Thyroid and Parathyroid diseases
Surgical Approach

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Parathyroid Glands

Case #1

- 40 y/o old lady
- Left fractured humerus due to trivial injury.
- Left ureteric stone removed 6 years ago.
- Right ureteric stone removed 3 years ago.
- Non-functioning Left kidney.
- High serum Ca 11.2 mg/dl
- Low P 2.2mg/ dl (phosphorus)

- The patient lost her left kidney because of obstructive uropathy which is caused by stones in the ureter. Case #1 is a clear picture of primary hyperparathyroidism.
- The main point in the history are :
  - young lady
  - fractured humerus from minor injury
  - history of renal stones
  - high serum Ca and low P

Case #2

- 30 y/o old lady
- Rt fractured Radius due to trivial injury
- Long history generalized bone ache, heart burn & easy fatigability.
- Lt ureteric stone removed 5 years ago
- High serum Ca 14.3 mg/dl
- Low P 2.4mg/dl

Case #3

- 45 y/o old lady
- ESRF
- Advanced bone disease

The interesting thing about the cases is they are patients with very advanced primary hyperparathyroidism who were coming to the hospitals for years and years and no body picked the diagnosis!!

A study has been carried out in Aseer city to find out what is the problem. They reviewed all the files of patients with hyperparathyroidism in 17 hospitals. They found that the total number of cases did not exceed 25 to 30 in the hospitals. That was surprising! Because statistics say that the expected number should be around 5000 cases! Where are those cases?

ANATOMY

There are four parathyroid glands. All are related to the thyroid glands. Two upper (develop from 4^{th} branchial pouches) and two lower glands (develop from 3^{rd} branchial pouches). Each weighs 30 to 50 mg and measures about 5 mm in dimension.
Blood supply: inferior thyroid arteries
Venous drainage: internal jugular, subclavian, and innominate veins

PHYSIOLOGY

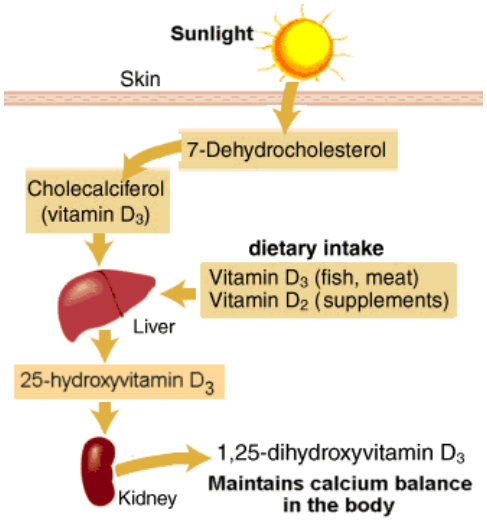
Factors that affect calcium in the body:

1- PTH (parathyroid hormone)

- PTH is synthesized and secreted by parathyroid glands. It is very sensitive to serum Ca levels and it aims at keeping serum Ca levels up in the blood.
- Hypocalcemia stimulates PTH secretion.
- Hypercalemia inhibits PTH secretion.
- PTH increases calcium reabsorption in PCT and increases phosphate clearance.
- It also mobilizes calcium from bones and indirectly increases GI absorption of calcium by stimulating Vit D production.

2- Vitamin D

- Vitamin D directly enhances GI calcium absorption.
- Low Vit D levels increase PTH secretion.



3- Calcitonin: decreases serum calcium levels

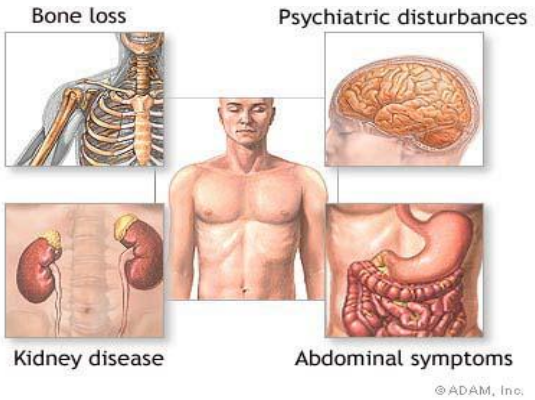
PRIMARY HYPERPARATHYROIDISM

- **The relation between PTH and Ca is disturbed.** Normally, PTH is secreted or inhibited whenever the balance is disturbed. And it goes back to normal once this balance is restored. However, here it is different story.
- **High PTH**
- **Low Phosphorus**
- **Normal or elevated serum Ca**
- Excess PTH secretion leads to increased GI absorption of Ca, increased urinary excretion of Ca, and bone loss.

- Three distinct lesions that can cause PHP:
  1- Carcinoma (1%)
  2- Adenoma (84%): only one is enlarged.
  3- Hyperplasia (15%): all are enlarged.

CLINICAL MANIFESTATIONS

- Renal stones and calcinosis
- Bone and joint pains
- Abdominal groans (pancreatitis, peptic ulcer)
- Psychic moans (mental disturbance)
- Fatigue overtones

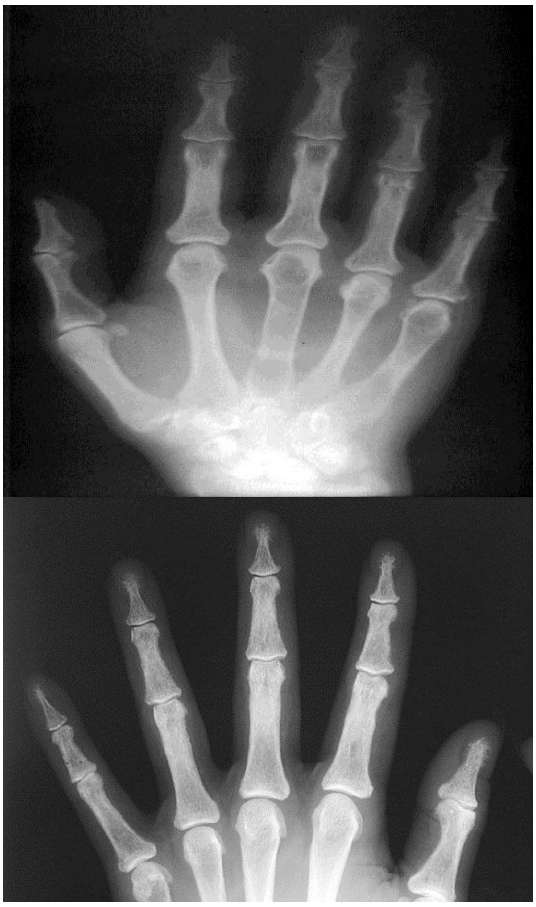


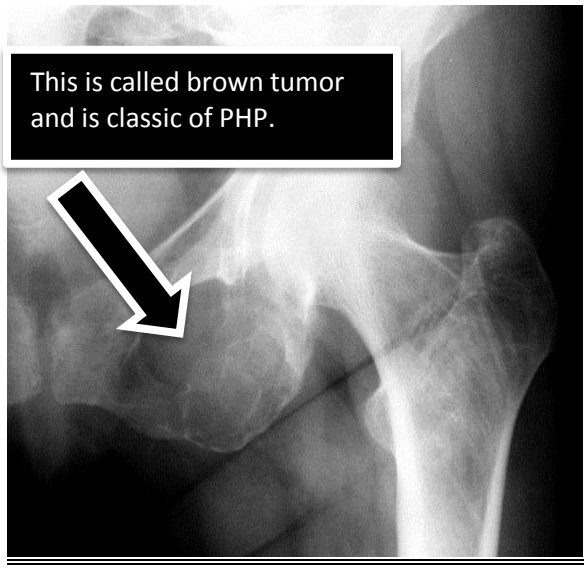
- The spectrum of symptoms ranges from no symptoms, mild symptoms, renal symptoms, to bone symptoms.
- Statistics from Western countries indicate a 0.1-0.5% prevalence rate for PHP.
- **No evidence for geographical variation.**
- 1200- 6000 cases are expected in Aseer area .
- Commonest cause of hypercalcaemia in society (outpatients) is **PHP**. However, in hospitals (inpatient), the most frequent cause is **malignancy**.
- Uncommon in children.
- 2-3 times in females.
- **Clinical presentation in the west**
  60-70% detected by routine screening.
  Many are asymptomatic.
- **Clinical presentation in KSA**
  Age 30 – 77 (median 40)
  Females 70 %
  All have advanced bone disease.
  54% have also renal manifestations

INVESTIGATIONS

- High serum Calcium
  sometimes you may find it low, so you have to repeat it again.
- High PTH
- Low serum Phosphate
- High Chloride

If you are still in doubt, you can x-ray the hand for signs of bone resorption.
There is periosteal resorption in the **radial side** of the phalanges





- Hypercalcemia could be drug-induced e.g. diuretics and Ca supplements.
- Elevated PTH occurs only with PHP, **f**amilial **h**ypercalcemic **h**ypocalciurea, or Vit D deficiency.
- A calcium:creatinine ratio less than 0.05 indicates **FHH**
- High PTH-rP indicates malignancy.
- Some tumors secrete PTH-rP as paraneoplastic syndrome. The most common one is bronchial squamous cell carcinoma, others include, breast, renal, and ovarian cancers.
- Primary bone cancers (multiple myeloma) cause hypercalcemia without high PTH-rP. Other tumors (lymphoma) that secrete Vit D behave in the same way.
- Primary bone cancers cause hypercalcemia without high PTH-rP.

MANAGEMENT

Patients can be managed medically (in case of hypercalcemia) or surgically (in case of PHP):

- **Hypercalcemia:**
  In case of acute, severe hypercalemia, patients are managed by large volume infusion.
  Loop diuretics are used adjunctively other drugs may be added to decrease bone turnover e.g. bisphosphate and calcitonin.
- **Primary hyperparathyroidism:**
  Currently, there is no definitive medical treatment.
- **Surgical management:**
  All symptomatic patients should be treated.
  - Asymptomatic: do not operate unless there are symptoms. So, it is better to wait.
  - For ESRD patients the most effective treatment is renal transplantation.
  - Single-gland resection is preferred for adenoma.
  - Subtotal resection (three and half) is preferred for hyperplasia.

POST OPERATIVE MANAGEMENT

What is Bone hunger syndrome?
Before operation: high PTH, in addition, bones are resorbed.
After operation: the bones now are free from the high PTH. Therefore, they will immediately take up calcium from serum which may lead to severe hypocalcemia to the point that the patient may have tetany.
To avoid this hungry bone syndrome, patients with advanced bone diseases are sent to ICU after operations for 24 hours monitoring.

SECONDARY HYPERPARATHYROIDISM

- **The problem here is not in the glands.**
- **High PTH**
- **Low Ca levels**
- E.g. rickets, malabsorption, Vit D, Renal failure.
- In these cases you should treat the cause.

CONCLUSIONS

- PHP is a very underdiagnosed disease in Saudi Arabia.
- Patients are not diagnosed early
- Complications could be serious and these are avoidable.

RECOMMENDATIONS

- The medical community needs to be more aware of the disease.
- Specifically the diagnosis should be considered in patients with
    - bilateral or recurrent renal stones
    - patients with suggestive radiological bone changes
    - and naturally in patients with high serum calcium level

Thyroid Gland

ANATOMY

- Thyroid gland lies in front of the trachea and is formed of two lobes that are connected by isthmus which lies at the second tracheal ring.
- It appears at 24th day of conception
- It weighs 15 to 25 mg
- Blood Supply: superior and inferior thyroid arteries.
- Venous drainage: thyroid veins.

PHYSIOLOGY

There are two distinct groups of hormone-producing cells in the thyroid gland. Follicular cells which are responsible for producing, storing, and secreting thyroxine. The other group is parafollicular cells, also called C cells, which secrete calcitonin

Mechanism of synthesis is complex but can be summarized as follows:

- trapping of iodide from the blood;
- oxidation of iodide to iodine (called organification step);
- binding of iodine with tyrosine (of thyroglobulin) to form iodotyrosines;
- coupling of monoiodotyrosines (MIT) and di-iodotyrosines (DIT) to form T3 and T4.

They are stored in the follicles. Upon stimulation by TSH, thyroglobulin is broken down from the complex, and T3 and T4 are released.

Presentation of thyroid gland can be three things:

1- Lump or no lump;
ask the patient to swallow. If the lump moved, it is either thyroid swelling or thyroglossal cyst.
then, ask the patient to protrude the tongue, if it moved, this is thyroglossal cyst.
2- Hyperthyroidism; or
3- Hypothyroidism.

Case #1

Fatima is a 30-year old Saudi lady that presented to the Outpatient clinic, complaining of a swelling in the midline of her neck that she had for 2 months.

Q: If it is a thyroid swelling, what could be the cause of this swelling?

- Thyroid cyst. It is benign. And very difficult to examine and differentiate between cyst and solid. Perform U/S and FNA to differentiate (FNA is good because it treats and you can send the aspirate to the cytology).
- Multi-nodular goiter
- Inflammatory
  three types: acute (rare), subacute (rare), and chronic (e.g. hashimoto thyroiditis, common).
- Benign tumor e.g. follicular adenoma.
- Malignancy.
  There are four types.
  -The commonest is the papillary and has very good prognosis.
  -follicular type (15%)
  -medullary type (c cells cancer)
  -anaplastic type: most dangerous
  -there is a fifth type which is present in our community. It is thyroid lymphoma. Needs only chemo/radio.

We perform nuclear scan to check for two things 1- cold nodule in case of malignancy 2- hyperfuntioning gland in case of thyrotoxicosis.

Case #2

Ahmed 28 years old came to the Outpatient clinic complaining of nervousness, palpitations, sweating, and weight loss. Clinical examination revealed the presence of goitre.

HYPERTHYROIDISM

It is a condition in which there is excessive secretion of thyroid hormones. The most common cause is **Graves' disease** (diffuse toxic goiter). Less common causes are the **toxic multi-nodular goiter** or **toxic adenoma**.

TOXIC MULTI-NODULAR GOITER

It occurs mainly in elderly. This type is rarely associated with eye signs and systemic manifestations. However, most of the symptoms are cardiac.

SINGLE TOXIC NODULE

On nuclear scan, part of the gland appears black (hot nodule) and the rest is normal.

GRAVES' DISEASE

Occurs predominantly in women (8:1 ratio) and it's the most common. The hyperthyroidism associated with Graves' diseases is caused by circulating IgG, called TSAb (thyroid-stimulating Ab). These IgG bind to TSH receptors on follicular cells and cause excessive production of T3 and T4.

The symptoms are:

- tiredness;
- emotional lability;
- heat intolerance;
- weight loss;
- Excessive appetite;
- **Palpitations.**

- **Sweating**
- Menstrual irregularities

The signs of thyrotoxicosis are:
- tachycardia;
- hot, moist palms;
- **exophthalmos;**
- **lid lag/retraction;**
- agitation;
- thyroid goiter and bruit (benign).

Lab tests:
- High T4, T3
- Low TSH

Management:
Three possible treatments for Graves' disease:

1- Medical blockade of the hormone
   - Iodide, administered as iodide potassium or Lugol's solution will temporarily inhibits the release of thyroid hormone (short-lived Rx).
   - Propranolol (and other beta blockers) can relieve some of the peripheral side effects (short-lived Rx).
   - Thionamides (e.g. PTU and methimazole) interfere with the synthesis of thyroid hormone by inhibiting organification and coupling steps.
   - One third of patients respond, however, the other two-thirds need more definitive Rx like surgery or radiotherapy.

2- Radionuclide ablation of the gland
   - The isotope of choice is ^{131}I
   - Best for elderly
3- Surgical resection
   - Reserved for non-responders or those with relapses.
   - Can be total or subtotal.
   - Stabilization and regression of symptoms and signs are reported after total thyroidectomy (which does not occur with medical treatment).
   - Best for young

Case #3

Aisha is a 55-year old lady that presented to your clinic. Her main complaint is related to some recent difficulty in hearing. The family noticed that she started to have difficulty in understanding. she gained weight, and her voice started to be coarse.

Lab tests:
- Low T4, T3
- Increased TSH