

Endocrine system. THYROID NEOPLASMS

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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.

note: most thyroid malignancy are found in females but if a male has the nodule there is a bigger chance for it to be malignant

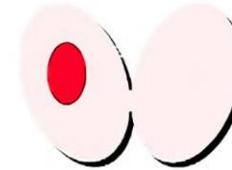
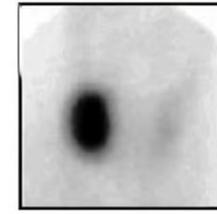
Benign vs malignant

- **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).

most of the cold nodules are malignant nodules



Cold



Hot

hot nodules are mostly benign not malignant

all of the thyroid took the uptake except the nodule

Neoplastic thyroid lesions

- **Benign:**

- follicular adenoma .

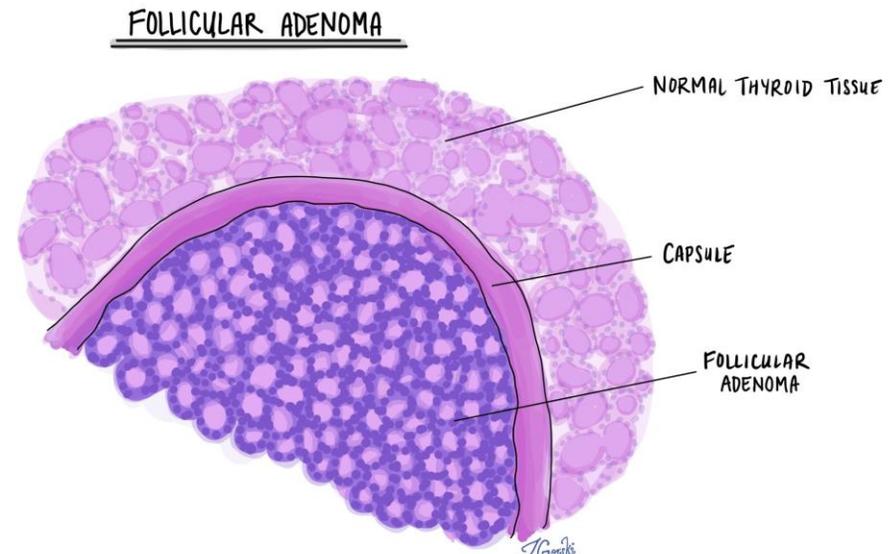
- **Malignant:**

- Papillary carcinoma (accounting for more than 85% of cases) **most common malignant cancer**
- Follicular carcinoma (5% to 15% of cases)
- Anaplastic (undifferentiated) carcinoma (<5% of cases)
- Medullary carcinoma (5% of cases)

Follicular adenoma

benign epithelium cancer

- 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.



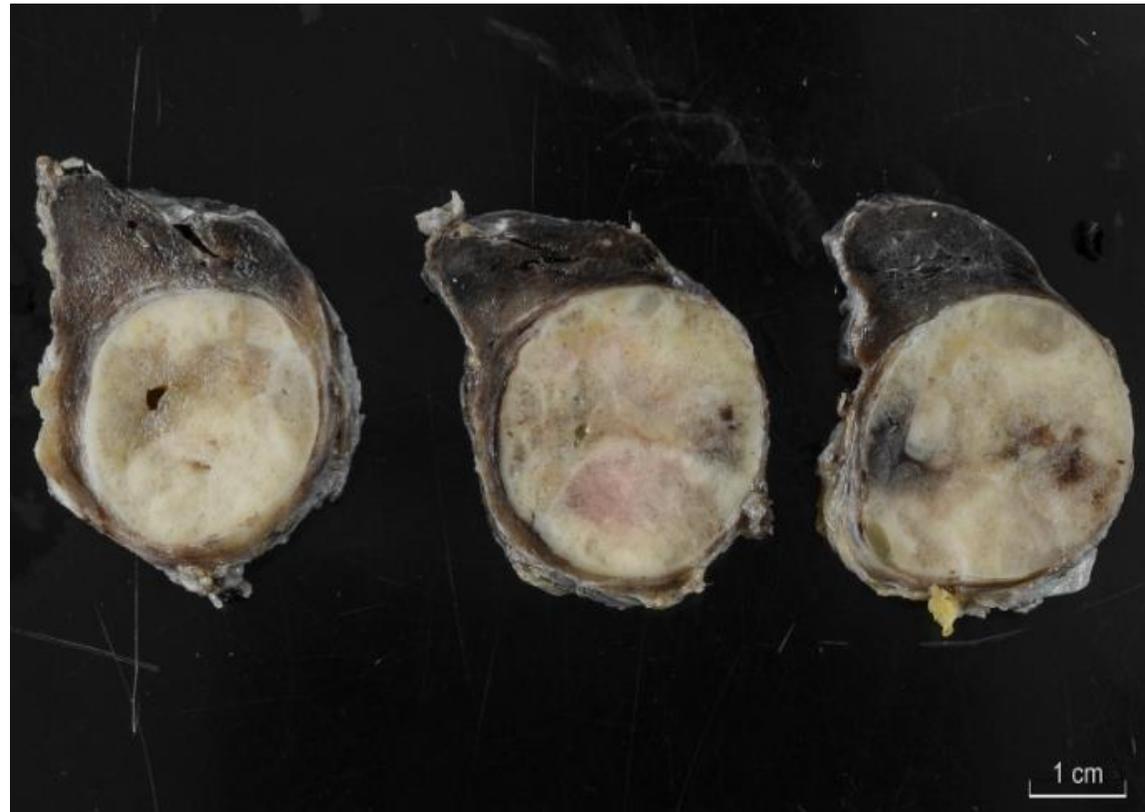
when someone has a single nodule we should put in mind that it's most likely to be adenoma, dominant nodule, thyroiditis, single cells

follicular adenoma contains 3 features: perforating cells that have no space between them, these cells are surrounded by a capsule, thin capsule (if thickening happens or abrasions are seen this is a risk or malignancy, signs of compression)

Morphology

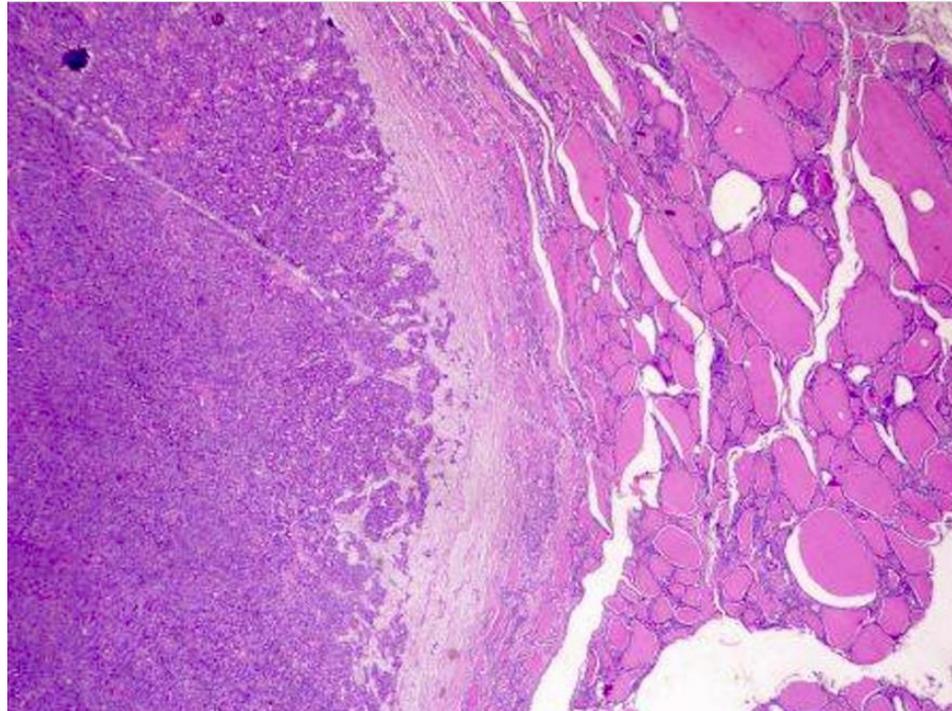
well circumscribed mass, homogenous (they all look alike)

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



Histology

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



Treatment

lobectomy is done because removing the mass alone won't confirm us what type of cancer it is, by lobectomy we can see that the capsule is thickened (an important feature to differentiate between adenoma and carcinoma) and we can see the abrasions of the cancer

- Lobectomy (not enucleation). removing the mass only
- Carry an excellent prognosis
- do not recur or metastasize.

Thyroid carcinoma

- 1% of all cancer in U.S., 0.2% of all cancer deaths.
- Increasing incidence due to new diagnostic practices which 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 50s
mostly after taking chemo or radiography in cases of breast cancer
- Ionizing radiation is the best established risk factor.
- Mainly 2 genes are involved: **genes of cancers are important**
- 1. BRAF amplification.
- 2. RET gene rearrangement .

Clinical features.

- Presented as 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 **size**
- Commonly treated with surgical resection.

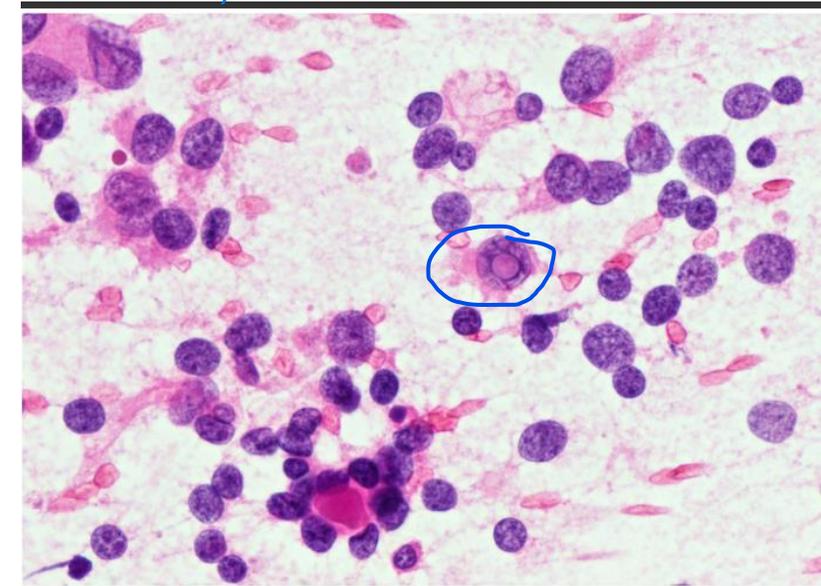
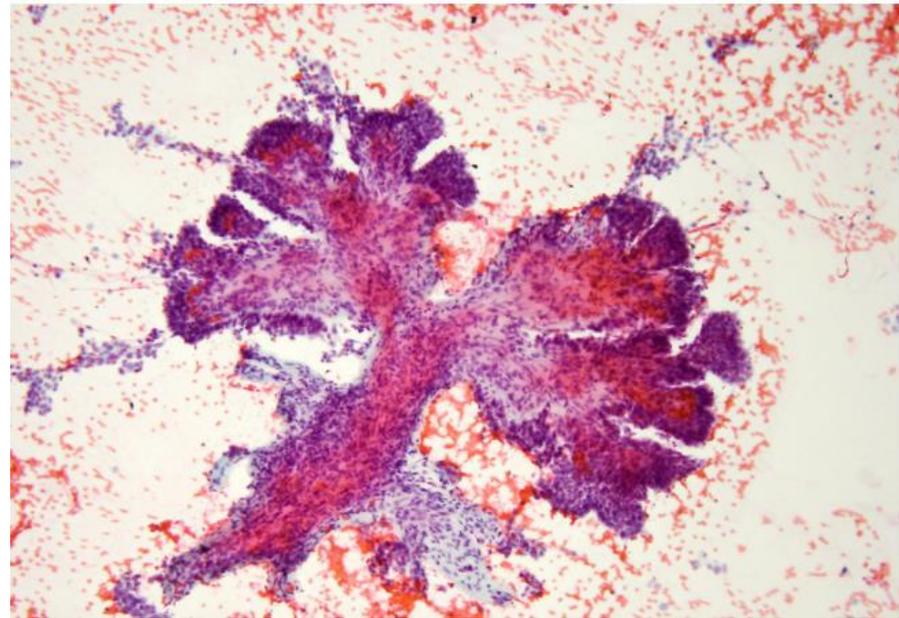
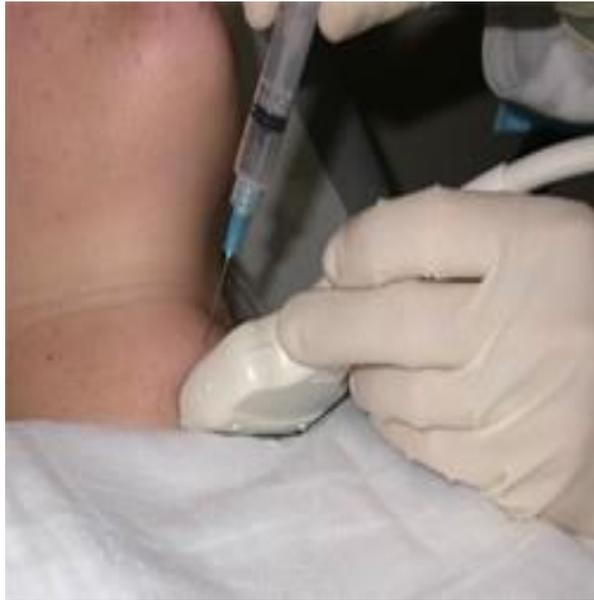


we put the needle in the center of the mass and withdraw the cells that are found in the mass

ultrasound guided pre-operative fine needle aspiration

cytology. the results in this picture are useful for cytology since no parenchyma or stroma (no tissue) will be shown

nuclear inclusions (central circular structure, pinkish color)



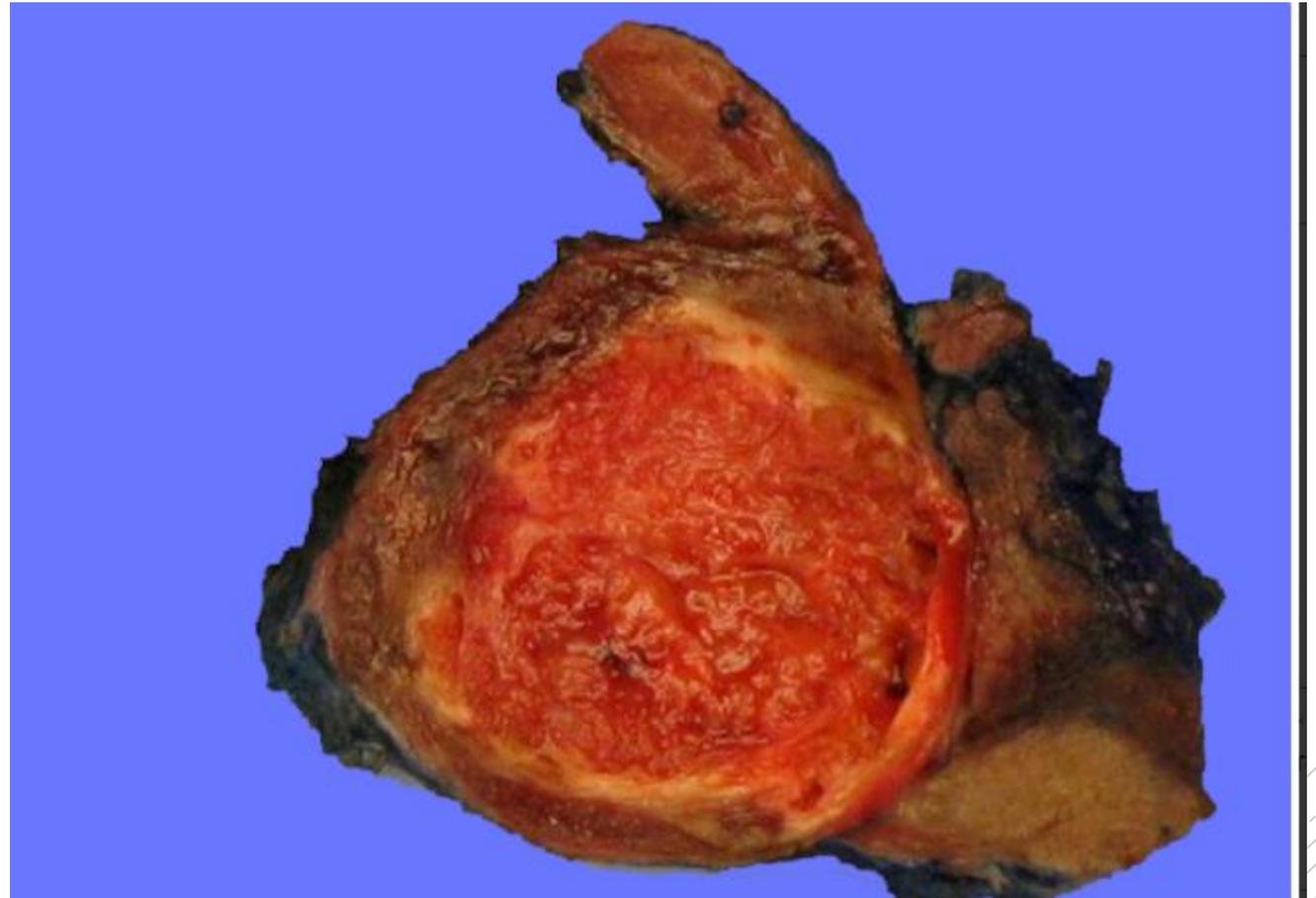
nearly no cytoplasm

this won't be useful in follicular adenoma since the distinguishing feature between adenoma and carcinoma is the capsule

papillae are central blood vessels with tumor cells surrounding them

Morphology

- Solid or cystic mass with papillary projections
not circumscribed

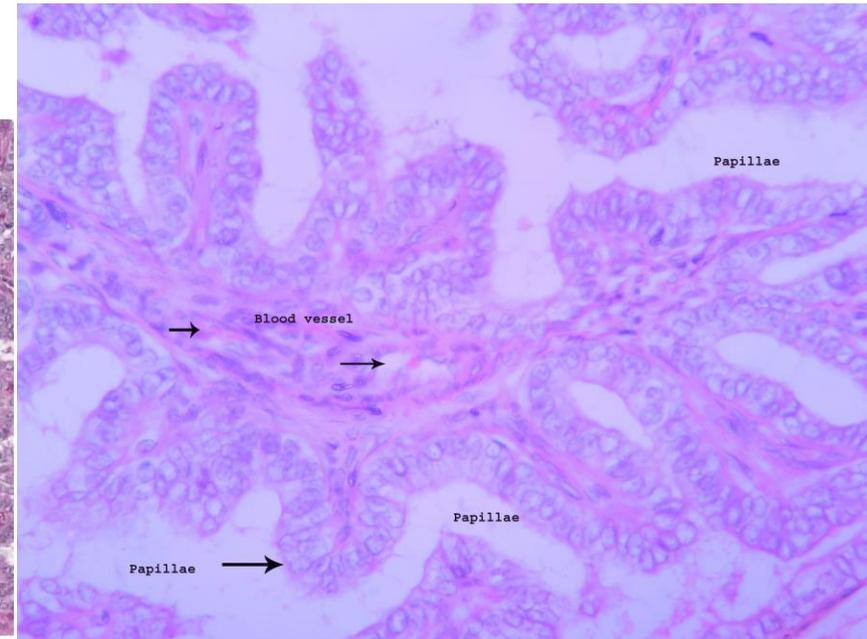
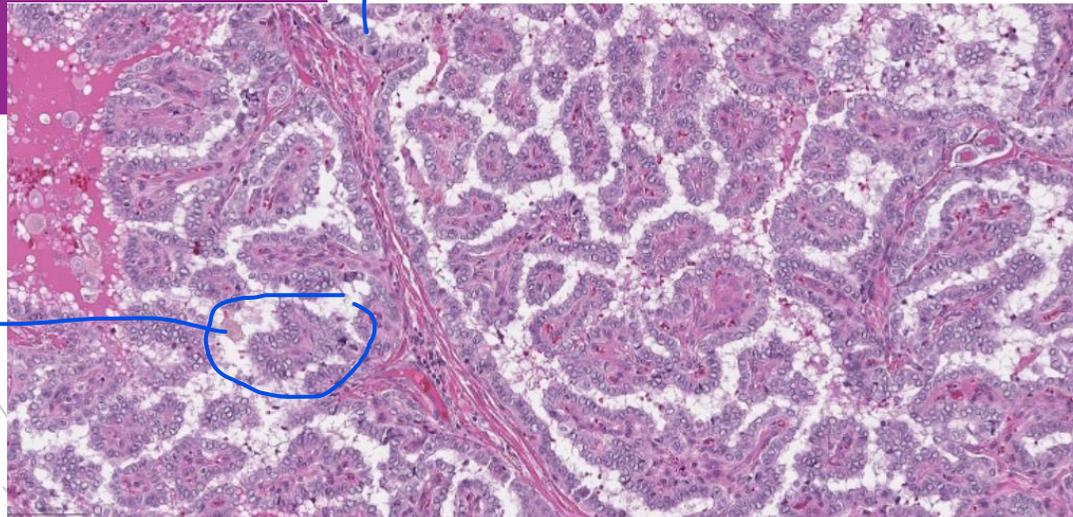


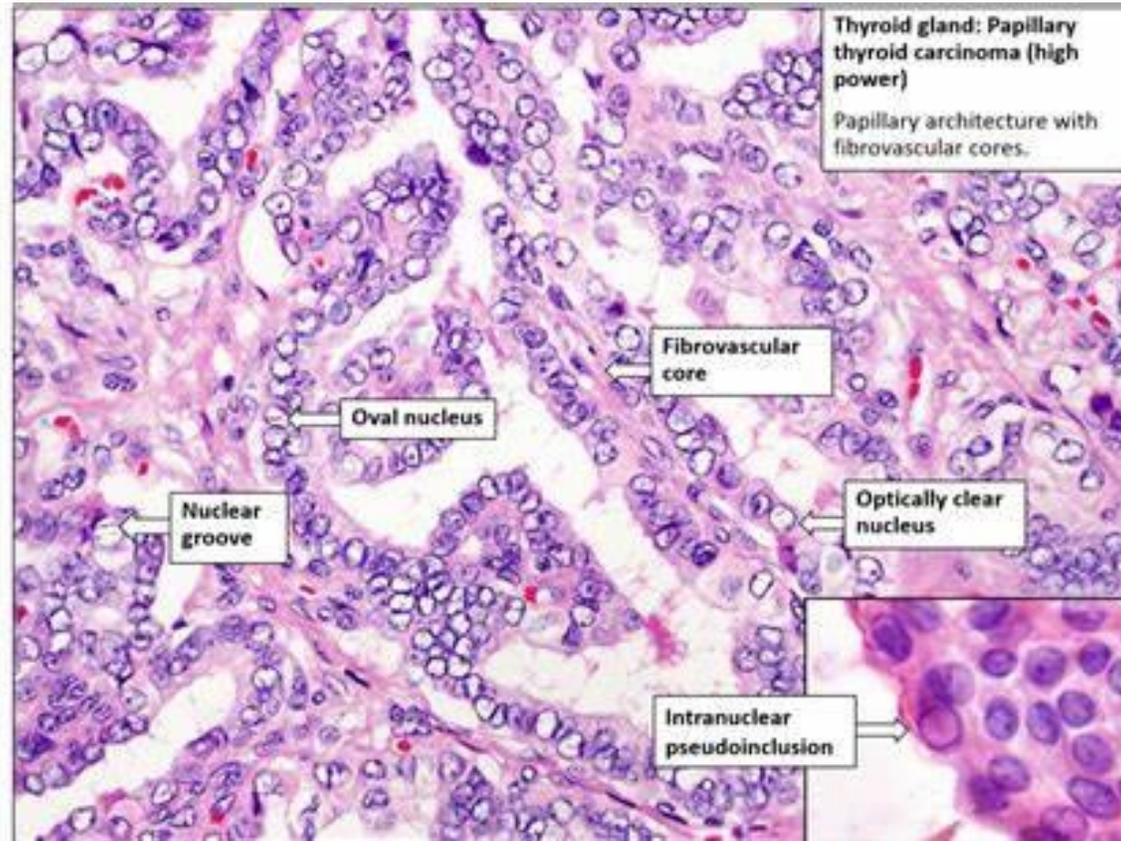
- Defined by two cardinal features:
 - ✓ true papillae with a fibrovascular core.
 - ✓ nuclear features of papillary carcinoma.

Histology.

central blood vessels

tumor cells

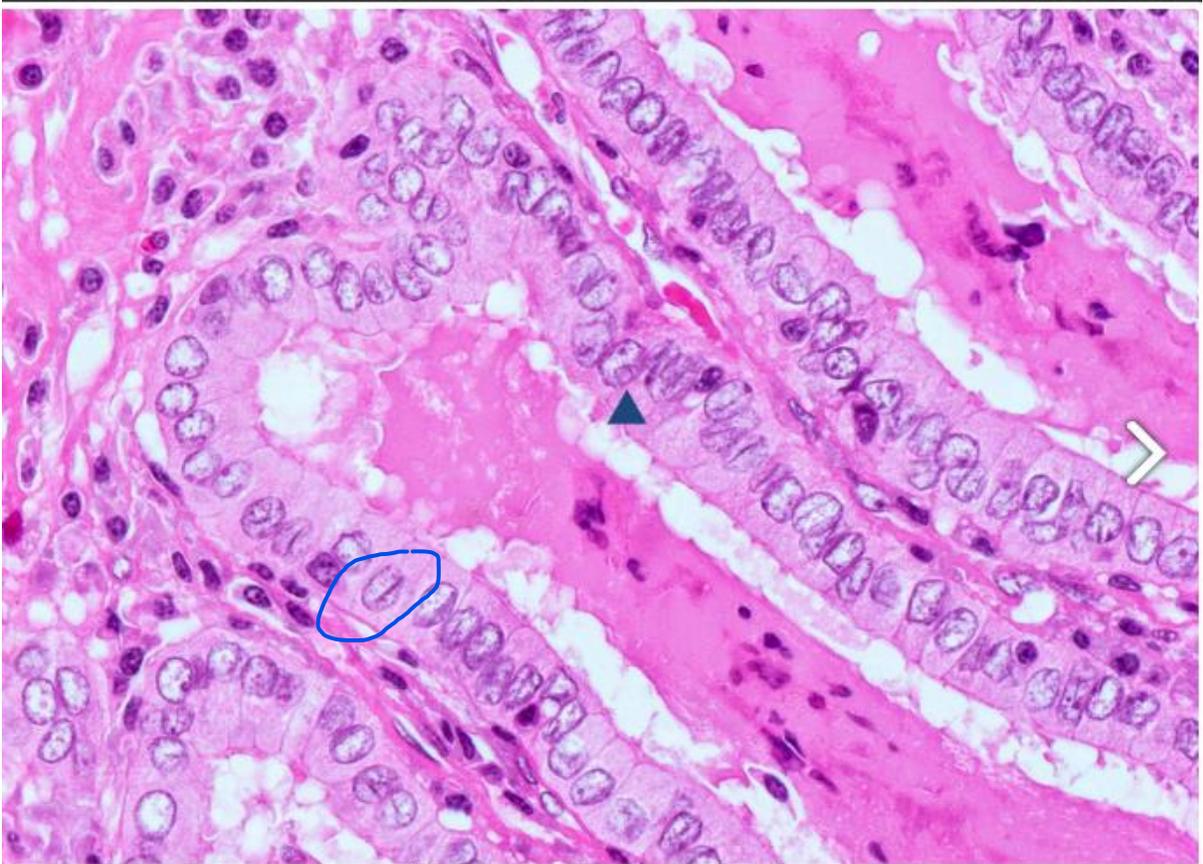
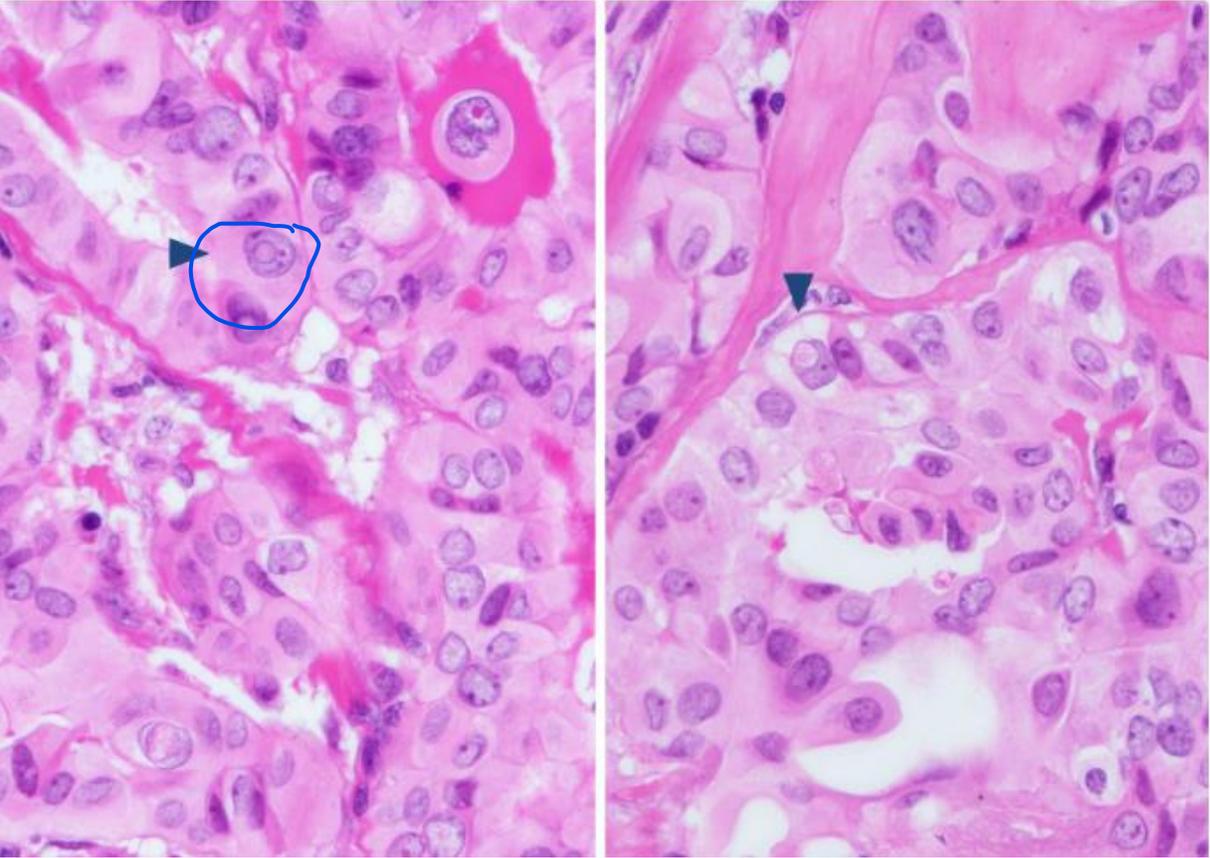




coffee bean groove

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

inclusion which contains center eosinophilic center



Papillary thyroid carcinoma nuclei:

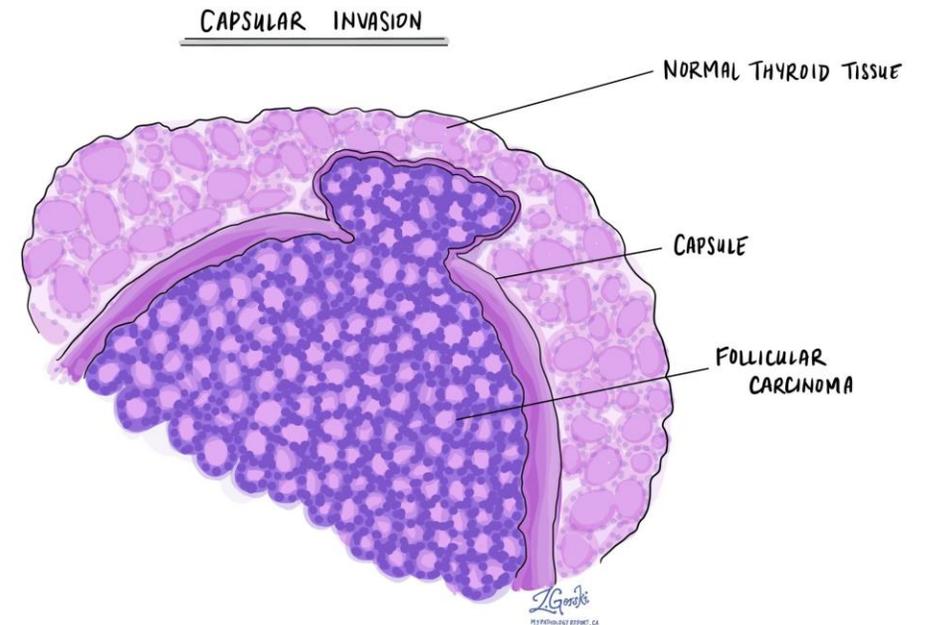
the nucleus has a groove in its center just like the coffee bean

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. **cretinism also is caused by iodine deficiency**
- The peak incidence between the ages of 40 and 60 years.
- **GENETIC FACTORS:** **important**
- ✓ Gain-of-function point mutations of RAS and PIK3CA.
- ✓ Loss-of-function mutations of PTEN.

Two types

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



Clinical features

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

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.

minimally invasive



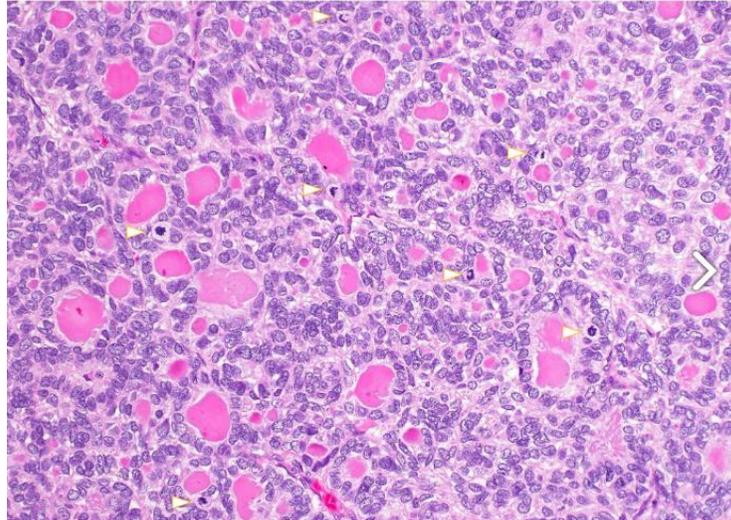
widely invasive



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)

follicular lesion

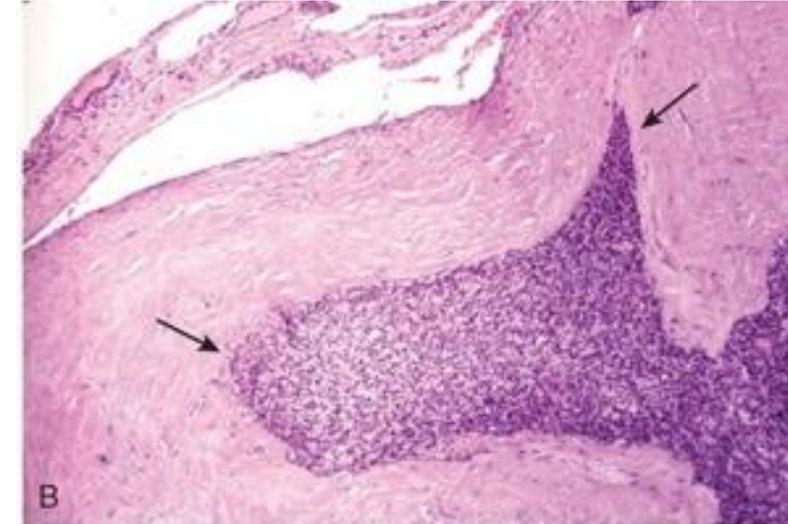


thick irregular capsule



red blood cells

follicular carcinoma with capsular invasion



3. . Anaplastic Carcinoma.

poor diagnosis, with poor differentiated histology

- 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.

hoarseness: abnormal voice change due to problems in the vocal cords

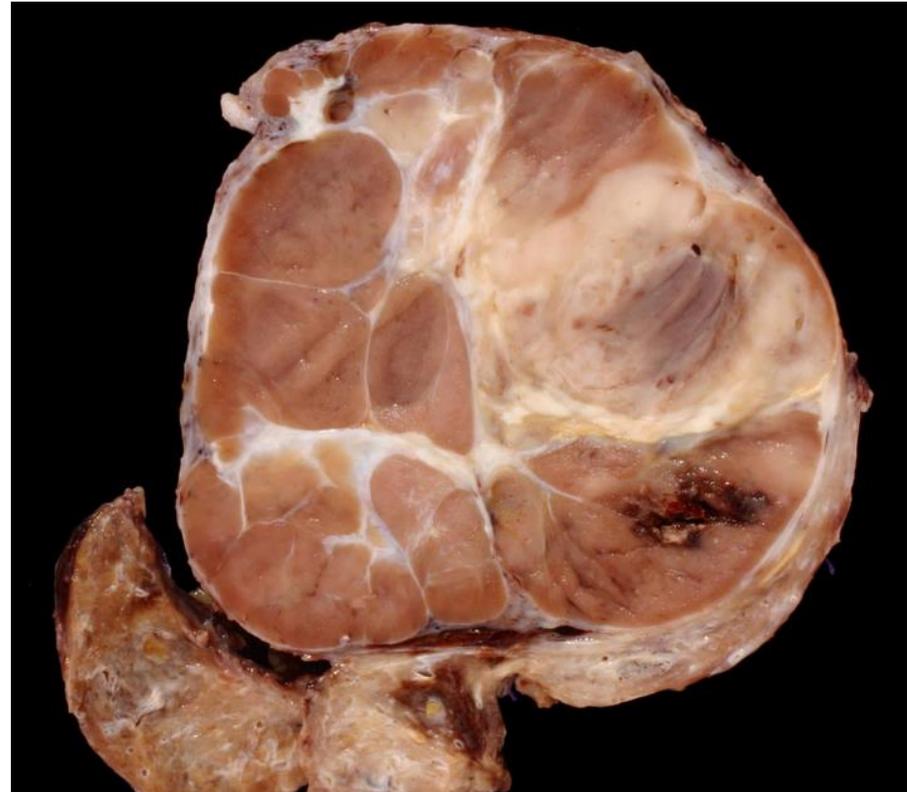
Clinical features

- Rapidly enlarging, bulky neck mass invades adjacent structures causing hoarseness, dysphagia, dyspnea.
- fixed to the underlying structures.
- Extrathyroidal extension in 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.

ugly invasive lesion



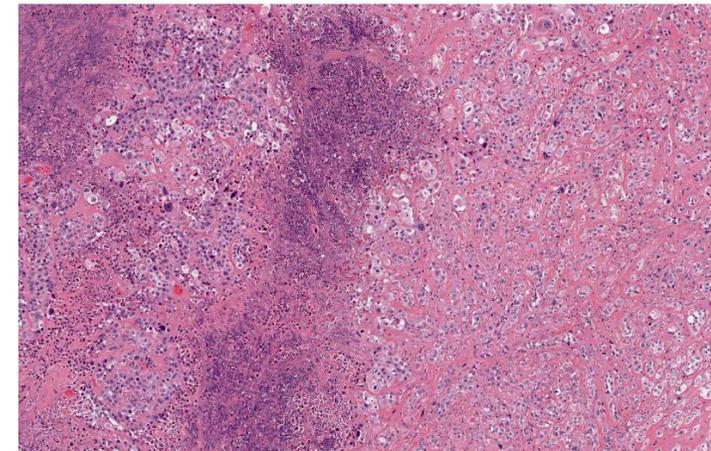
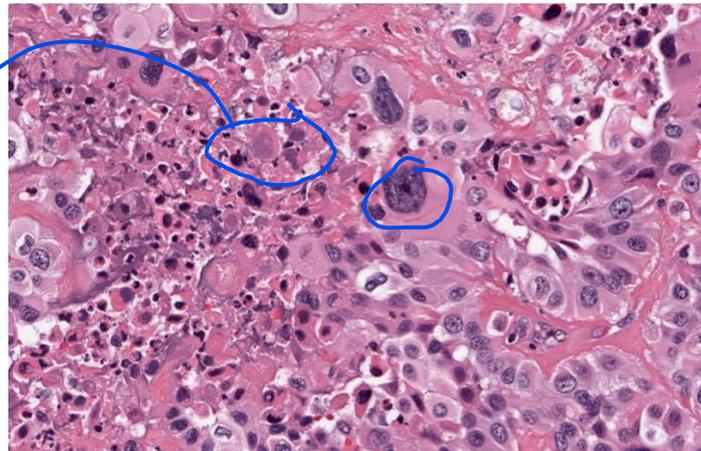
Histology

- **Common features include :**

- ✓ widely invasive growth.
- ✓ extensive tumor necrosis.
- ✓ marked nuclear pleomorphism .
- ✓ high mitotic activity

bizarre nucleus,

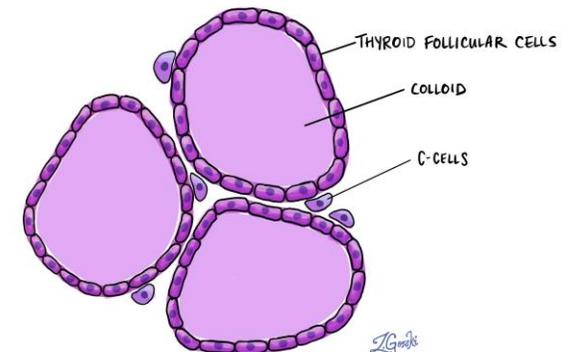
atypical mitotic figure



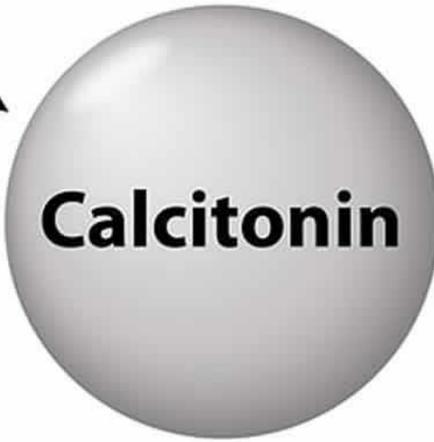
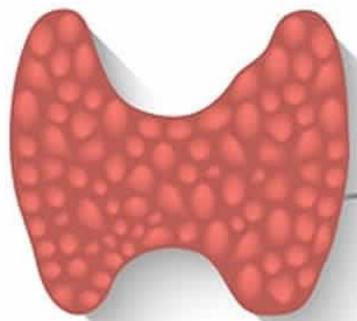
4. Medullary Carcinoma.

- 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 **single lesion with good prognosis**
 - **Familial:** 30%, younger patients (mean age 35). **part of a syndrome**
 - ✓ Occurring in the setting of MEN syndrome 2A or 2B,
 - ✓ familial medullary thyroid carcinoma without an associated MEN syndrome

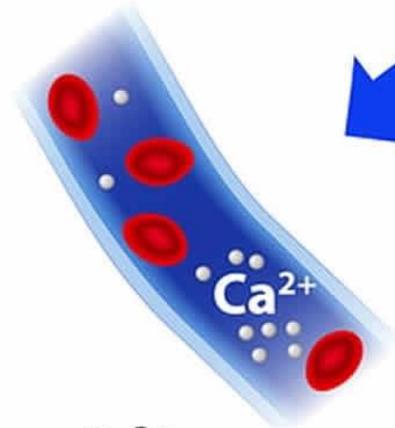
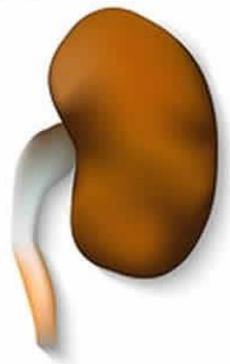
NORMAL THYROID FOLLICLES AND C-CELLS



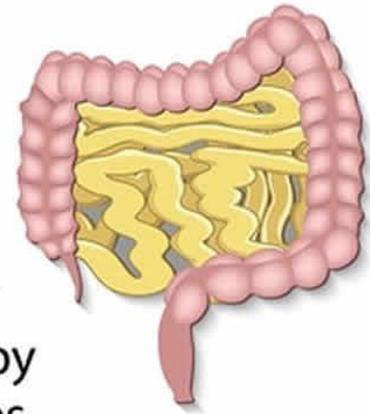
Thyroid gland



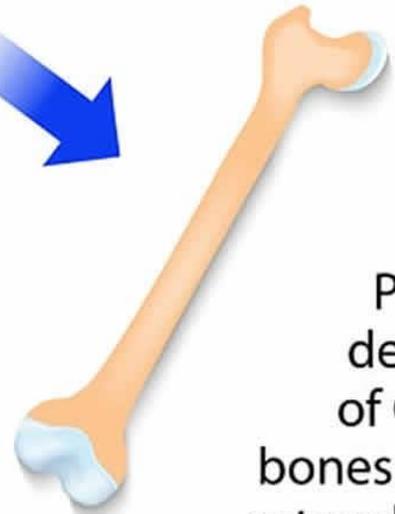
Inhibits Ca^{2+} reabsorption in the kidney (excreted in the urine)



Lowers Ca^{2+} levels in blood



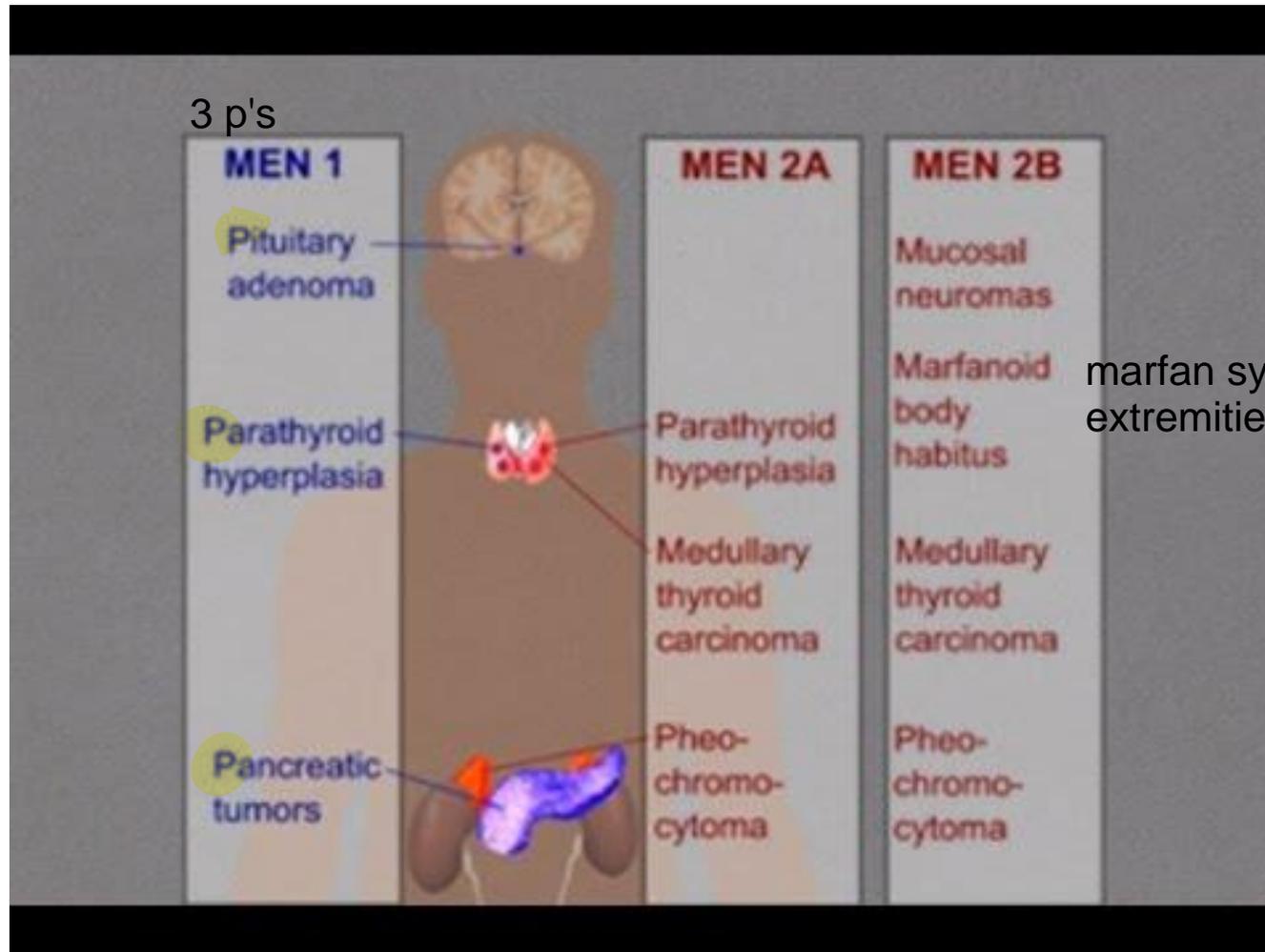
Inhibits Ca^{2+} absorption by the intestines



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

very important

3 p's



marfan syndrome: very tall, long extremities. problem in collagen

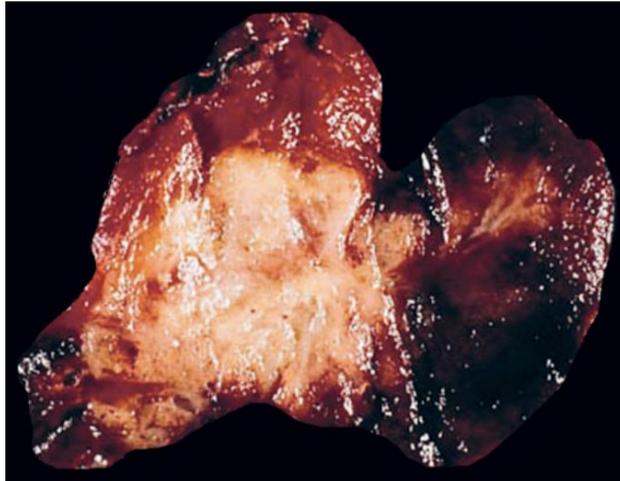
Clinical features

if a patient who had prostate cancer had a surgery there should be follow ups every 6 months to see if there are tumor markers

- Presents with painless thyroid mass, cold on scanning
- Up to 75% of patients have nodal metastasis.
- Serum calcitonin correlates with tumor burden .tumor load in the body
- Patients with metastasis may have severe diarrhea and flushing when the tumor reaches the liver; it will get rid of some material of the tumor causing symptoms other than thyroid signs
- Some tumors may produce ACTH or CRH (Cushing syndrome).

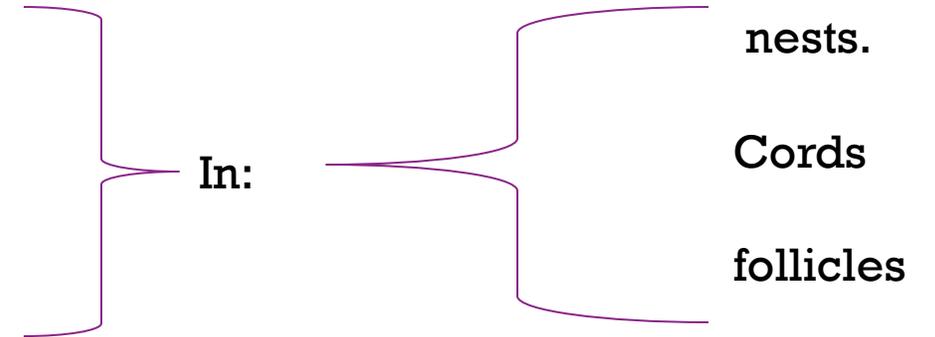
Morphology

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



Histology

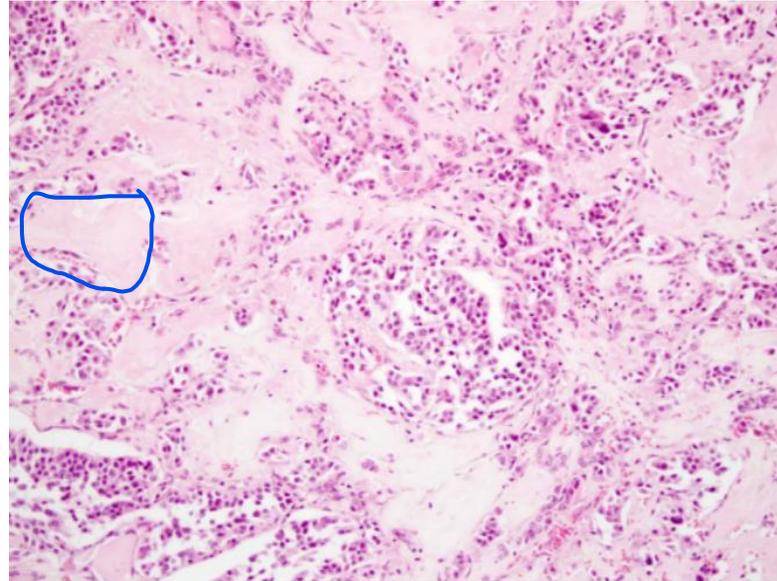
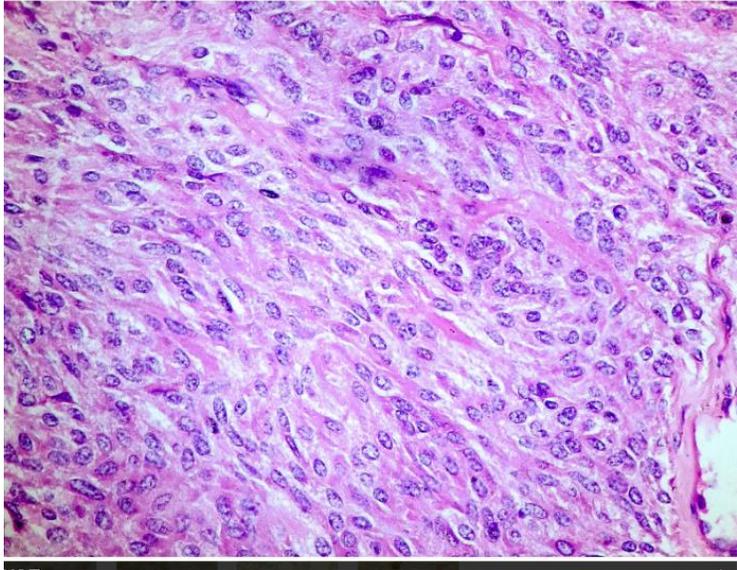
- Wide variety of morphology:
- Round.
- Plasmacytoid.
- polygonal
- spindle cells.



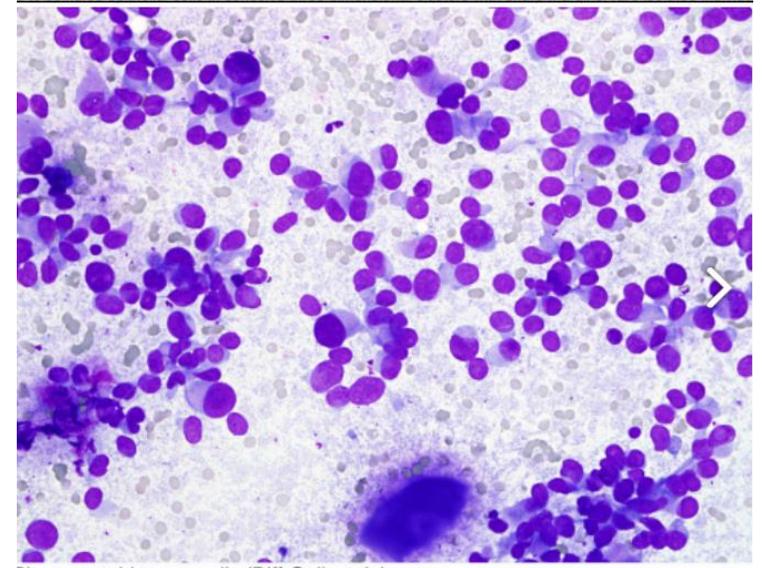
• Eosinophilic to amphophilic granular cytoplasm due to secretory granules

- Stroma has amyloid deposits from calcitonin

amyloid (pale eosinophilic)



eccentric nucleus, the nucleus is pushed to the sides of the cell



THANK YOU