Dr Suhail bakar

LECTURE 2 PART 1 SHEET

بسم الله الرحمن الرحيم

Parathyroid gland

- **We have four parathyroid gland: 2 superior, and 2 inferior.**
- **how do parathyroid gland develop Embryologically? >> <u>((this important because it's related to some clinical and practical points))</u>**

-Superior parathyroid gland.

-Inferior parathyroid gland.

Embryologically: The superior parathyroid gland developed from <u>4th FOURTH PHARYNGEAL POUCH</u>.(also lateral part of thyroid gland develop from 4th PHARYNGEAL POUCH).

-**Inferior** parathyroid originated from **<u>3rd PHARYNGEAL POUCH</u>**.

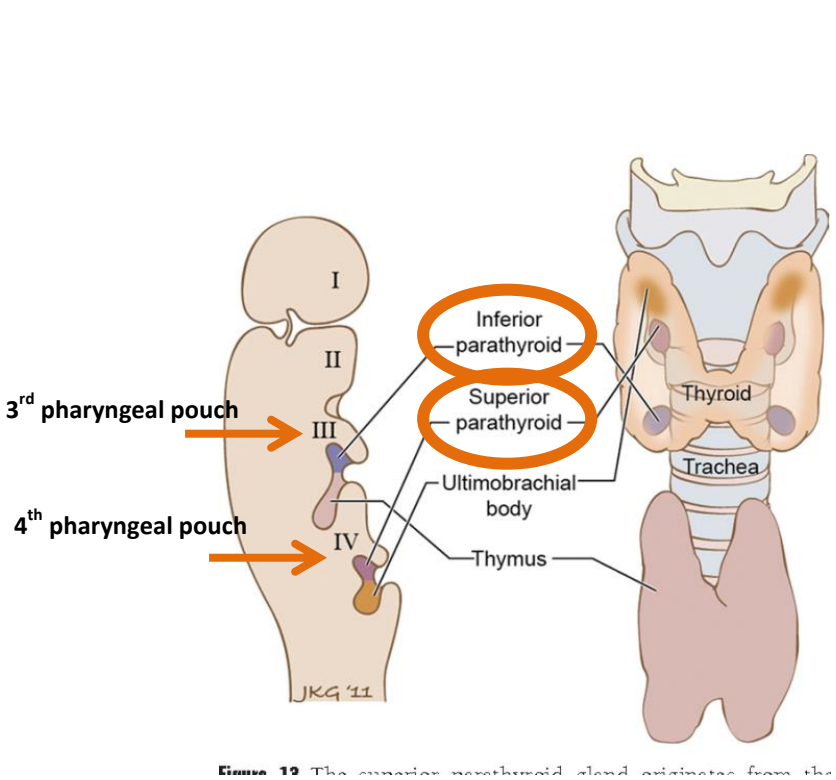
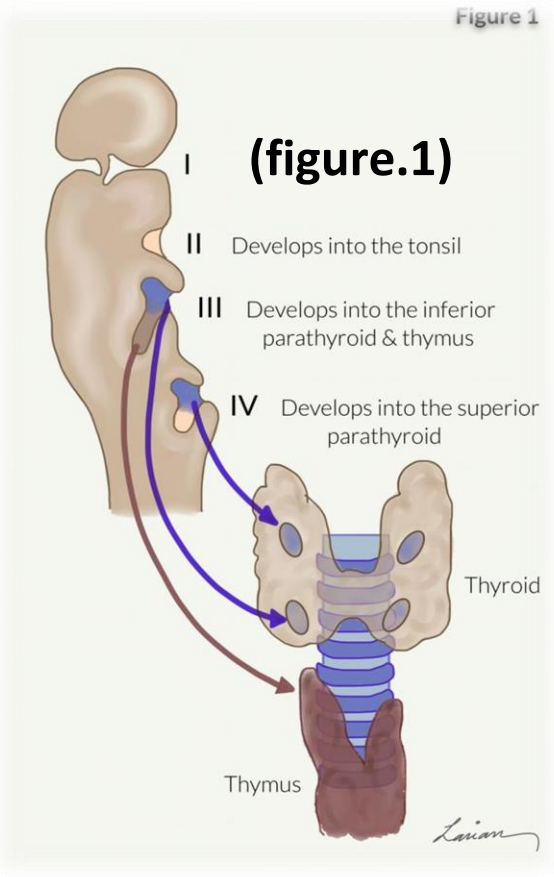


Figure 1

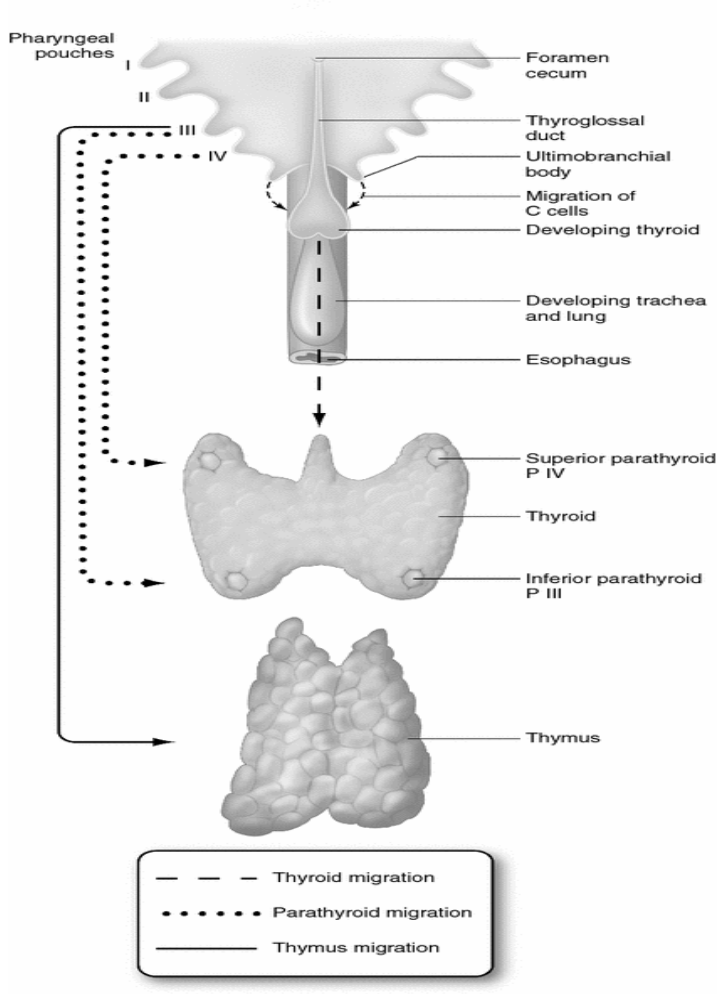


(figure.1)

◈**<u>Superior</u>** parathyroid and **<u>lateral</u>** part of thyroid BOTH are developed from **<u>4th FOURTH PHARYNGEAL POUCH</u>**.

◈ **<u>Inferior</u>** parathyroid and **<u>thymus</u>** developed from **<u>3rd THIRD PHARYNGEAL POUCH</u>**.

▶The superior and ***inferior parathyroid glands*** develop from the fourth and third pharyngeal pouches, **respectively**



▶ Embryologically **<u>distance</u>** <u>along which **inferior parathyroid gland migrate is longer**</u> **compered** to superior parathyroid**. (figure.1)**

- Question : therefore whose of them (superior **or** inferior parathyroid) have a chance to be more ectopic?

Answer is: <u>inferior</u> parathyroid gland has <u>more chance to be ectopic</u>, because the <u>distance that of which migrates is LONGER.</u>

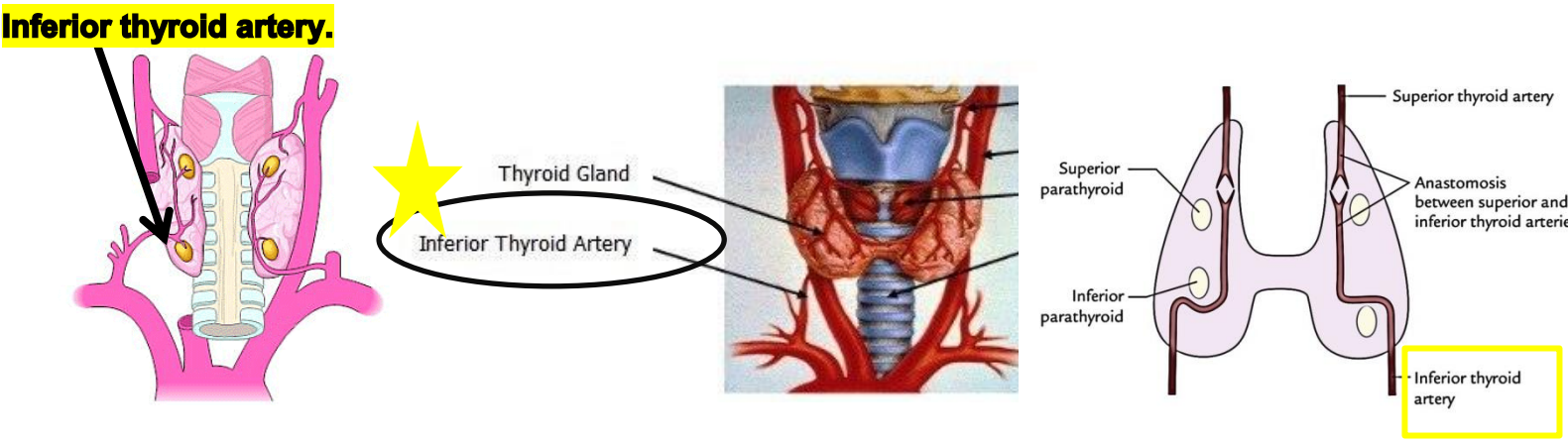
The *inferior glands* migrate *with* the thymus; from third 3rd pharyngeal pouch. And find their location. Hence they are <u>more likely to be found in ectopic locations due to longer distance of migration.</u>

(كلما زادات مسافة البعد كلما زادت احتمالية الاحداث الغلط)

➢The greater the travel distance >>> the greater is the mistaken events

➢Blood supply of parathyroid gland is: Inferior thyroid artery.

parathyroid glands receive their blood supply from branches of the **inferior thyroid** arteries,

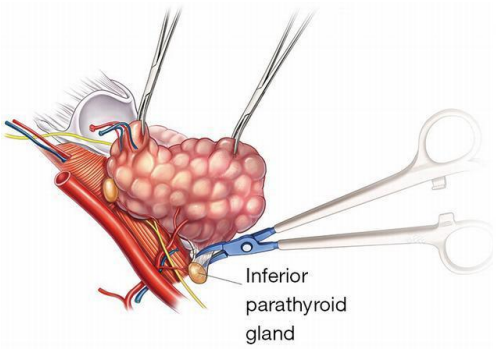


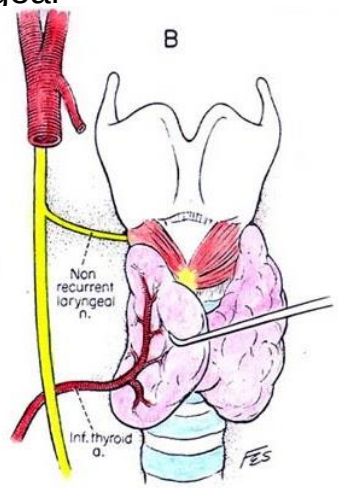
➢That's why during thyroidectomy the inferior thyroid arteries must be carefully tied off to avoid injury or damage to **inferior laryngeal nerve.** (During thyroidectomy, care must be taken when ligating the inferior thyroid artery to avoid damaging the inferior laryngeal nerve).

➢ In surgery this called as

→ **Terminal branch ligation**

Of inferior thyroid artery.



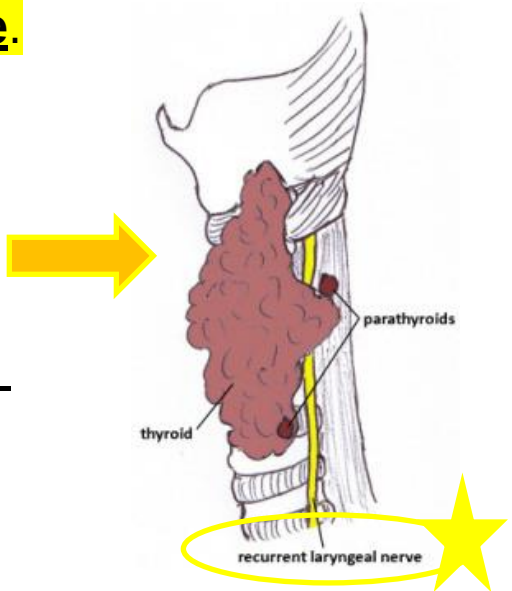


Anatomically: there is important nerve

Called **Recurrent Laryngeal nerve**.

➢**Inferior parathyroid** known as **anterior** gland because it is ventral to the nerve.

➢**Superior parathyroid** gland known as **posterior** gland; because it is posterior to recurrent laryngeal nerve.



▶ Hyperparathyroidism:

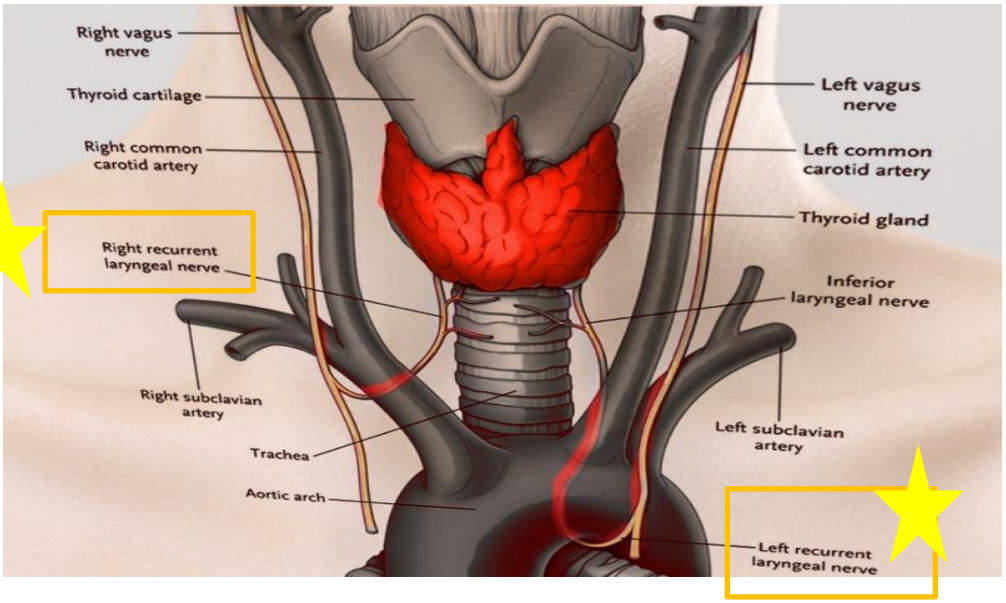
It is hyper function of parathyroid gland which lead to increase circulation levels of parathyroid hormone (↑PTH).

▶ The cause of this elevation might be:

1) Primary Hyperparathyroidism: which means the parathyroid **gland itself** increase in their function. one or more of the parathyroid glands ,The parathyroid gland(s) becomes overactive and secretes excess amounts of parathyroid hormone (PTH). As a result, the blood calcium rises to a level that is higher than normal (called hypercalcemia).

2) Secondary Hyperparathyroidism: means there is **another cause** rather than parathyroid gland. (there **is underlying cause** that cause increase of the function of parathyroid gland). Excessive secretion of parathyroid hormone (PTH) by the parathyroid glands in response to hypocalcemia (low blood calcium levels), with resultant hyperplasia of these glands. This disorder is primarily seen in patients with chronic kidney failure.

3) Tertiary hyperparathyroidism



What dose means secondary 2ry?

To know 2ry you have to remember **Vit-D metabolism.**

◈ Exposure of **skin** to sunlight means that cholesterol converts to → Cholecalciferol (vitamin D_3),

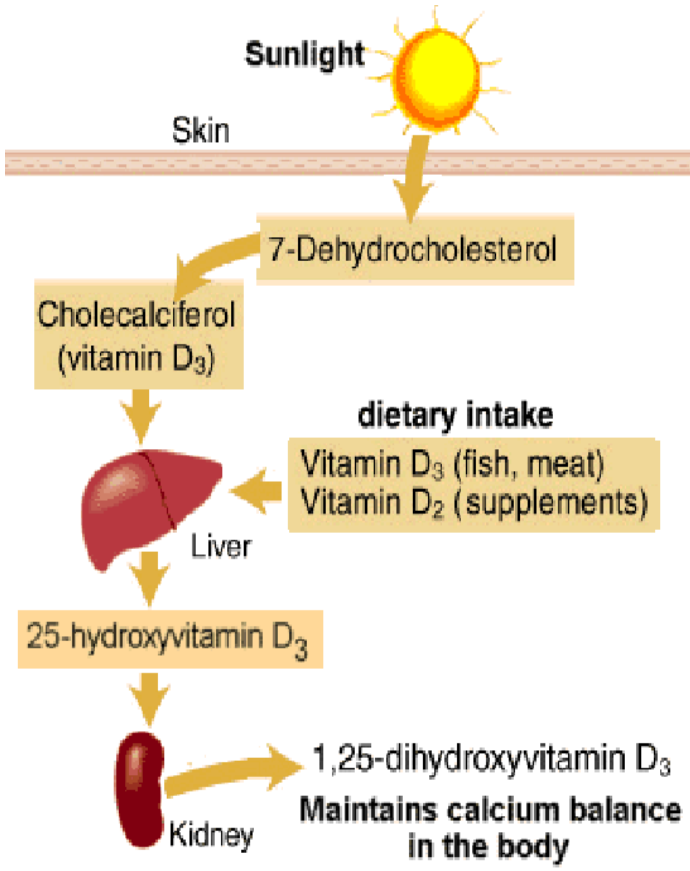
◈then it goes to **liver** and It is converted in the liver to→ calcifediol (25-hydroxyvitamin D_3)→

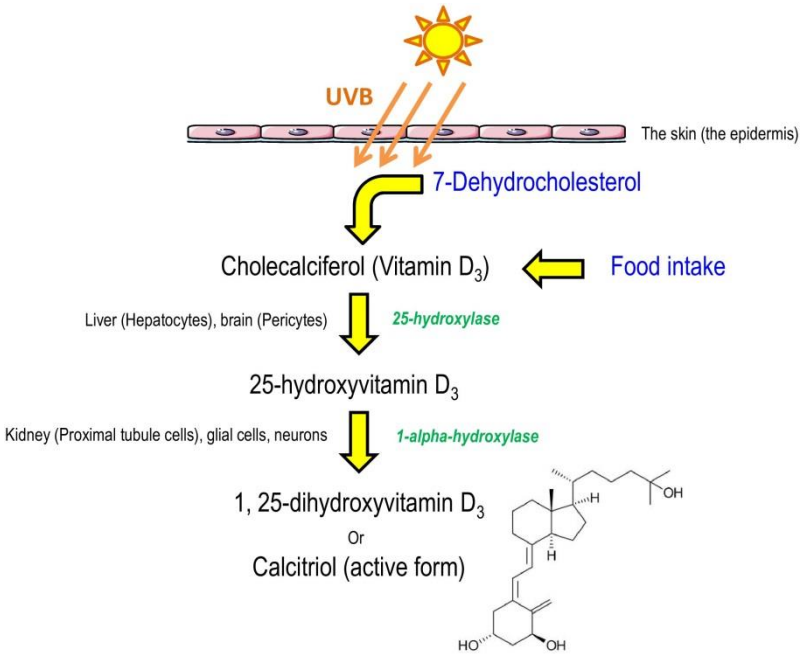
◈next it goes to **kidneys** and converted to→ to calcitriol (1,25-dihydroxyvitamin D) **"1 25-dihydroxycholecalciferol".**

● In **kidney** the **renal hydroxylase** is *responsible* for **converting 25 hydroxycholecalciferol → to 1,25 dihydroxycholecalciferol**

✹**parathyroid hormone (PTH)→ Is catalyzing and stimulate renal hydroxylase**

➤ Why✪ **renal hydroxylase (1-alpha hydroxylase) is convert** (25-hydroxyvitamin D_3)to → (1,25-dihydroxyvitamin D) ?? Because it's the ACTIVE form of Vit-D, and It is cause the abosrtion of CA++2





➢**2ry parahyperthyroidism is an elevation on PTH not because of parathyroid gland itself.**

➢**It is because another cause that lead the parathyroid increases in their function.**

➢ **As a (compensatory enhanced).**

➢→**To <u>compensate low level of Calcium</u> CA++ in blood.**

✹What are the most two common causes of 2ry parahyperthyroidism??

1. Renal failure.
2. Vit-D deficiency (all **4 gland** are hyperplasia in this patient)

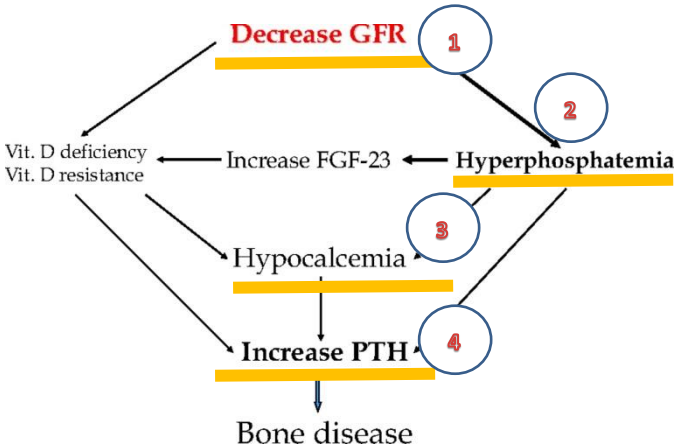
✹ Why does renal failure lead to 2ry hyperparathyroidism???

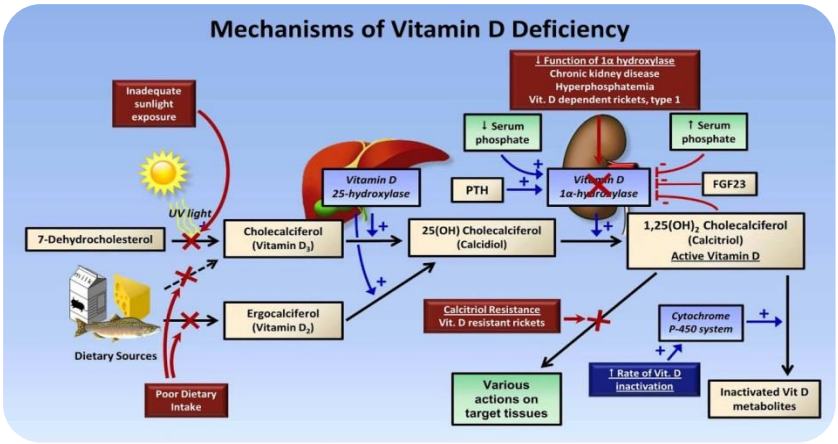
➤Because renal hydroxylase (1-alpha hydroxylase) is an enzyme found in kidney , and during kidney failure ⇨it means NO this enzyme ⇨which means No Vit-D which means⇨ NO absorption of Ca2+ ⇨ which means hypercalcaemia ⇨which finally lead to 2ry hyperparathyroidism.

➤ **Chronic kidney failure is the most common cause of secondary hyperparathyroidism.**

➤Failing kidneys do **not convert enough vitamin D to its active form**, and they do not adequately excrete phosphate. When this happens, **insoluble calcium phosphate forms in the body and removes calcium from the circulation** which lead to Hypocalcaemia (((Increase phosphate concentration in blood "hyperphosphatemia" and decreased calcium concentration → increase PTH secretion and synthesis→ parathyroid hyperplasia.))))

Renal failure →Hyperphosphatemia→ Hypocalcaemia→ increase PTH





✹Management of 2ry hyperparathyroidism??

▶Mainly it's Medical not surgical.

▶(HOMEWORK) Although there is an indications of surgery in 2ry hyperparathyroidism EXAMQ

Note (Doctor gives us this question as a **homework** but he said this **very important** to be know because we are going **to be asked about it in the exam** so I will put it here)

❖INDICATIONS OF SURGERY IN 2RY HYPERPARATHYROIDISM:-)IMPORTANT

TABLE II

Indications for Surgical Management of Secondary Hyperparathyroidism

- Refractory hyperparathyroidism, with markedly elevated and nonsuppressible levels of parathyroid hormone
- Severe hypercalcemia
- Progressive hyperparathyroid bone disease
- Pruritus that does not respond to medical or dialytic therapy
- Progressive extraskeletal calcifications or calciphylaxis
- Otherwise unexplained symptomatic myopathy

SECONDARY HYPERPARATHYROIDISM

Indications for Surgery

- **Failure of reliable maximal medical Rx.**
- **Development of significant symptoms: Musculo-skeletal, pruritis, calcinosis cutis, neuro-psych.**
- **Calcium x Phosphorus product above 70.**
- **Osteopenia, decreasing measured bone density, bone biopsy.**
- **Development of Tertiary Hyper-PTH**

✹ SO The **management is medical** but *there is a surgical indication in some cases(PLEASE REMEMBER)*

#Adenoma of parathyroid gland:

#Parathyroid hyperplasia:

◈ If there is an adenoma of parathyroid gland that secrete PTH. (three adenoma is uncommon)It could be **one** adenoma or **two**, or **four** adenoma that what called (**four parathyroid-gland hyperplasia** disease).

-Parathyroid hyperplasia involves enlargement of all four parathyroid glands,

◈but in general as adenoma it can be **on**e gland or **two**.

90% → one gland (single gland disease)

5-10% → two gland. (two gland disease)

⊙ In men it can be genetic hyperplastic four gland.

- Parathyroid hyperplasia may occur sporadically (without a family history) or as part of three familial (inherited) syndromes: multiple endocrine neoplasia 1 (MEN 1) and MEN 2A and isolated familial hyperparathyroidism.

- Multiple endocrine neoplasia (MEN) is characterized by the occurrence of tumors **involving two or more endocrine glands** within a single patient.

▶ Q: How to differentiate between 1ry and 2ry hyperparathyroidism?

Answer: by blood lab investigation analysis. By

PTH and Ca2+ results.

✹↑PTH ↓ Ca2+ : 2ry hyperparathyroidism

✹↑PTH ↑ Ca2+ : 1ry hyperparathyroidism

❖1ry: is problem in the parathyroid gland itself → so the result of BOTH PTH ↑ also Ca++↑

❖2ry: the cause is of increase PTH because of condition that cause decrease in levels of Ca++ → therefore compensatory mechanism to this low Ca++ levels → PTH increased amount and secreted.

✪Clinical presentation of patient with primary hyperparathyroidism: (important) مهم جدا

▶↑PTH , → first starts with bones. That the increase in PTH take % percentage in bones.

1) BONES MANIFESTATION:

- BONE PAIN (VERY PAINFUL BONES)
- OSTEOPENIA
-BONE CYST
-OSTEITIS
-PATHOLOGICAL FRACTURE

2) CALCIPHLAXIS: (therefore it can participate and cause calciphylaxis in which calcium accumulate in blood vessels which lead to nephrocalcinosis which is impaired renal function, it can participate in renal tubules)

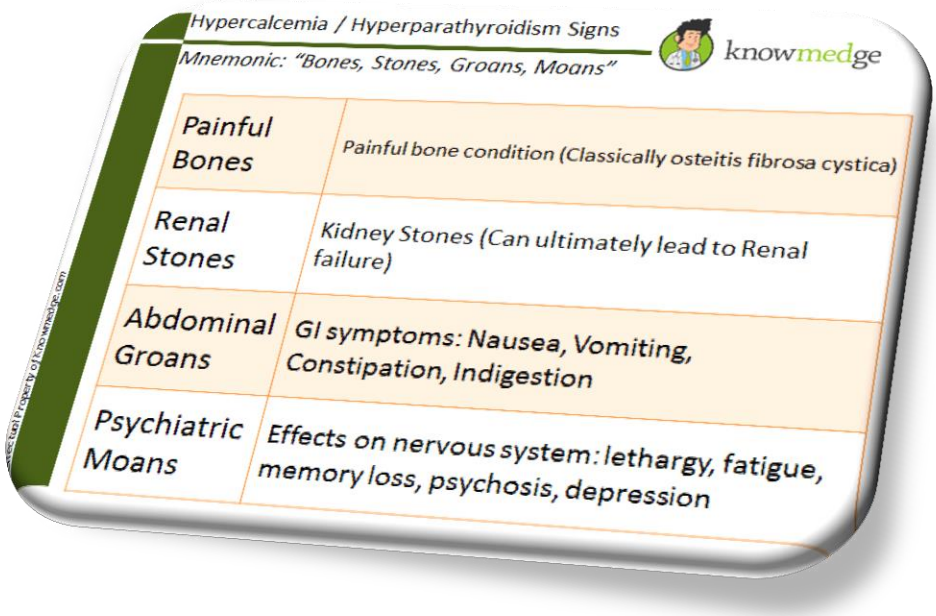
3) Renal stones. -The most common stone in hyperparathyroidism is: calcium OXALATE stones.

4) Abdominal GROANS.

5)Acute pancreatitis. (patient with hypercalcaemia come with acute pancreatitis)

6) Psychotic disorder.

7) Fatigue



Q: abdominal pain causes associated with hypercalcemia differential diagnosis DDX?

1- Acute pancreatitis.

2- peptic ulcer disease.

3- renal colic.

4-constipation

5- psychic disorder

▶Management of hypercalcemia due to 1ry primary hyperparathyroidism is a surgery method of management.

- if one is destroyed → simply restrict it .
- if two are destroyed → both are restricted.

EXAM Q: a case of patient come to clinic fatigue, depressant, complains from painful bones you did PTH, Ca++ blood analysis. The result was showing an elevation in both PTH↑ and Ca++↑. And you diagnose the patient with 1ry primary hyperparathyroidism. What is your NEXT STEP TO DO?

Answer is should be like this:

1- U/S ultrasound.

2- nuclear medicine sestamibi scan**(medical imaging technique specific for parathyroid)**

3- Parathyroid hormone (PTH) monitoring during the surgical procedure can confirm the removal of all hyperfunctioning parathyroid tissue, as the half-life of PTH is approximately 5 min. **(The 1/2 half-life of parathyroid gland is 5 minutes so it must be after 5 mins after remove the gland the TSH must decrease. If it was not decreased you repeat the test up to 4times , if it was still not decresed this means there is something wrong almost there is another gland you should look for it and remove it.)**

Done by: SARA ALANAFISI