting for more than 85% of cases)

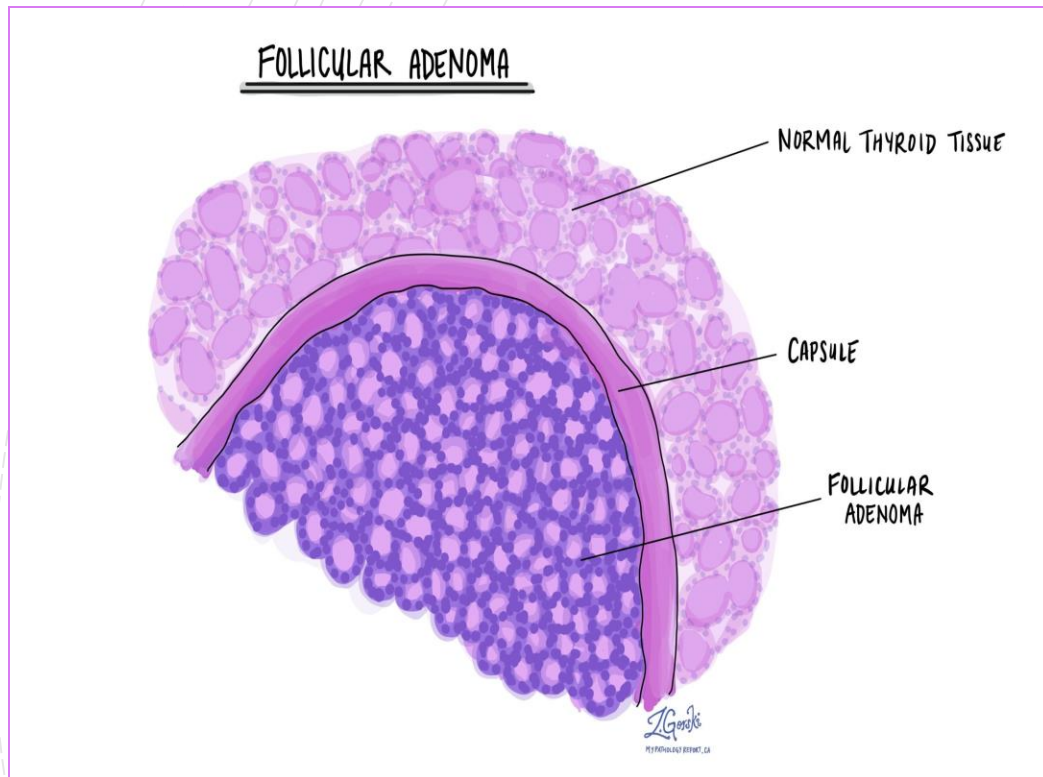
Follicular carcinoma (5% to 15% of cases)

Anaplastic (undifferentiated) carcinoma (<5% of cases)

Medullary carcinoma (5% of cases)



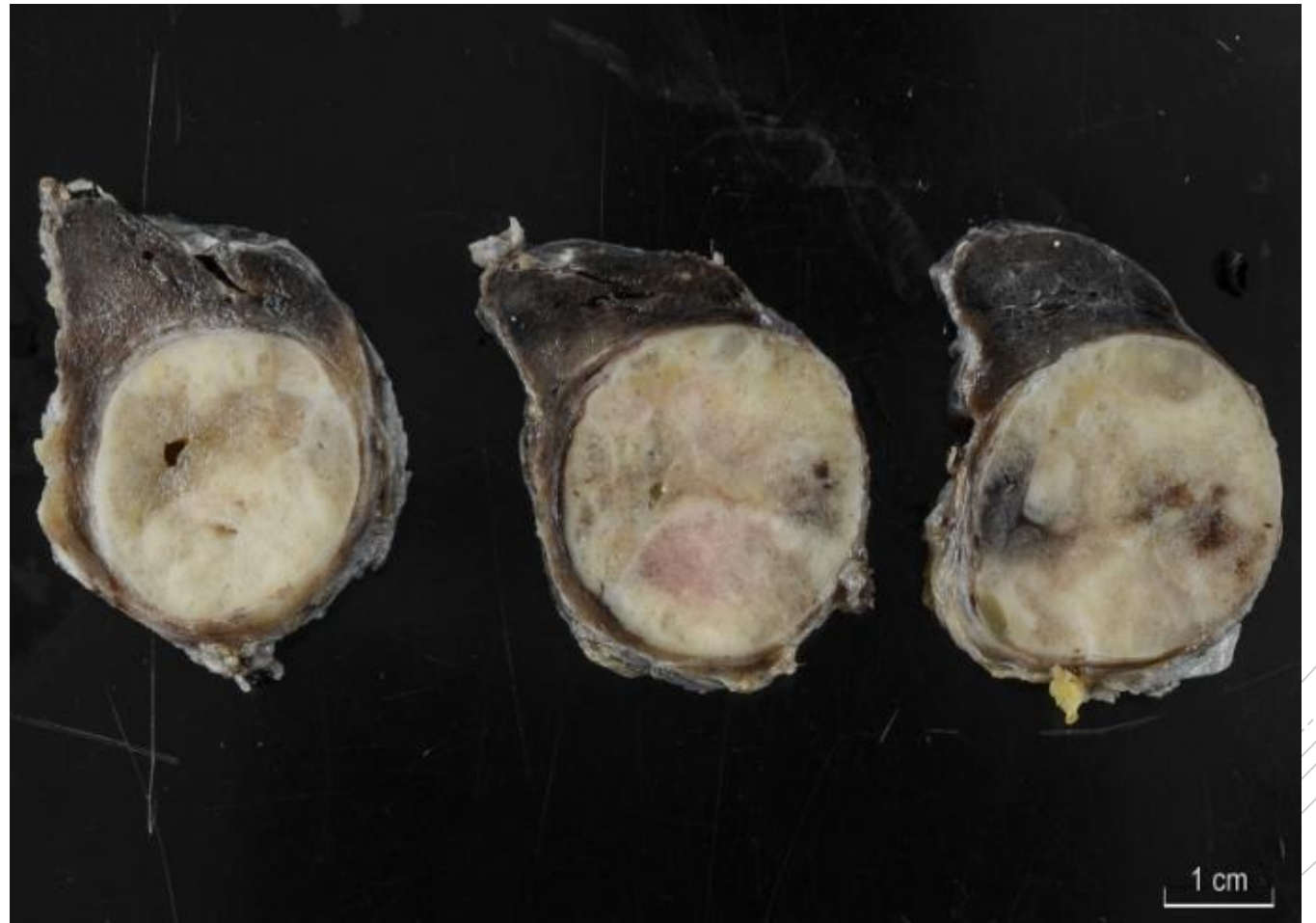
# Follicular adenoma



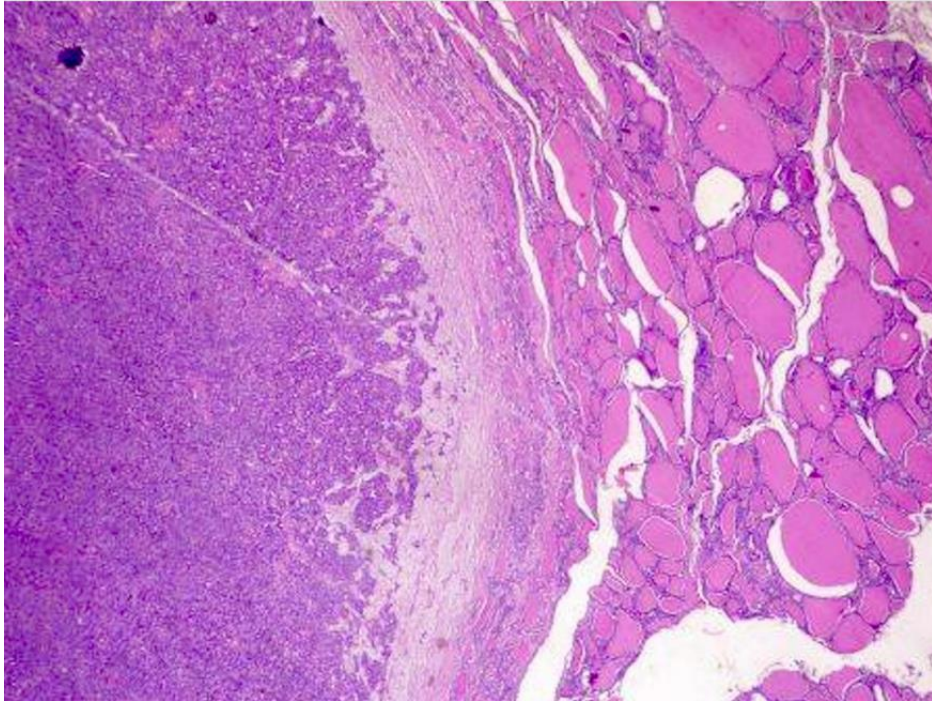
- Adenomas of the thyroid are benign neoplasms derived from follicular epithelium.
- Follicular adenomas usually are solitary, DDX??
- the vast majority of adenomas are nonfunctional, a small proportion produce thyroid hormones (toxic adenomas), causing clinically apparent hyperthyroidism.

## Morphology

- Solitary, encapsulated, variable size (1 - 10 cm).



# Histology



- **Closely packed follicles.**
- **Completely enveloped by a thin fibrous capsule**
- **surrounding thyroid tissue shows signs of compression.**

## Treatment

- Lobectomy (not enucleation).
- Carry an excellent prognosis
- do not recur or metastasize.

# Thyroid carcinoma

- 1% of all cancers in U.S., 0.2% of all cancer deaths.
- Increasing incidence due to new diagnostic practices that detect smaller tumors.
- 20-year survival is 90%, because most are indolent papillary carcinomas
- A female predominance has been noted among patients who develop thyroid carcinoma in the early and middle adult years (Often estrogen receptor positive).

# 1. Papillary Carcinoma.

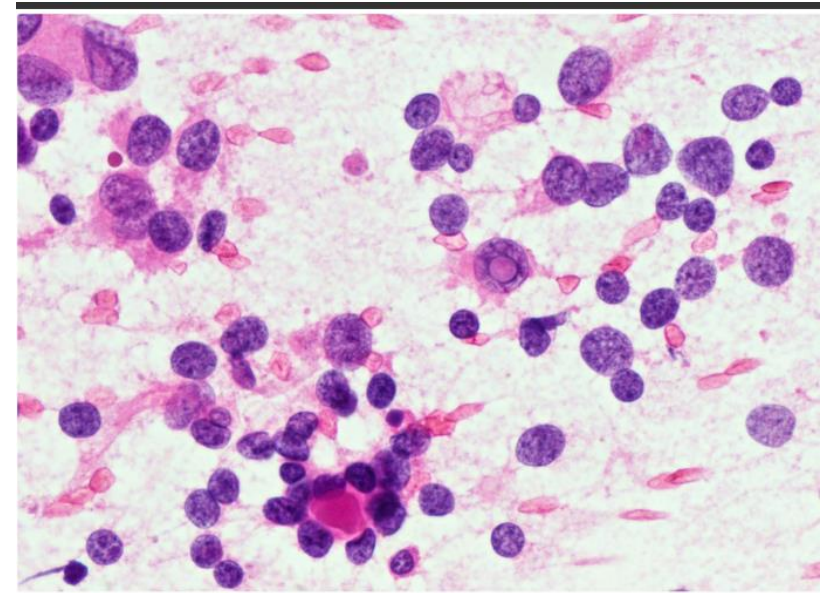
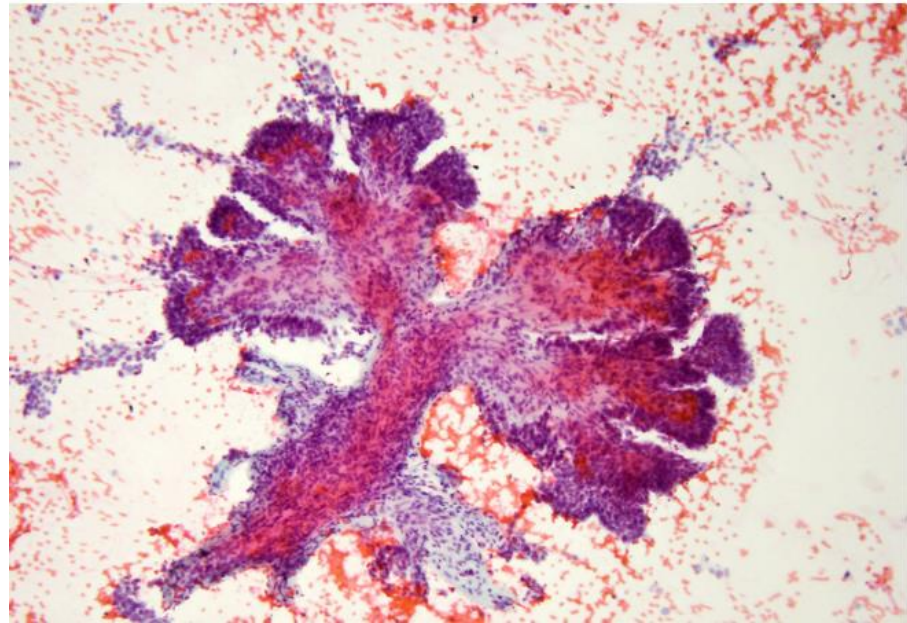
- The most common types of thyroid carcinoma.
- Female predominance; F:M ratio = ~3:1
- Median age of diagnosis in the 50s
- Ionizing radiation is the best-established risk factor.
- Mainly 2 genes are involved:
  1. BRAF amplification.
  2. RET gene rearrangement.

# Clinical features.



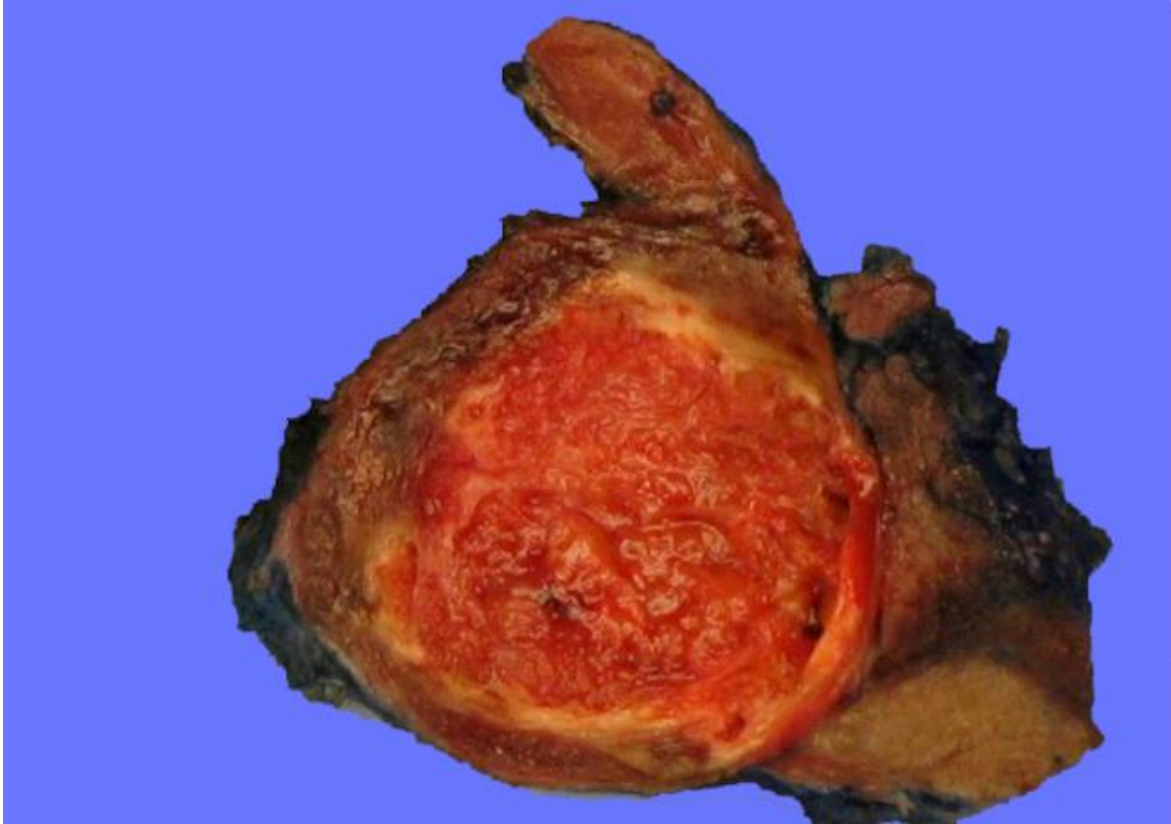
- Presented as a painless palpable thyroid mass.
- The diagnosis is first rendered on ultrasound-guided pre-operative fine needle aspiration cytology
- Surgical pathology report of a resected specimen provides further information about the subtyping (i.e., variant) and microstaging
- Commonly treated with surgical resection.

# Ultrasound-guided pre-operative fine needle aspiration cytology.



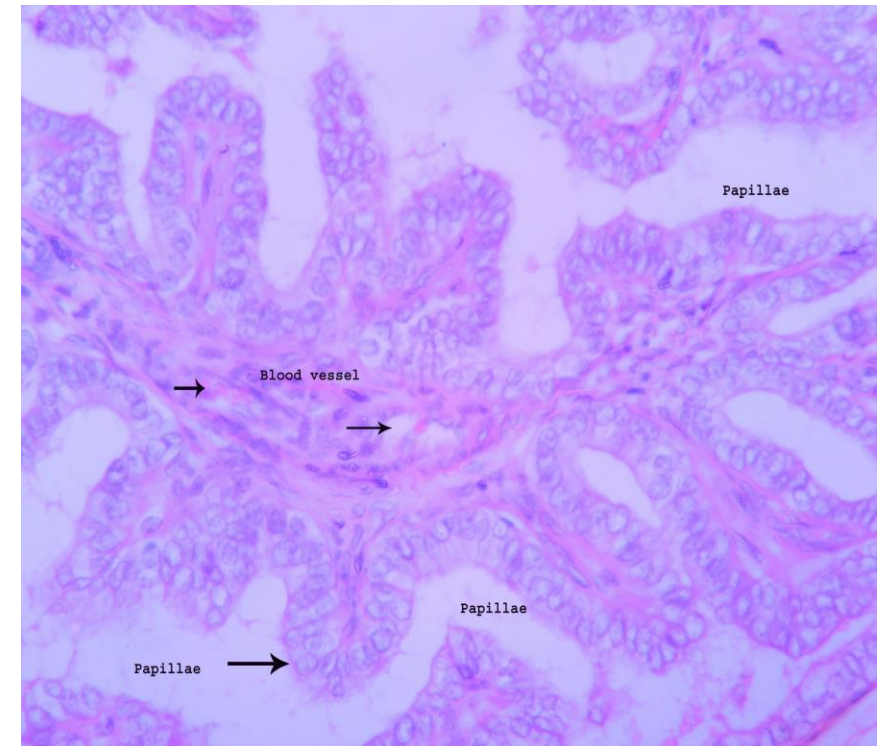
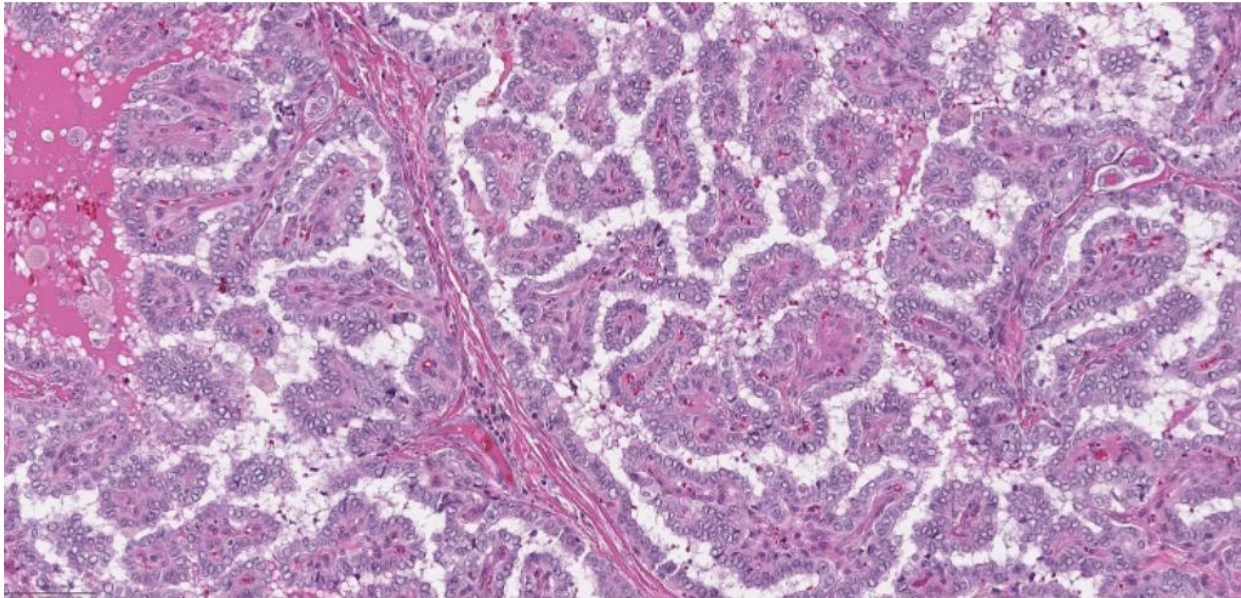
## Morphology

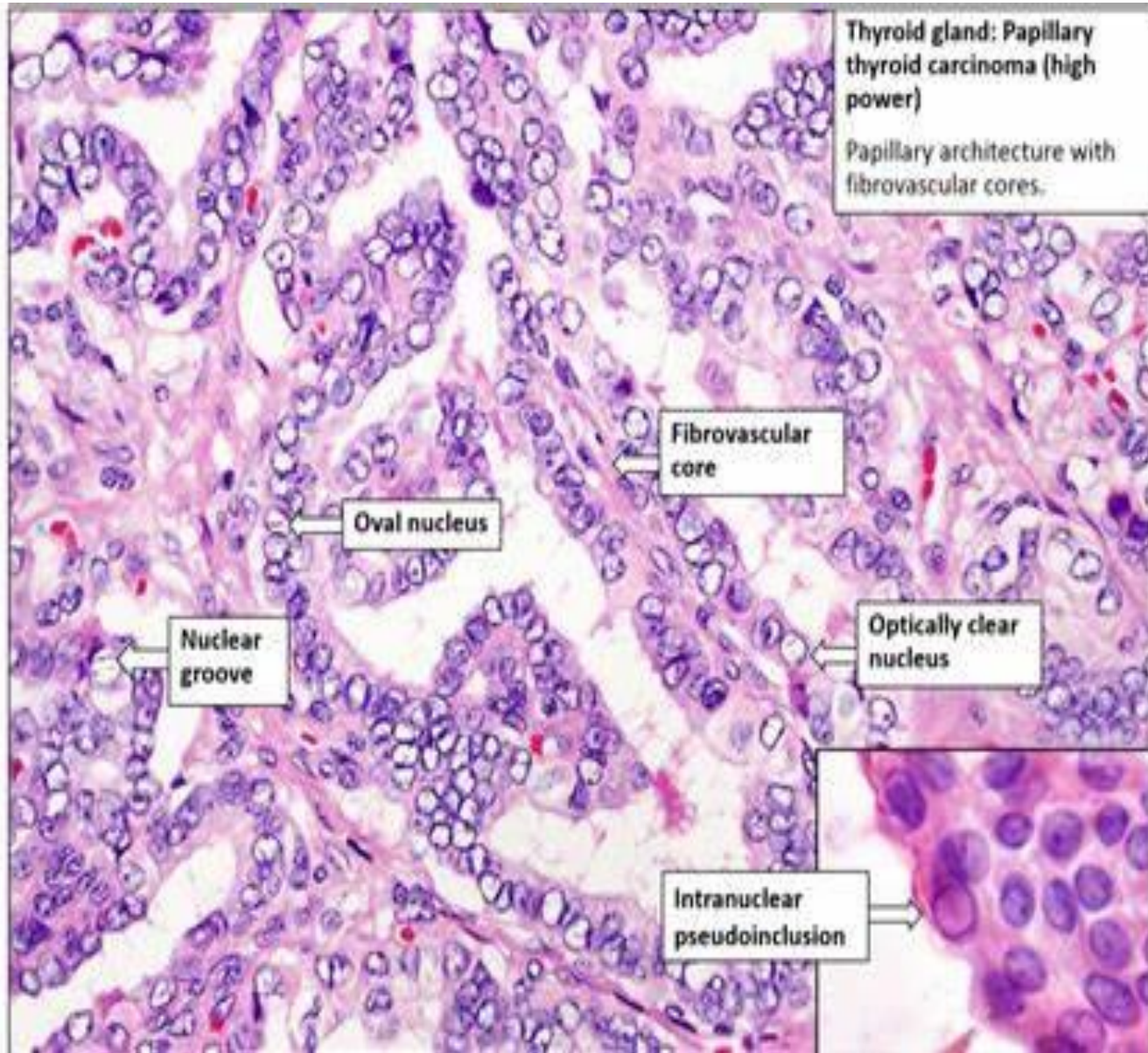
- Solid or cystic mass with papillary projections



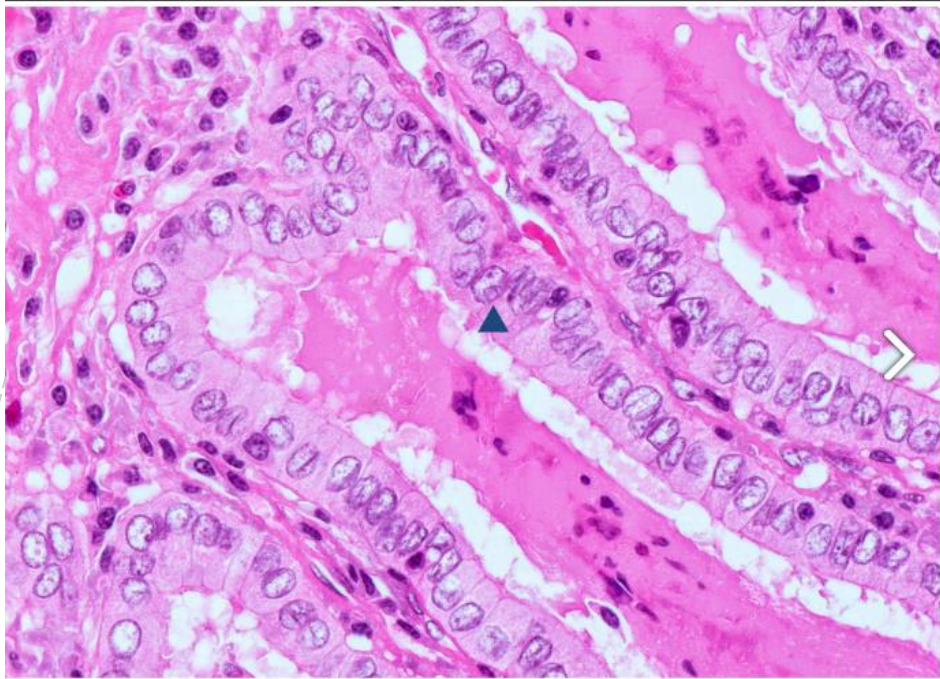
# Histology.

- Defined by two cardinal features:
  - ✓ true papillae with a fibrovascular core.
  - ✓ nuclear features of papillary carcinoma.

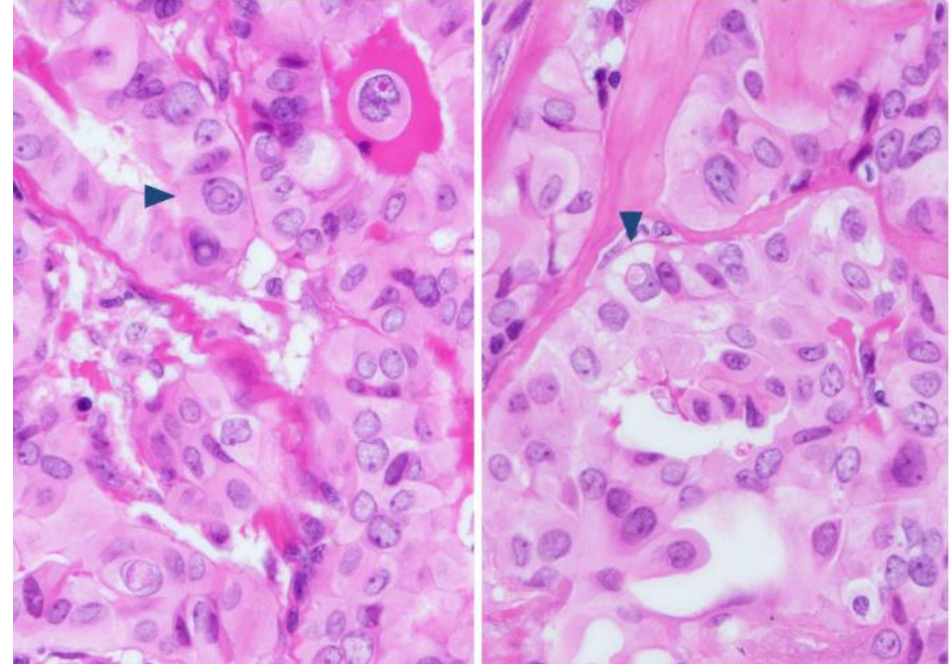




- irregular nuclear contour.
- nuclear groove.
- nuclear pseudoinclusion



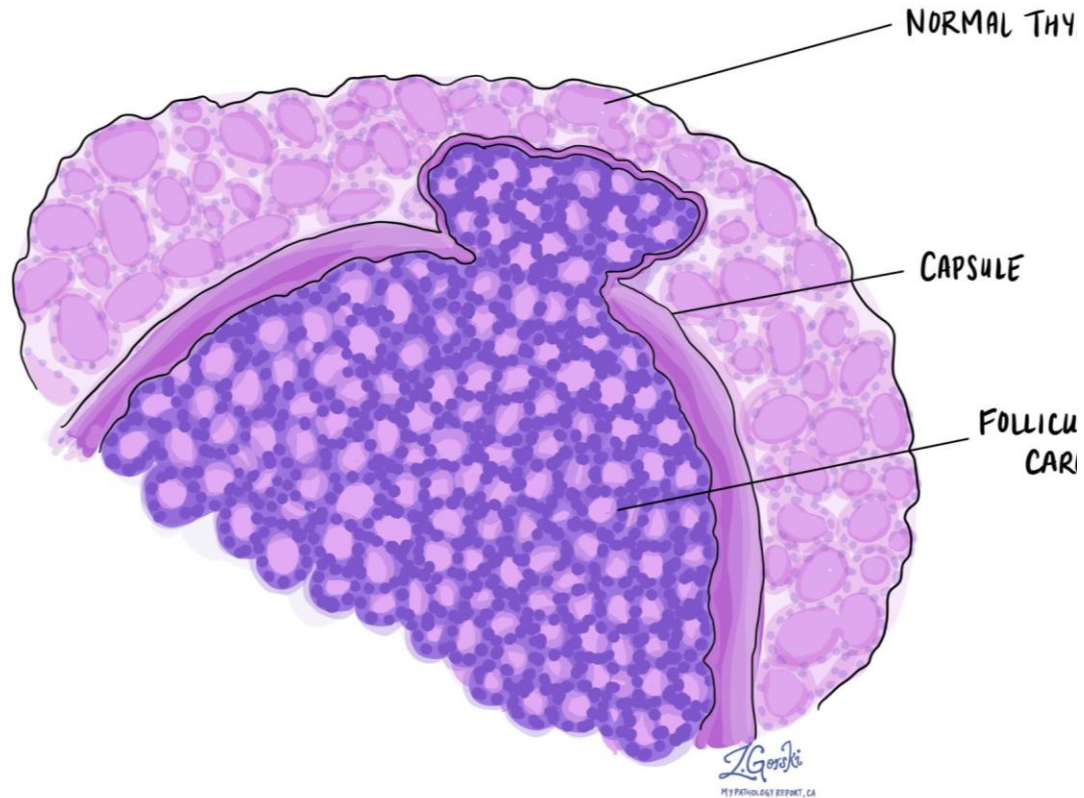
Papillary thyroid carcinoma nuclei:



## 2. Follicular Carcinoma.

- Thyroid carcinoma with follicular differentiation but no papillary nuclear feature.
- Follicular lesion with capsular or vascular invasion but without papillary nuclear features.
- More common in women and in areas with dietary iodine deficiency.
- The peak incidence between the ages of 40 and 60 years.
- GENETIC FACTORS:
  - ✓ Gain-of-function point mutations of RAS and PIK3CA.
  - ✓ Loss-of-function mutations of PTEN.

## CAPSULAR INVASION



## Two types

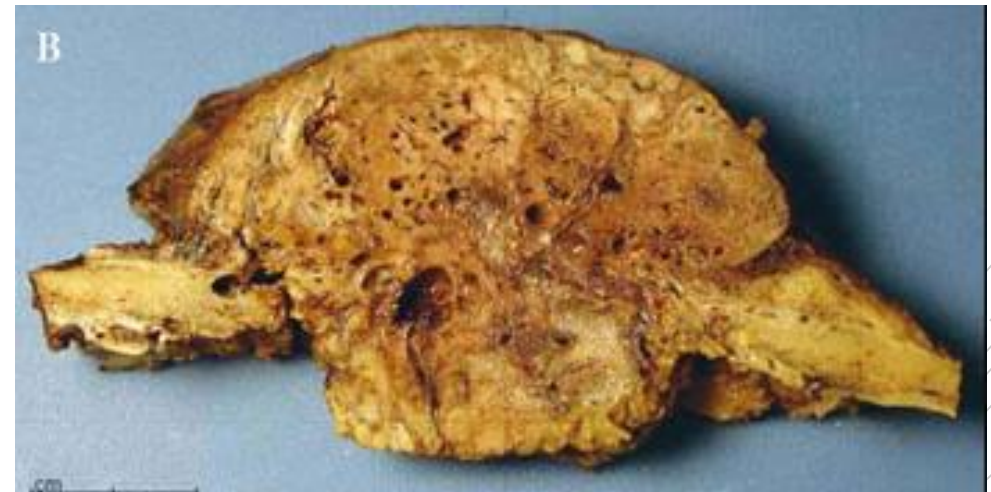
- 1. Minimally invasive follicular carcinoma
  - With capsular invasion.
  - With vascular invasion
- 2. Widely invasive.

## Clinical features

- Usually "cold" on radionuclide scan
- Does not metastasize through lymphatics but does spread to lungs, liver, bone, and brain via blood vessels
- Less than 5% with ipsilateral lymphadenopathy.
- **Treatment:**
  - ✓ thyroidectomy and radioactive iodine
  - ✓ No nodal dissection is needed

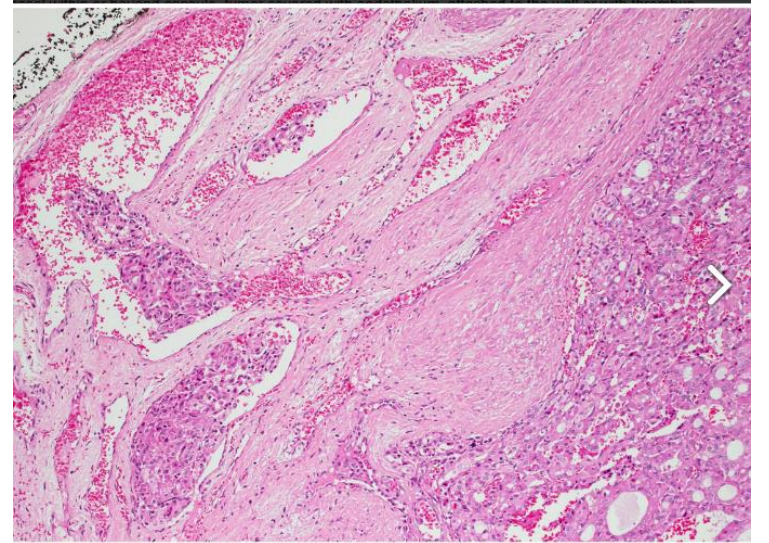
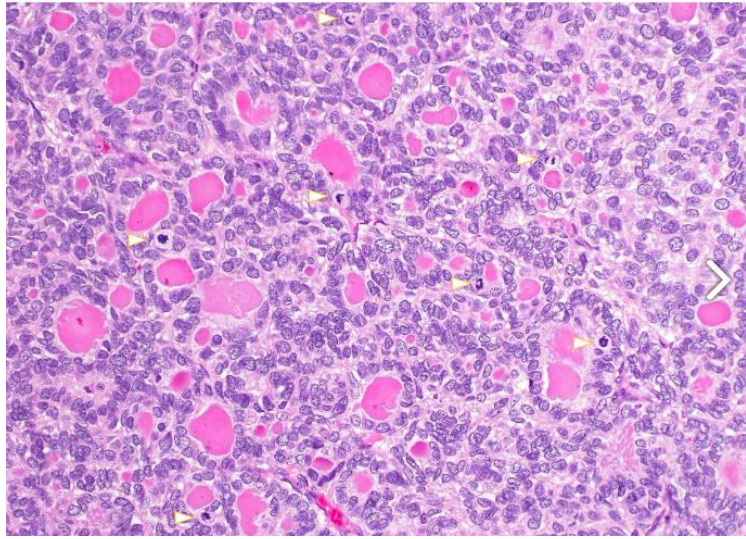
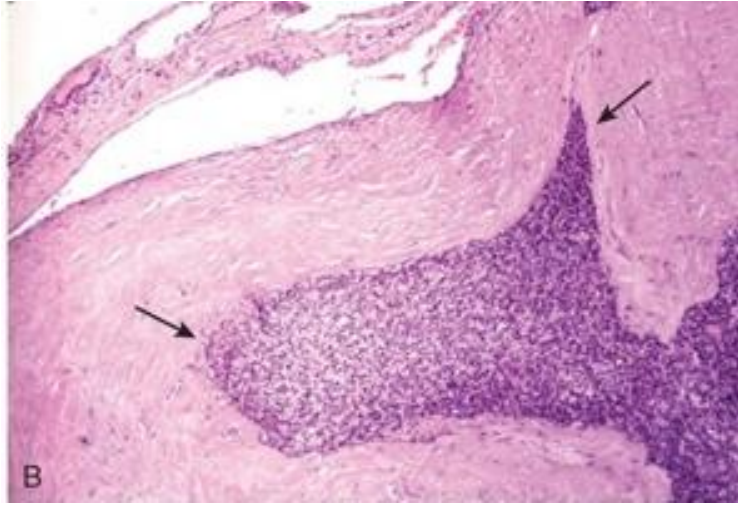
## Morphology

- Tan to brown solid cut surface, can have cystic changes and hemorrhage
- Minimally invasive: usually single encapsulated nodule, with thickened and irregular capsule
- Widely invasive: extensive permeation of capsule or no capsule.



# Histology

- solid pattern of follicles (small, normal sized or large).
- No nuclear features of papillary thyroid carcinoma
- Invasion of adjacent thyroid parenchyma, capsule (complete penetration) or blood vessels (in or beyond the capsule)



### 3. Anaplastic Carcinoma.

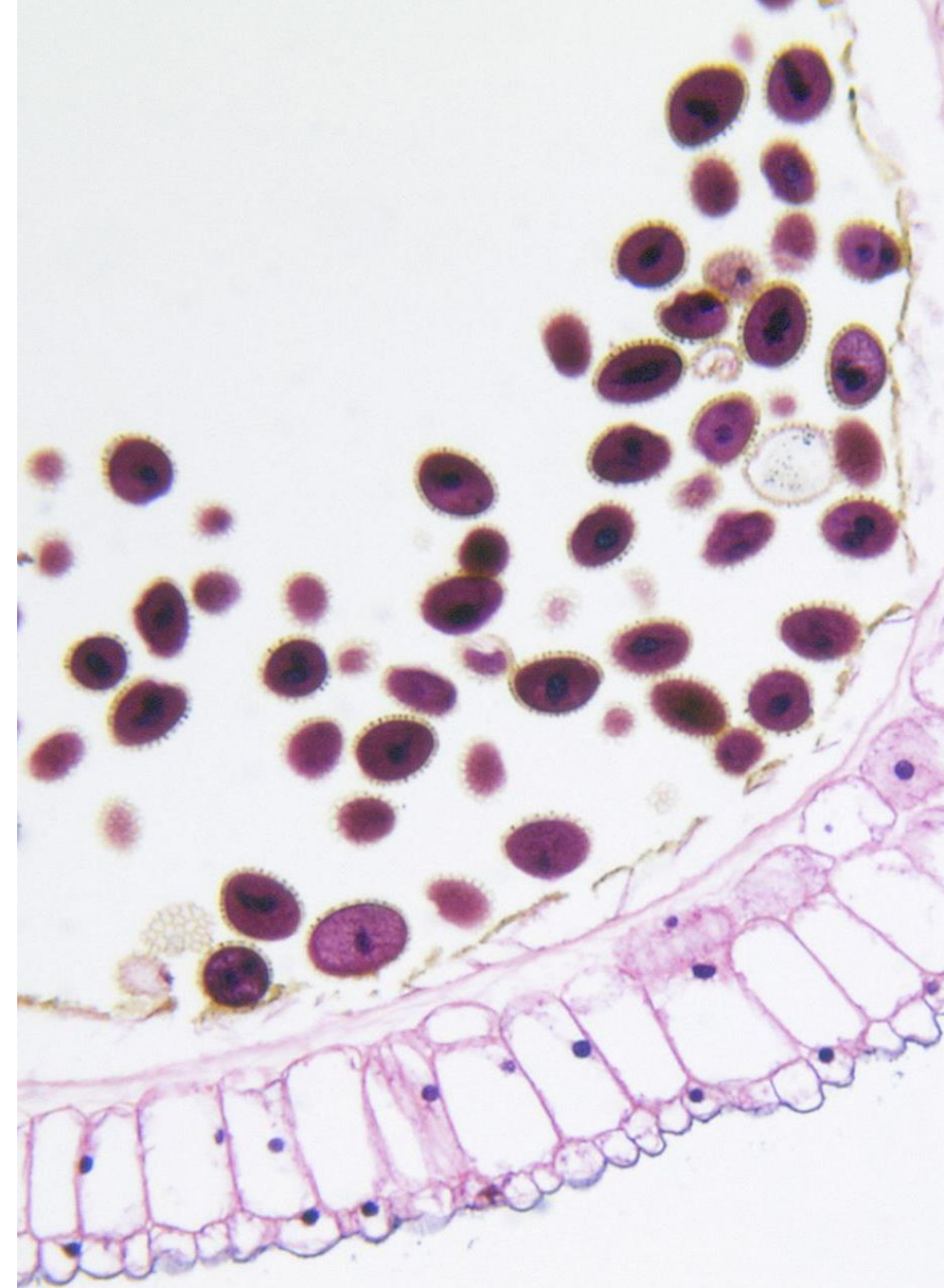
A highly aggressive thyroid malignancy composed of undifferentiated follicular thyroid cells, devoid of morphologic features of thyroid origin.

Medium age 60 - 70 years with incidence to rise with age, F:M = 2:1.

Higher incidence in areas of dietary iodine deficiency.

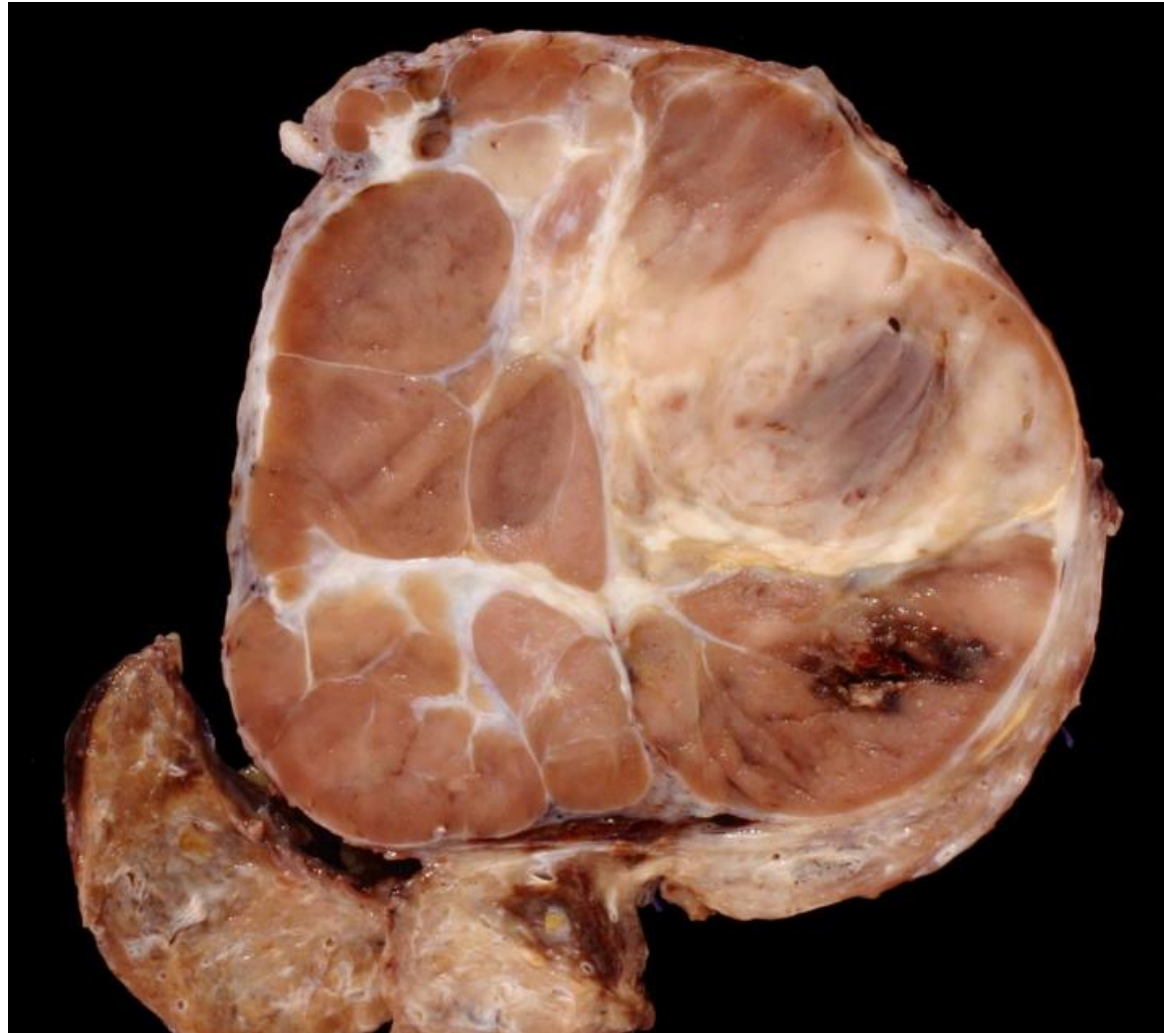
#### GENETIC FACTORS:

Inactivation of TP53.



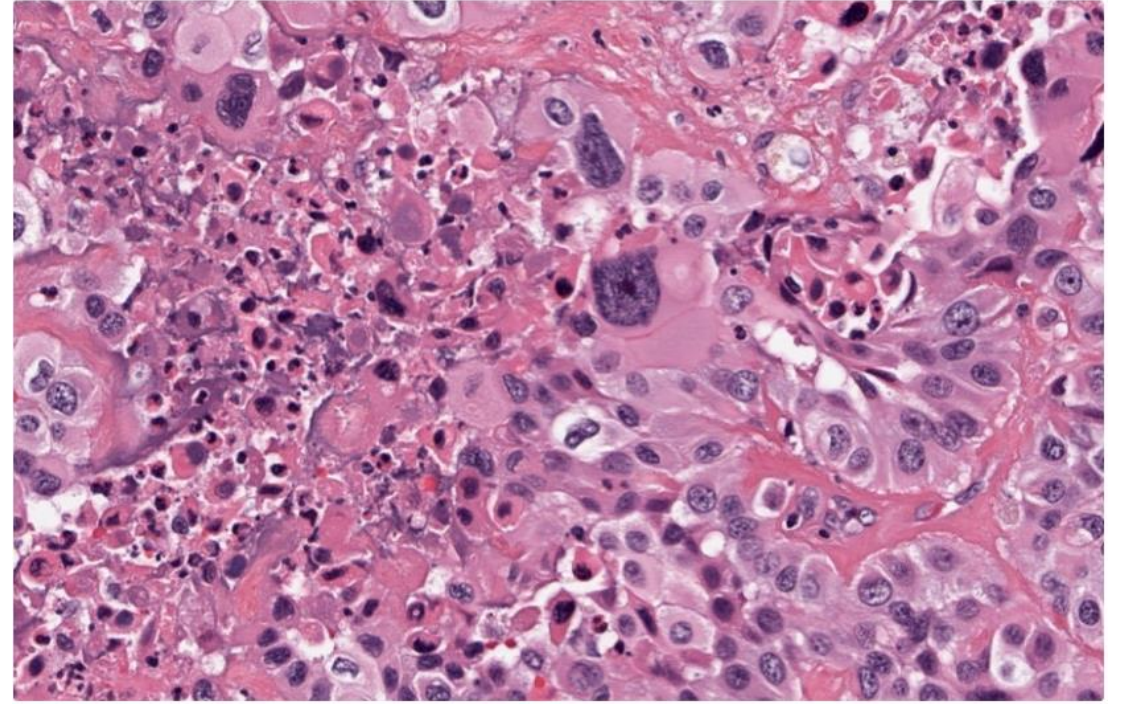
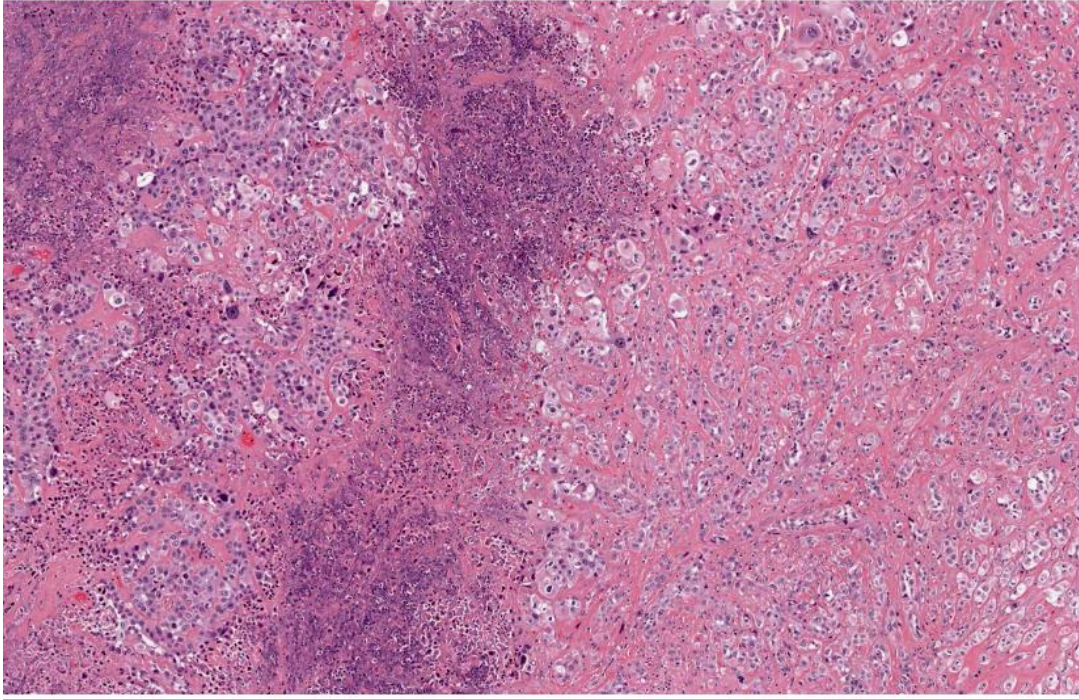
# Clinical features

- Rapidly enlarging, bulky neck mass invades adjacent structures, causing hoarseness, dysphagia, and dyspnea.
- Fixed to the underlying structures.
- Extrathyroidal extension in the majority of cases
- Regional nodal metastases and vocal cord paralysis present in up to 40% and 30%, respectively
- **Treatment**
- Radiation therapy, surgery when feasible, or chemoradiation, either concurrently or sequentially



## Morphology

- **Bulky solid mass (mean: 6 cm) with zones of necrosis or variegated appearance.**



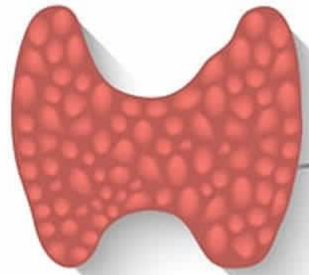
## Histology

- Common features include :
  - ✓ widely invasive growth.
  - ✓ extensive tumor necrosis.
  - ✓ marked nuclear pleomorphism.
  - ✓ high mitotic activity

## 4. Medullary Carcinoma.

- Neuroendocrine tumor derived from C cells (formerly called parafollicular cells), which secrete calcitonin
- 1 - 2% of thyroid carcinomas
- Either sporadic (nonhereditary) or familial (hereditary)
  - **Sporadic:** 70%, age 40 - 60, solitary
  - **Familial:** 30%, younger patients (mean age 35).
  - ✓ Occurring in the setting of MEN syndrome 2A or 2B,
  - ✓ familial medullary thyroid carcinoma without an associated MEN syndrome

## Thyroid gland

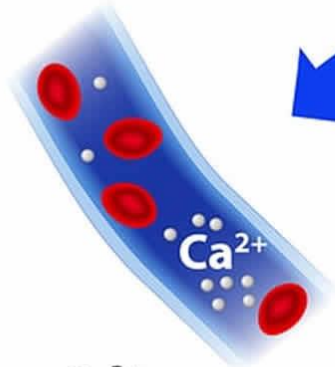


**Calcitonin**

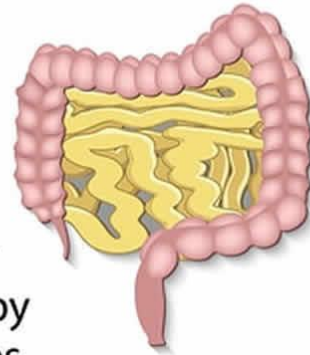
Inhibits  $\text{Ca}^{2+}$  reabsorption  
in the kidney (excreted  
in the urine)



Lowers  $\text{Ca}^{2+}$   
levels in blood

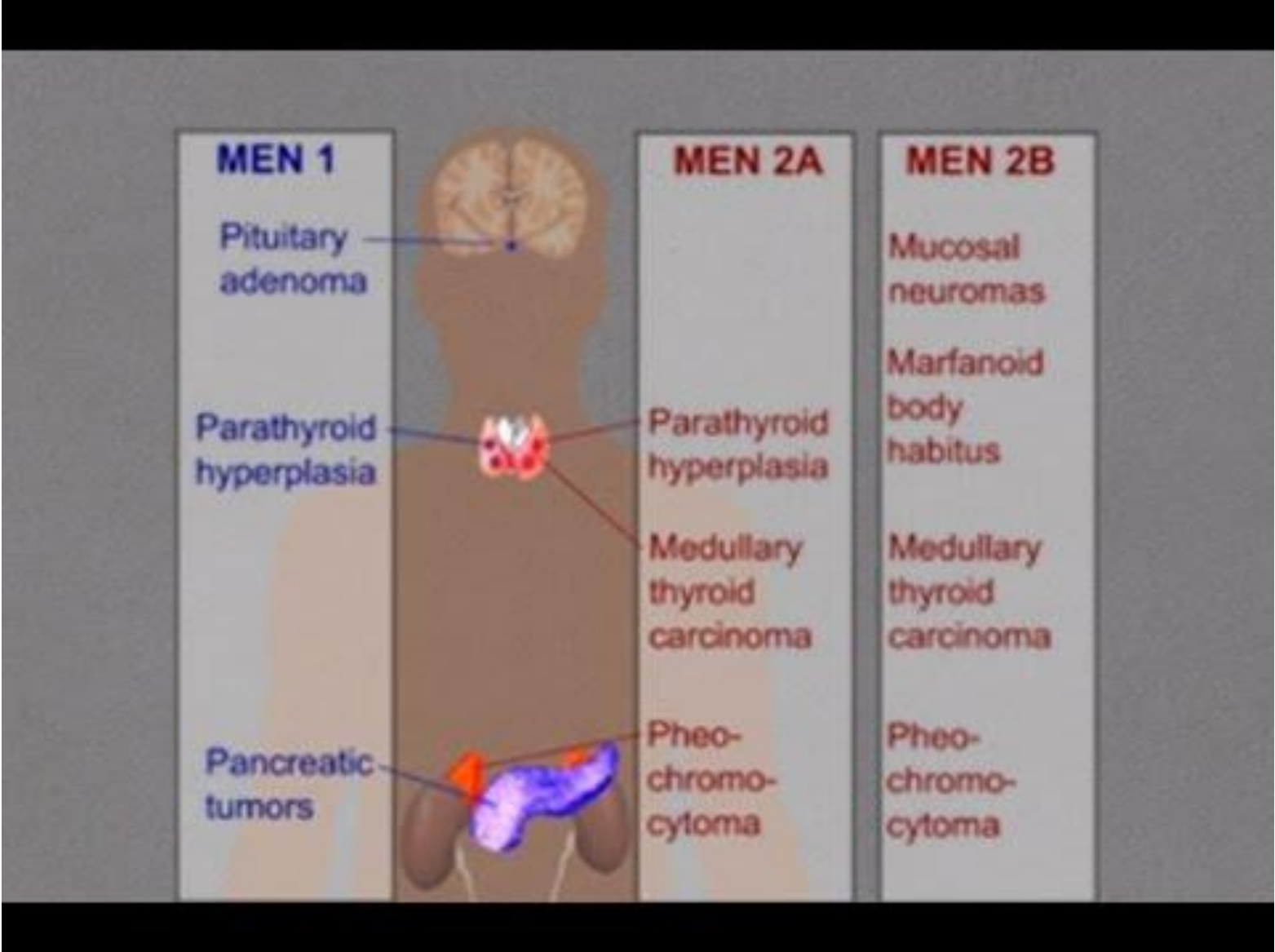


Inhibits  $\text{Ca}^{2+}$   
absorption by  
the intestines



Promotes  
deposition  
of  $\text{Ca}^{2+}$  into  
bones (inhibits  
osteoclasts and  
stimulates osteoblasts)



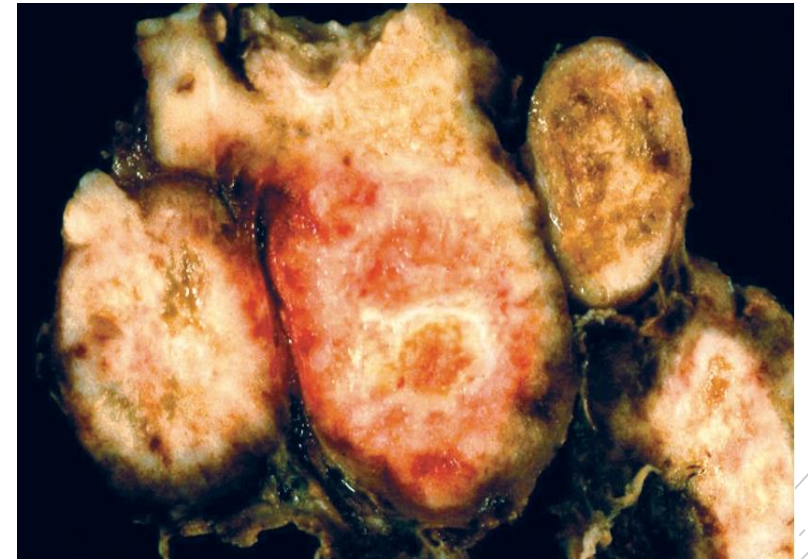
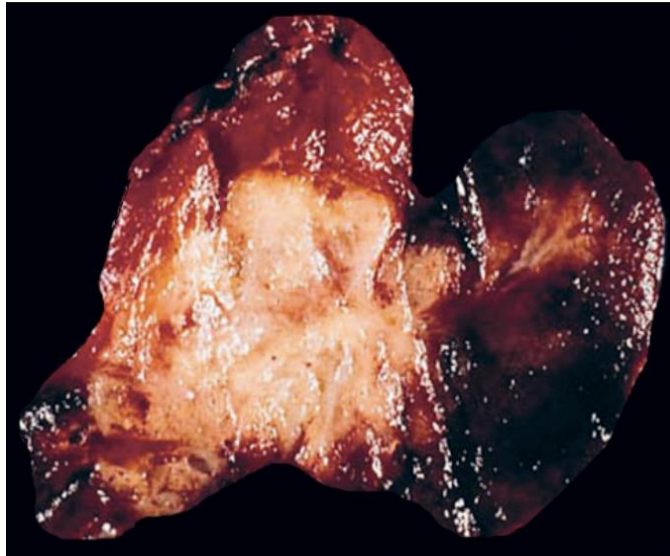


## Clinical features

- Presents with painless thyroid mass, cold on scanning
- Up to 75% of patients have nodal metastasis.
- Serum calcitonin correlates with tumor burden .
- Patients with metastasis may have severe diarrhea and flushing
- Some tumors may produce ACTH or CRH (Cushing syndrome).

## Morphology

- **Sporadic:** typically presents as a single circumscribed but nonencapsulated, gray-tan mass
- **Familial:** generally bilateral / multiple foci.



# Histology

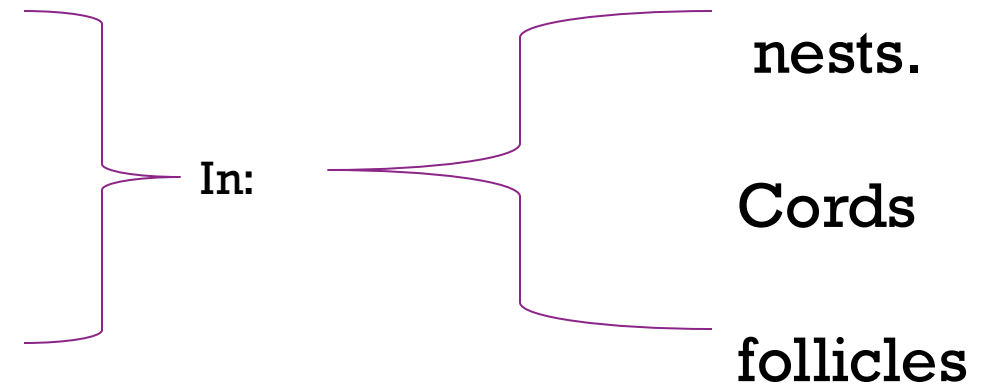
- Wide variety of morphology:

- Round.

- Plasmacytoid.

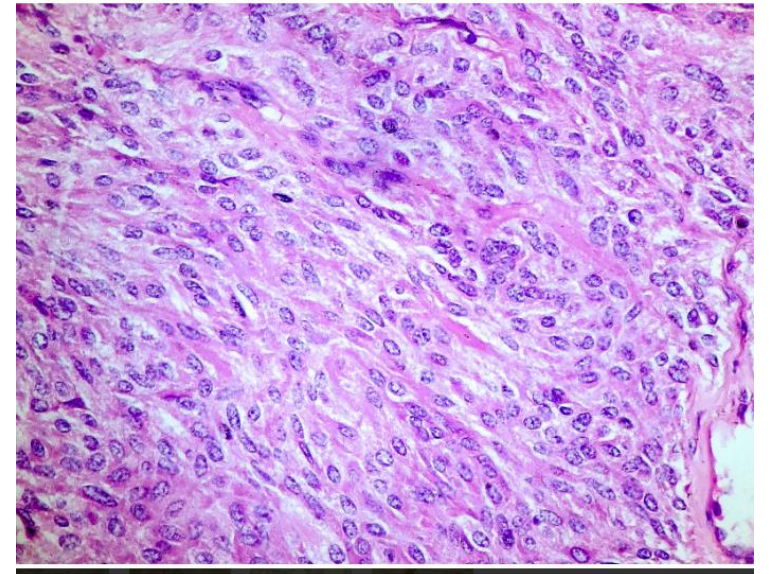
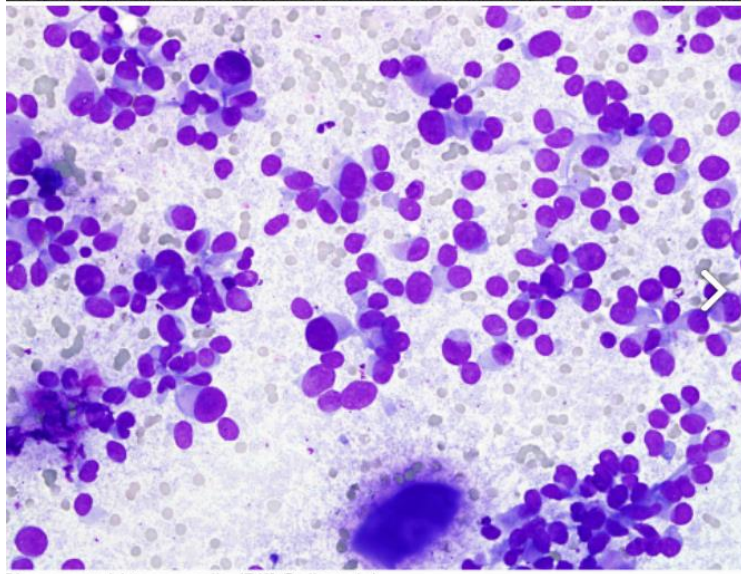
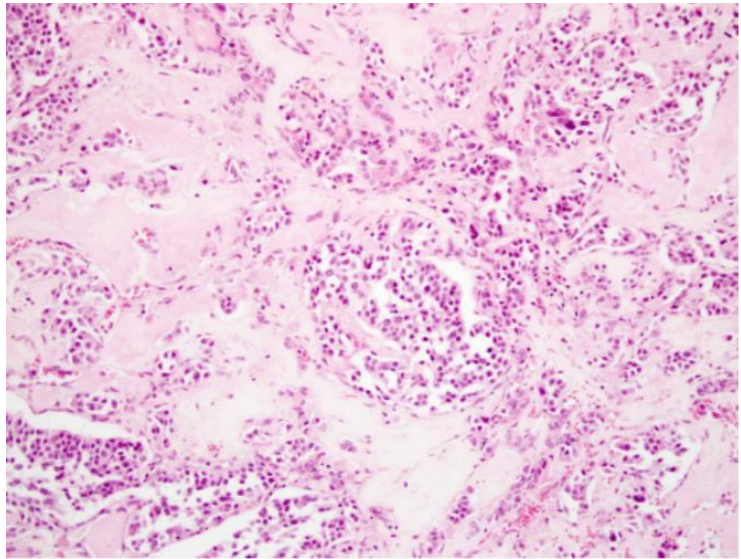
- polygonal

- spindle cells.



- Eosinophilic to amphophilic granular cytoplasm due to secretory granules

- Stroma has amyloid deposits from calcitonin





Thank you