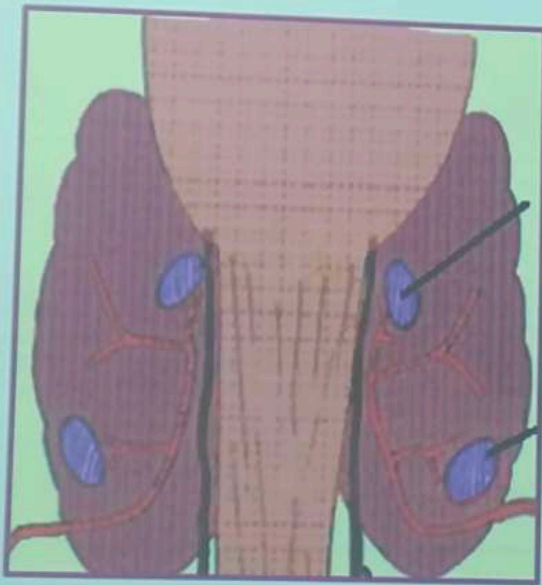


Endocrinology

Parathyroid Glands



- Four glands located behind the thyroid
- Length 6 millimeters
- Width 3 millimeters
- Thickness 2 millimeters
- Often accidentally removed
- Normal function with at least 2 glands

Ectopic parathyroid tissues

In rare cases the parathyroid glands are located within the thyroid glands.

Location of Ectopic glands:

Paraesophageal (28%)

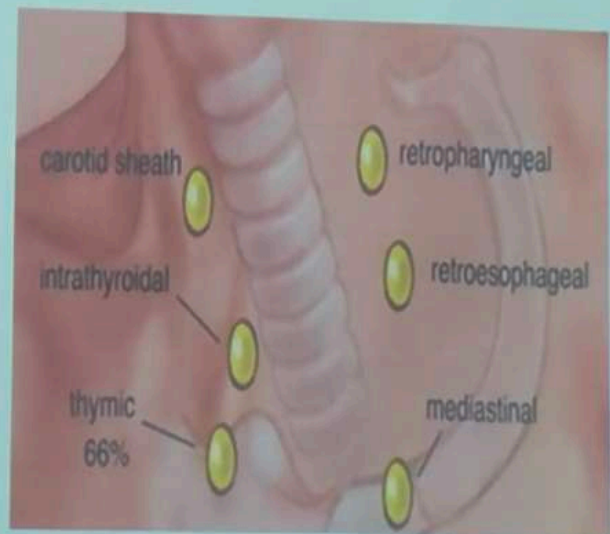
Mediastinum (26%)

Intrathymic (24%)

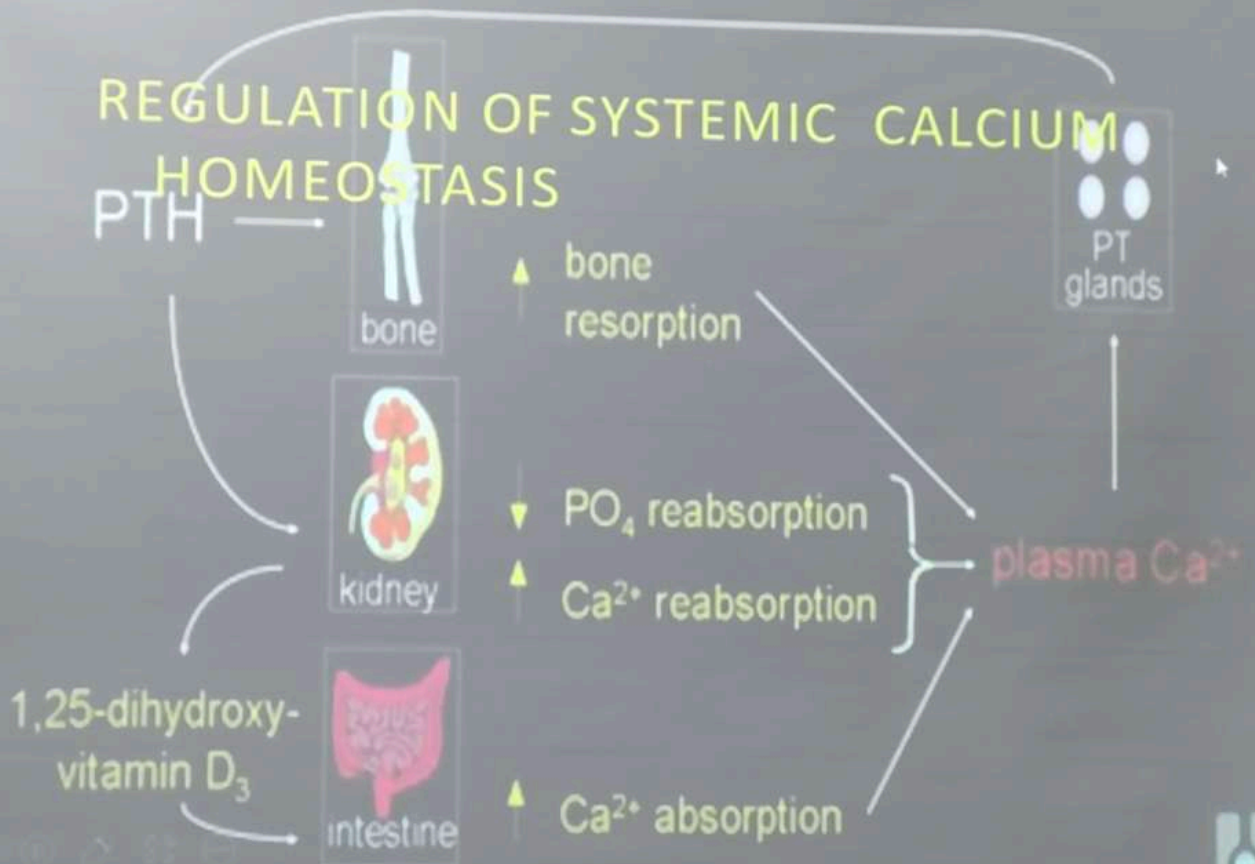
Intrathyroidal (11%)

Carotid sheath (9%)

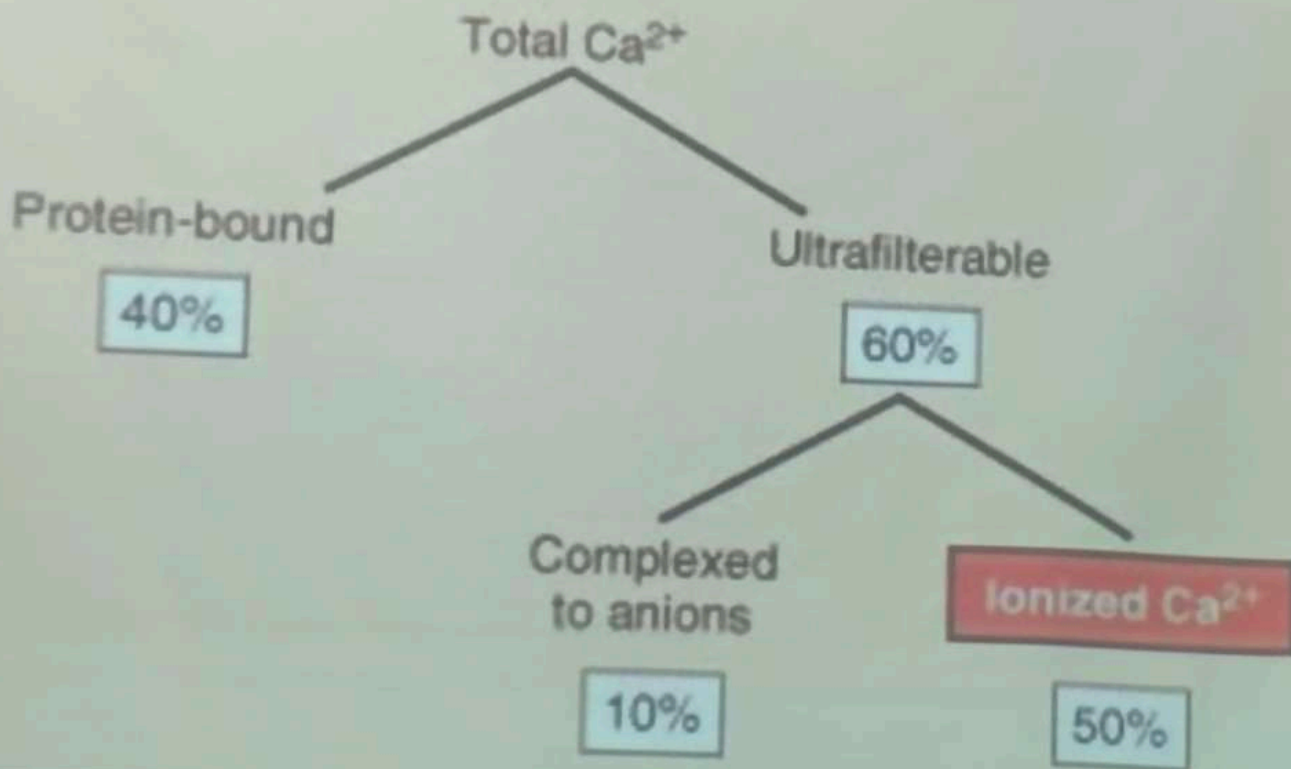
High cervical (2%)



REGULATION OF SYSTEMIC CALCIUM HOMEOSTASIS



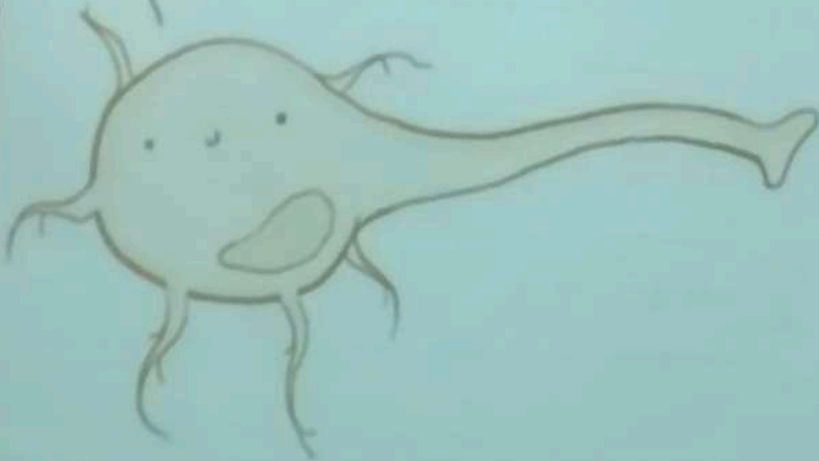
FORMS OF Ca^{2+} IN BLOOD



NEURON

* RESTING STATE of SODIUM CHANNELS
STABILIZED by Ca^{2+}

PREVENTS SPONTANEOUS
DEPOLARIZATION



NOTE

Primary Hyperparathyroidism and **Malignancies** account for **90%** of cases of hypercalcemia

Hyper Parathyroidism

Hyper Parathyroidism

- ⌘ Increase PTH hormone
- ⌘ Hyper calcemia

• **PRIMARY HYPERPARATHYROIDISM** is the unregulated overproduction of PTH by **parathyroid glands adenoma/hyperplasia** resulting in abnormal calcium homeostasis.

• **SECONDARY HYPERPARATHYROIDISM** is the overproduction of PTH secondary to a **chronic abnormal stimulus** for its production.

• **TERTIARY HYPERPARATHYROIDISM** is characterized by the development of **autonomous hypersecretion** of PTH causing hypercalcemia.

PRIMARY

Adenoma of
parathyroid glands;
Multiple adenomas;
Hyperplasia;
Parathyroid
carcinoma.

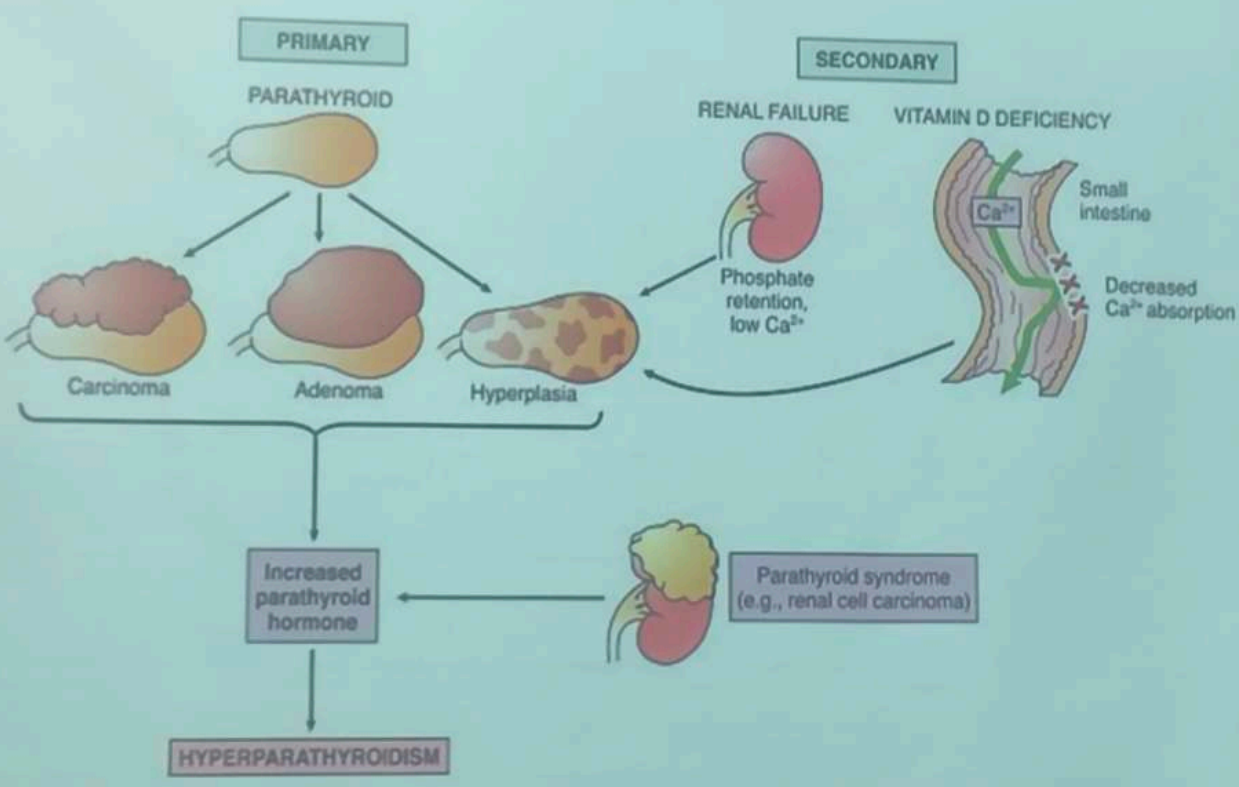
SECONDARY

Kidney diseases;
Hyperphosphatemia
appears to be
particularly important
in the development of
parathyroid
hyperplasia.

TERTIARY

**The etiology
is unknown.**

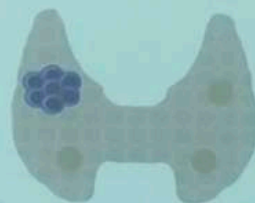
A change may
occur
in the set point
of the
calcium-sensing
mechanism to
hypercalcemic
levels.



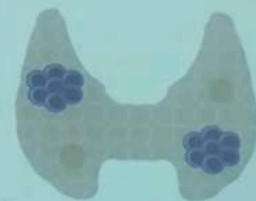
ETIOLOGY of PHTP

- A single **adenoma** is found in 80% of patients
- Parathyroid **gland hyperplasia** occurs in 20% of patients.
- Primary hyperthyroidism is associated with **MEN I and II**.

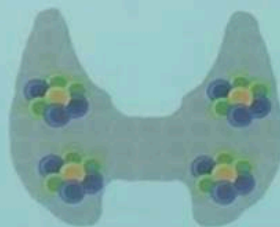
Types of Pathology



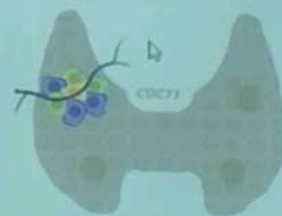
Single Adenoma



Multiple Adenoma



Hyperplasia



Parathyroid Cancer

PHYSICAL FINDINGS & CLINICAL PRESENTATION

- Primary hyperparathyroidism can be classified as **asymptomatic** (75% to 80%) and **symptomatic**.
- Physical examination may be entirely normal. The presence of signs and symptoms varies with the rapidity of development and degree of hypercalcemia.

Clinical features of hypercalcemia

HIGH Ca^{2+} →



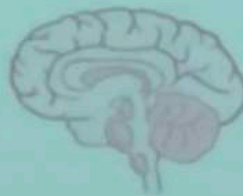
Na^+ CHANNELS
LESS LIKELY TO OPEN

- ↳ HARDER TO DEPOLARIZE
- ↳ LESS EXCITABLE

SLOWER or
ABSENT
REFLEXES
(classic symptom)

SLOW MUSCLE
CONTRACTION

CONSTIPATION
MUSCLE
WEAKNESS



- * CONFUSION
- * HALLUCINATION
- * STUPOR

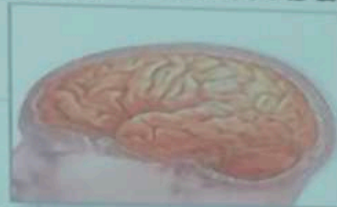
Clinical Features

- **Gastrointestinal:** constipation, anorexia, nausea, vomiting, pancreatitis, ulcers, abdominal pain
- **Central nervous system:** confusion, anxiety, fatigue, obtundation, psychosis, lassitude, depression, coma
- **Genitourinary:** renal stones, renal insufficiency, polyuria, nocturia.

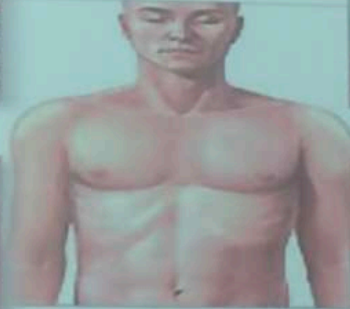
Bone loss



Psychiatric disturbances



Kidney disease



Abdominal symptoms

ADAM.

stones, bones, abdominal groans and psychic moans
(renal stones, peptic ulcers, pancreatitis, confusion, lethargy,
weakness)



INVESTIGATIONS

- PTH levels
- Calcium, phosphate
- RFTS and serum electrolytes
- Ultrasound neck
- CXR (bones ,lungs)
- CT scan / MRI
- Mammogram
- ECG = short QT interval



HYPERcalcaemia

Normal

HYPOcalcaemia

Radiography - HPT

- Osteopenia
- Subperiosteal resorption (diagnostic)
- Brown tumors (cystic accumulations of fibrous tissue)
- Loss of cortical definition
- Soft tissue calcification
 - Metastatic calcification; eg., vascular calcification



**Salt and Pepper
Skull**

Treatment

TREATMENT

- **Surgery** is the only effective treatment for primary hyperparathyroidism. It is generally indicated in all patients <50 yr and patients with complications from hyperparathyroidism, such as nephrolithiasis and osteopenia.
- **Percutaneous ethanol injection** into the parathyroid gland should be considered in selected patients who have undergone a subtotal parathyroidectomy for multiple-gland disease and have recurrent hyperparathyroidism as a result of remnant gland.

HYPERCALCEMIA

Hypercalcemia -- Serum calcium > 10.5 mg/dl

- **Mild**: total Ca : 10.5-11.9 mg/dl
- **Moderate**: total Ca : 12-13.9 mg/dl
- **Severe**: total Ca: 14-16 mg/dl

Treatment of acute hypercalcemia

Promote Ca^{2+} excretion

Normal saline	1-2 L every 6 h	IV	4-6 h	Improves GFR and promotes Ca^{2+} excretion
Furosemide	40-120 mg every 2-4 h	IV	2-4 h	Inhibits Ca^{2+} reabsorption in TALH

Decrease intestinal absorption

Prednisone	20-30 mg every 12 h	Oral	2-4 days	Inhibits gut absorption
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Decrease plasma [Ca^{2+}]

Hemodialysis	Use dialysate bath containing low Ca^{2+}		Few hours	Removal from blood
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Treatment of acute hypercalcemia

Decrease bone resorption

Calcitonin	2–4 MRC units/kg every 4–8 h	IV	4–12 h	Inhibits bone resorption
Pamidronate ^a	30–90 mg in 100–200 mL saline or D5W once	IV over 4–24 h	2–3 weeks	Inhibits bone resorption. Clinical response takes 2–3 days
Zoledronate ^a	4 mg in 50 mL of saline or D5W once	IV over 15–20 min	2–3 weeks	Inhibits bone resorption. Clinical response takes 2–3 days
Gallium citrate	200 mg/m ² /day in 1 L of saline for 5 days	IV	1–2 weeks	Inhibits bone resorption

Hypo parathyroidism

1. Primary hypoparathyroidism:

Circulating antibodies for the parathyroid glands , associated autoimmune diseases: Pernicious anemia, Ovarian failure, Autoimmune thyroiditis, Diabetes mellitus, Addison's

2. Secondary hypoparathyroidism After anterior neck exploration for thyroidectomy, abnormal parathyroid gland removal, excision of a neck lesion.

3. Pseudohypoparathyroidism

4. Pseudopseudohypoparathyroidism

Clinical measures of hypocalcemia

Low Ca^{2+} →



Na⁺ CHANNELS UNSTABLE

↳ CELL DEPOLARIZES MORE EASILY

↳ CELL MORE EXCITABLE

TETANY

* INVOLUNTARY MUSCLE CONTRACTION

CHVOSTEK'S SIGN



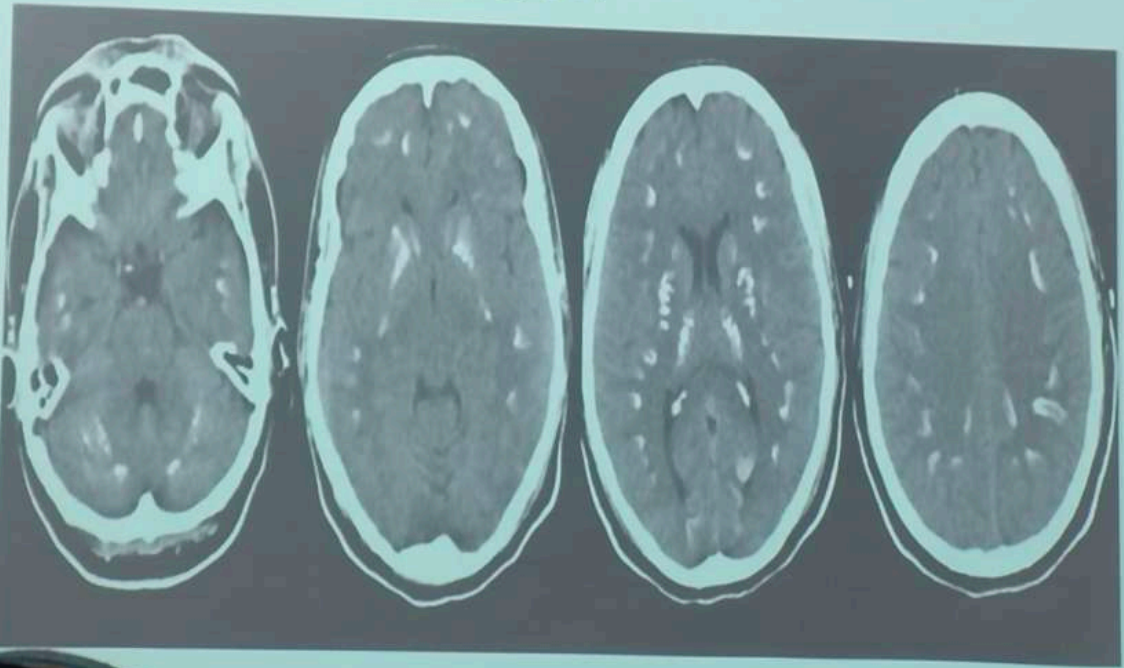
TROUSSEAU'S SIGN



Investigations

- S. Calcium and Phosphate levels
- S. Albumin
- RFTs (for renal disease)
- PTH levels
- Parathyroid antibodies (present in idiopathic hypoparathyroidism)
- Vitamin D level
- Magnesium level
- X-rays of metacarpals (showing short 4th metacarpals-- pseudo hypoparathyroidism)
- ECG

Brain Calcification



Treatment chronic Hypocalcemia

Treatment is aimed at **correcting the cause**.

- **Oral calcium supplementation** (500–1,500 mg elemental Ca²⁺)
calcitriol 0.5–1 µg/day are generally used for patients with hypoparathyroidism or PTH resistance, chronic kidney disease, and osteomalacia.
- **Thiazide diuretics.** (reabsorb calcium)
- Nutritional **vitamin D deficiency**, either cholecalciferol (effective dose 400–1,000 U/day) or ergocalciferol (effective dose 25,000–50,000 U three times/week)

Treatment of Hypocalcaemia

Severe Symptomatic:

- IV 10% Calcium Gluconate 10 ml over 10 minutes
- Continuous IV infusion of Calcium Gluconate @ 0.1 mmol/kg over 24 hours
- Continuous Cardiac monitoring for Bradycardia

Severe Asymptomatic:

Oral Calcium Supplements @ 0.2 mmol/kg (Max 10 mmols or 400 mg Ca) 4 x a day