

Parathyroid Gland and *Hyperparathyroidism*

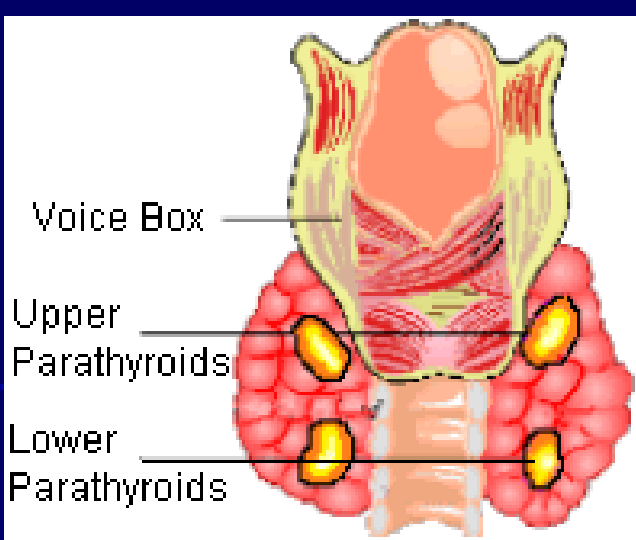
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- Ex Professor of surgery B J Medical College Pune

Anatomy of Parathyroid gland

- Small, oval in shape 0.5 to 6x3x1.5mm
- Yellowish brown colour 30 to 40 mgs
- Size and appearance resembles a ` Tur dal
- **Exact no.** of parathyroid may vary
- Gilmour (1936)

88% 4 glands

6% 5 glands

6% Glands : might be due to fusion

- Small fat lobules usually bruised on operation table may look like parathyroid
- Sink test
Sink in water parathyroid will sink – fat lobule will float

Position of Parathyroid

- Upper two Parathyroid glands fairly constant,
- closely embedded in thyroid at Postero Lateral border of thyroid Gland immediately above entry of inf. thyroid artery.
- Rarely it might vary above and within substance of thyroid gland along the of thyroid gland.
- with approximately 75% being located either cricothyroidal or juxtathyroidal, and the remainder are located primarily behind the upper pole of the **thyroid** gland.
- Common embryological origin from IV th bronchial arch. Parathyroid IV

- Inferior Thyroid gland varies in position.
- Usually situated at the lower pole of thyroid gland.
- May be found any where in this situation downwards to the upper pole Thymus.
- 5% found in upper anterior Mediastinum.
- Embryo logically Inferior. thyroid gland shows origin with Thymus – 3rd bronchial arch
Parathyroid III

di George Syndrome – Congenital absence of parathyroid gland
Thymus and pharyngeal derivatives

Right side
Normal sites

Left side
Variations of normal

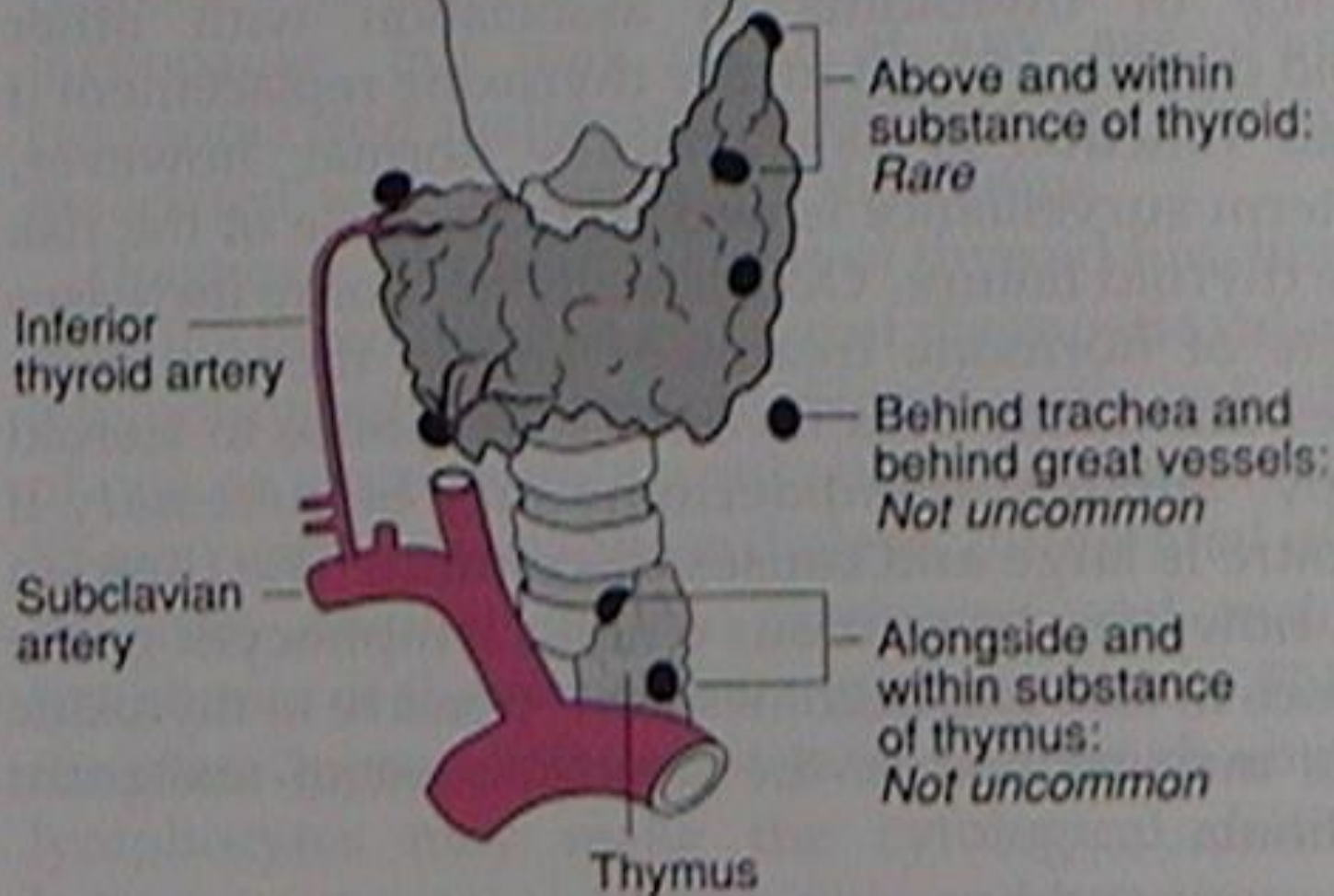


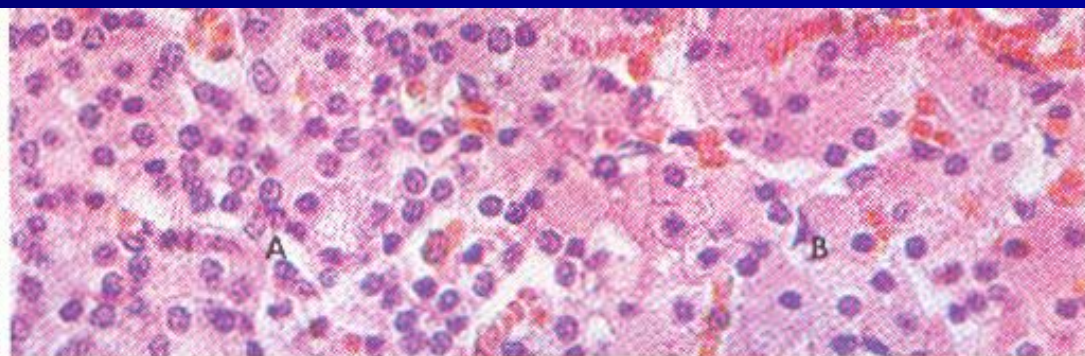
Fig. 38.1 Parathyroid gland. Normal and uncommon sites.

Histology:

- Rich sinusoidal capillary net work with islands of secretory cells.
- Glandular cells
- Chief (Principle cells) Small, vasicular nuclei and poorly staining cytoplasm
- Clear cells : Found in hyperplastic Neoplastic Tumours.



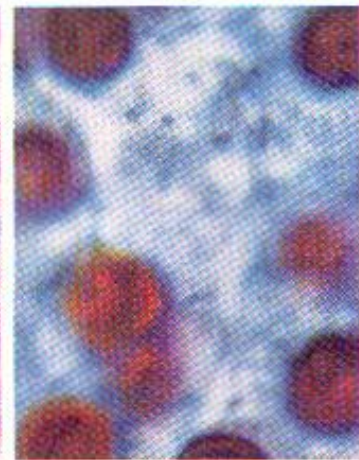
NORMAL HUMAN PARATHYROID GLAND;
H. AND E. STAIN, X 17½



NORMAL HUMAN PARATHYROID GLAND; H. AND E. STAIN, X 350
A=LIGHT AND DARK CHIEF CELLS; B=OXYPHIL CELLS



PAS STAIN, X 675
GLYCOGEN IN
CHIEF CELLS



BODIAN STAIN, X 1800
SECRETORY GRANULES
IN CHIEF CELLS



BAAF STAIN, X 1350
MITOCHONDRIA IN
OXYPHIL CELLS

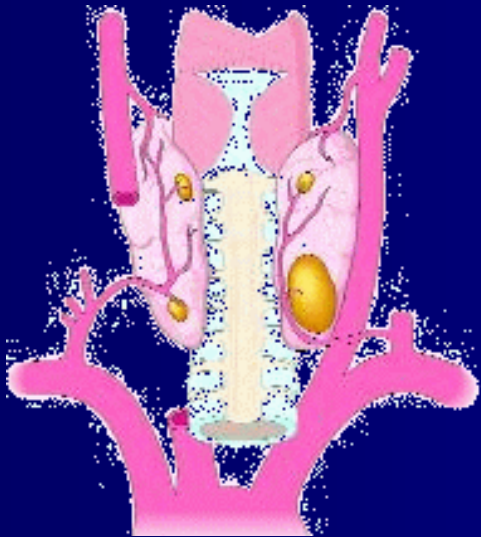


Fig. 38.1 Parathyroid gland. Normal and uncommon sites.

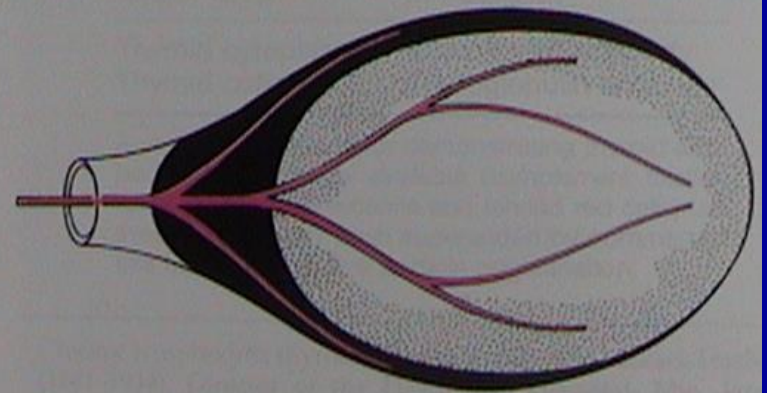


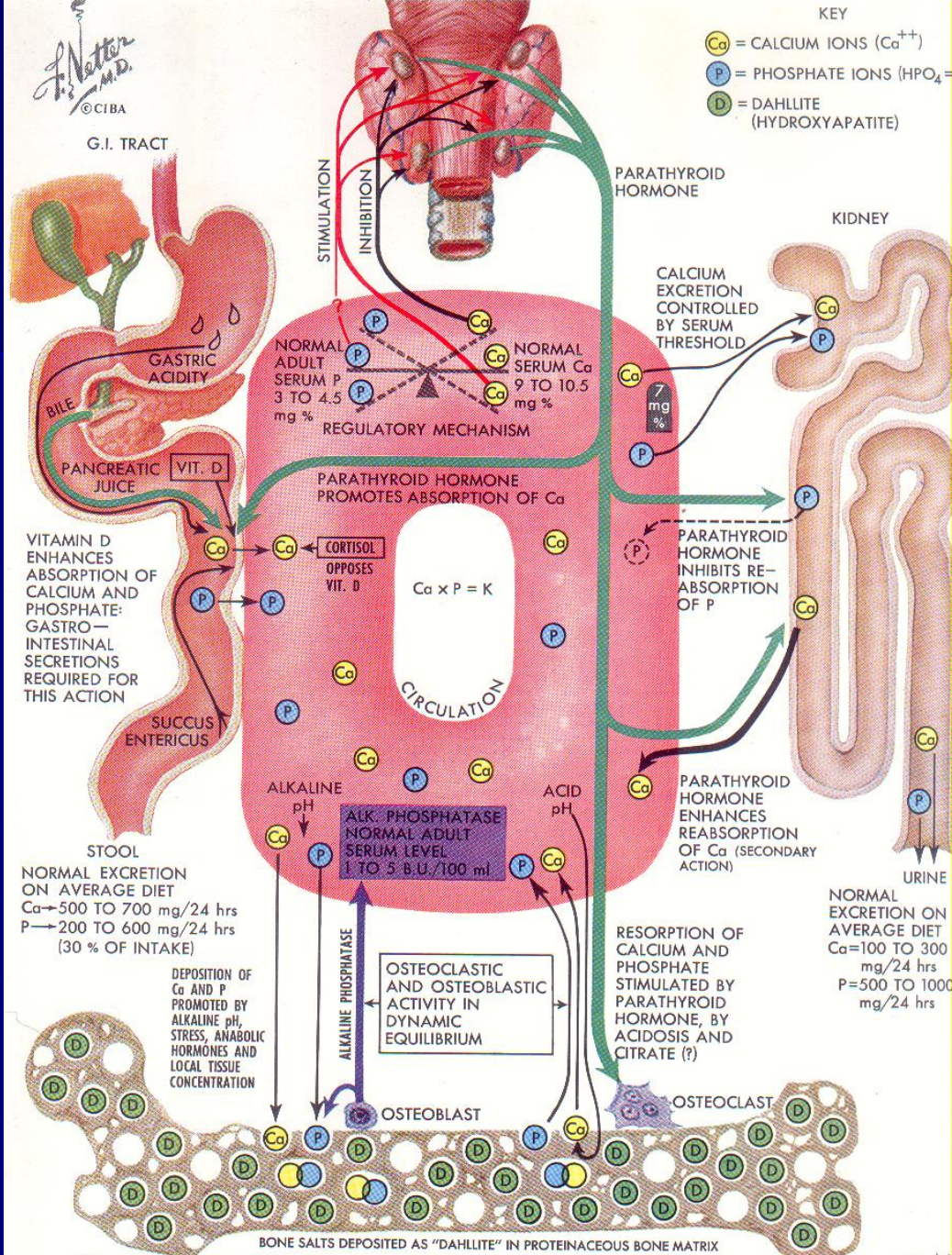
Fig. 38.2 The blood supply of a parathyroid gland.

Physiology:

Chief cells produce Parathormone
Released directly into circulation

1. Stimulates osteoclastic activity.
increasing bone Reabsorption by mobilizing Ca PO₄ from bone.
- 2) Increases Reabsorption of calcium from renal tubules Thus reducing urinary excretion of calcium.
- 3) Augments absorption of Ca from gut.
- 4) Renal tubular excretion PO₄ ↓ increases Ca

Physiology of Parathyroid

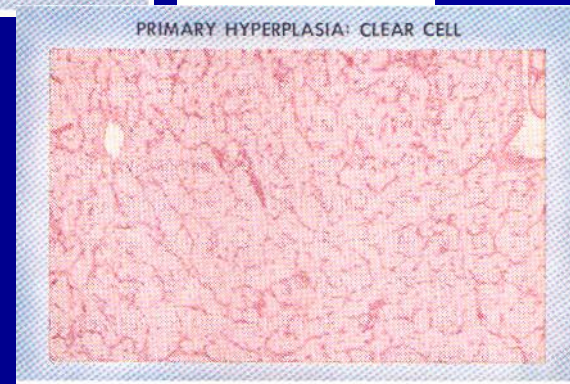
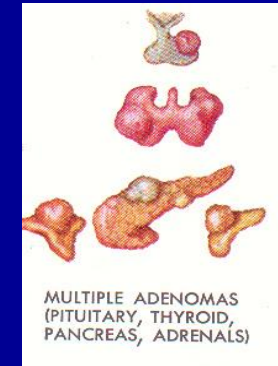
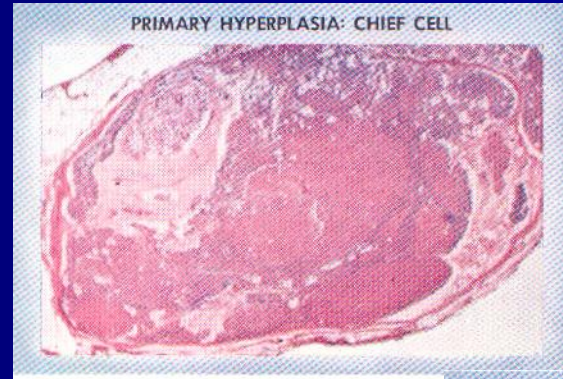


Hyperparathyroidism

1) Primary

a) Hyperplasia

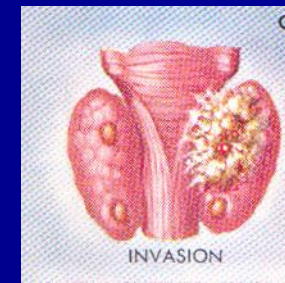
- Chief Cell Alone
MEN I
MEN II a
FHHH
- Water Clear Cell (WCCH)



b) Neoplasia

Carcinoma

Adenoma (MEN I, MEN II a)





2) Secondary :

- Chronic renal failure with Renal osteodystrophy
(Serum Ca lowers leading to Compensatory parathyroid
Hyperplasia of all 4 glands)
- Malabsorption syndrome

■ 3) Tertiary HPT :

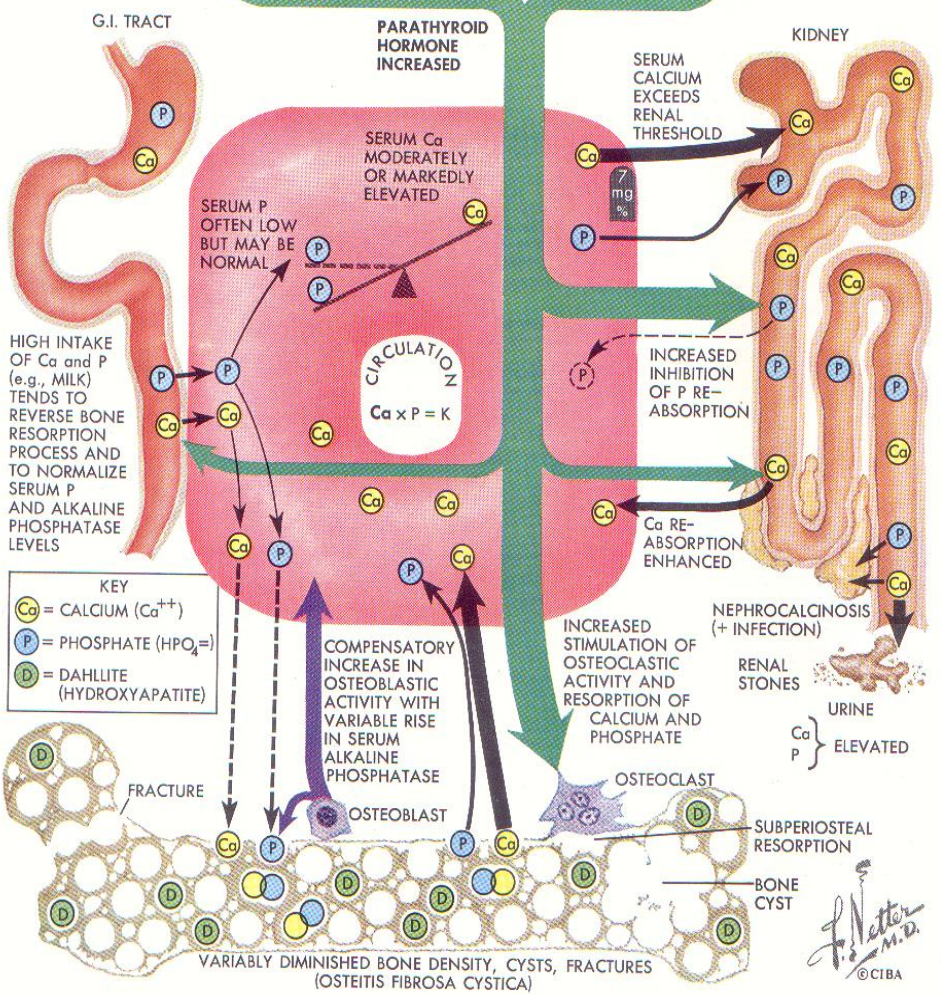
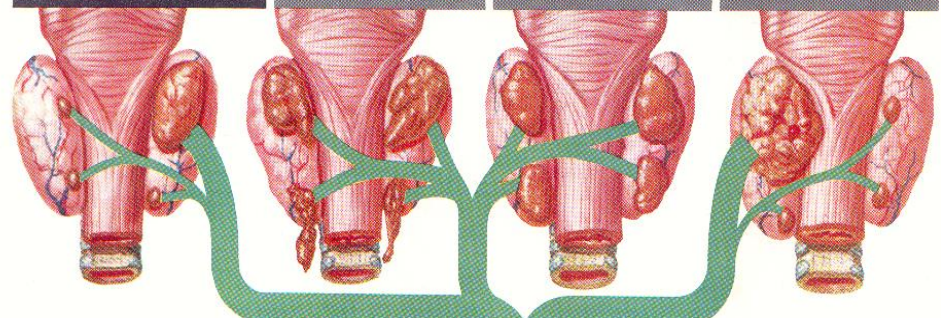
Persistent HPT after Renal Transplantation in
Renal osteodystrophy

ADENOMA (USUALLY SINGLE, OCCASIONALLY MULTIPLE) ABOUT 80% OF CASES

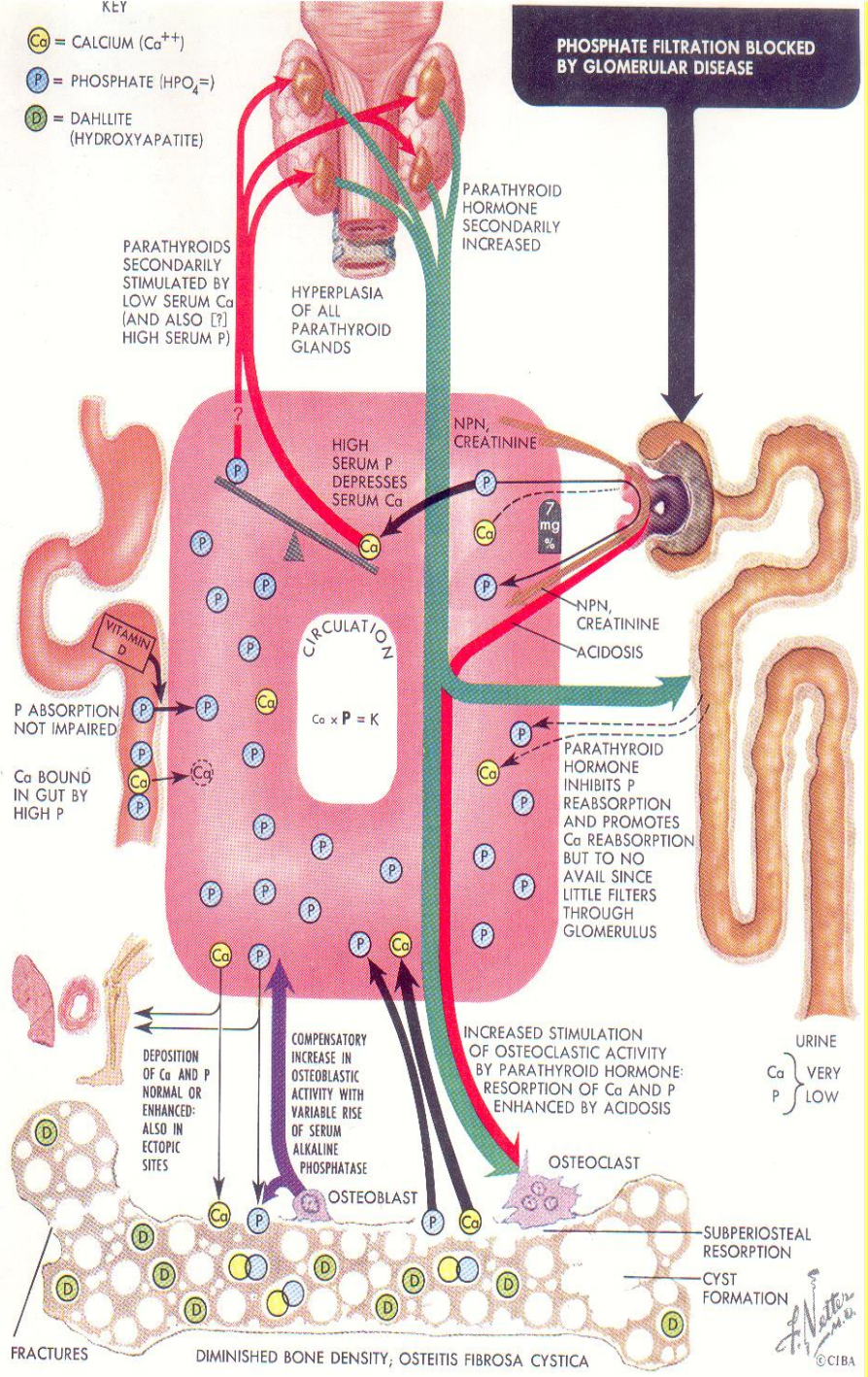
PRIMARY "WATER CLEAR" CELL HYPERPLASIA ABOUT 10% OF CASES

PRIMARY CHIEF CELL HYPERPLASIA ABOUT 8% OF CASES

CARCINOMA ABOUT 2% OF CASES



Primary Hyperthyroidism



Secondary Hyperthyroidism

F. Netter M.D.
© CIBA

Clinical Features

Bones,
Stones,

Abdominal groans
and Psychic moans

BONES

- Rarely found in first decade of life.
- 20 to 60 years.
- Common in females than males

Vague bony pain and joint pains D/D Rheumatism

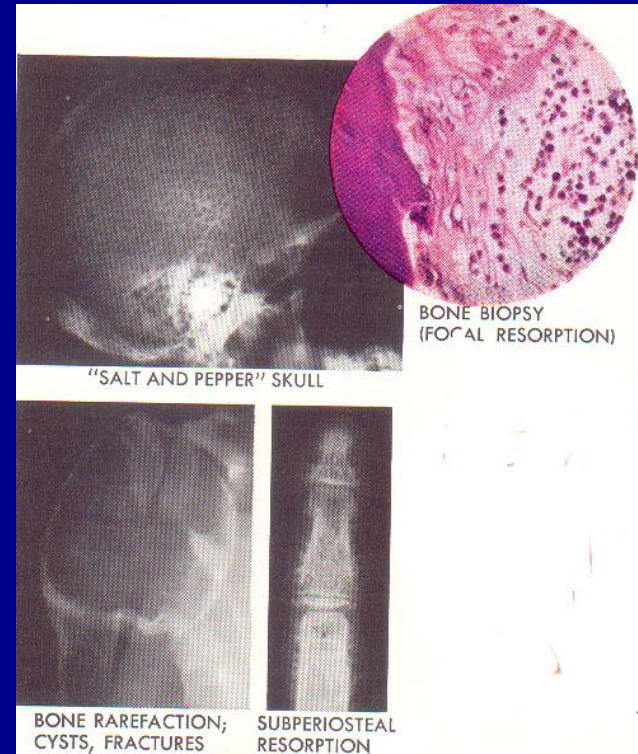


Loss of density and subperiosteal resorption of the phalanges in a case of primary hyperparathyroidism.

Early Skull, Phalanges
Loss of density
Sub Periosteal erosion

Generalized decalcification of skeleton Von-Reclinghausen's disease
(Osteitis cystica fibrosa)

■ Pathological fractures



"SALT AND PEPPER" SKULL

BONE BIOPSY
(FOCAL RESORPTION)

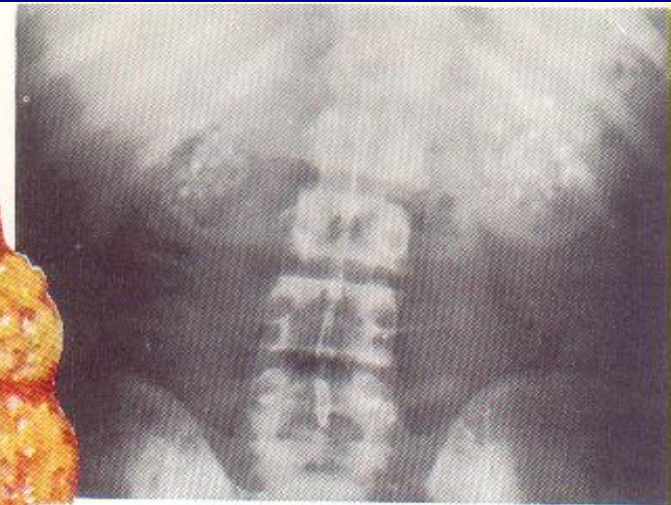
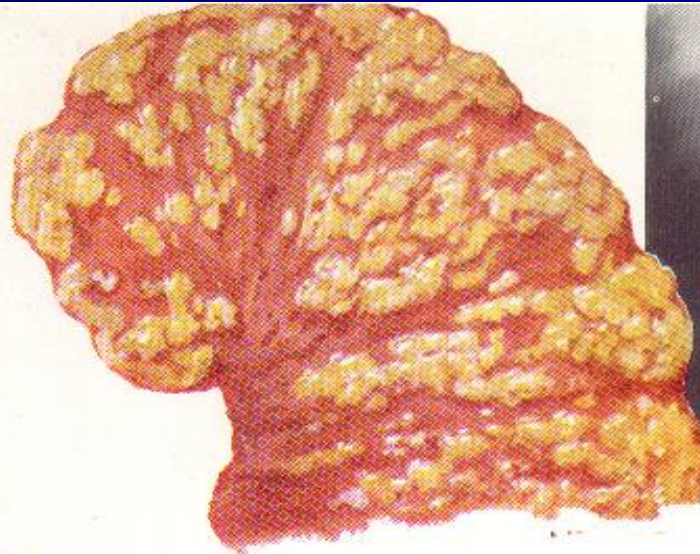
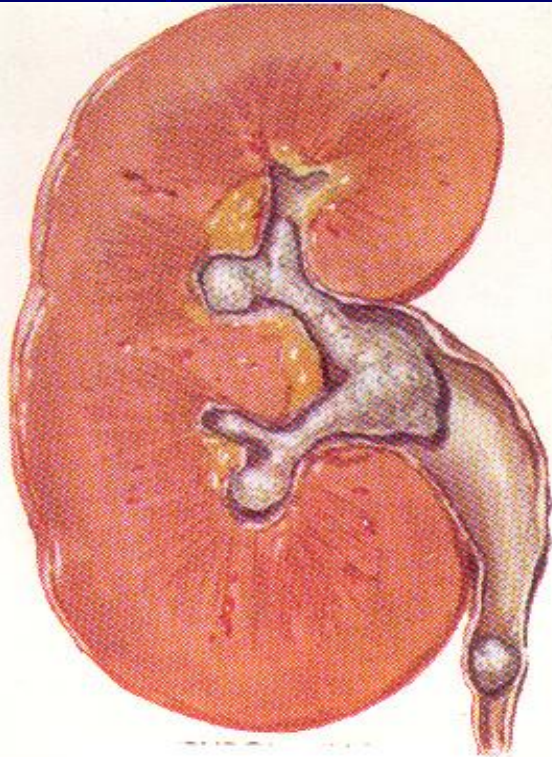
BONE RAREFACTION;
CYSTS, FRACTURES

SUBPERIOSTEAL
RESORPTION

- Late: Generalized calcification
- Multiple bone cyst
- Psuedo tumours of Jaw

Stones:

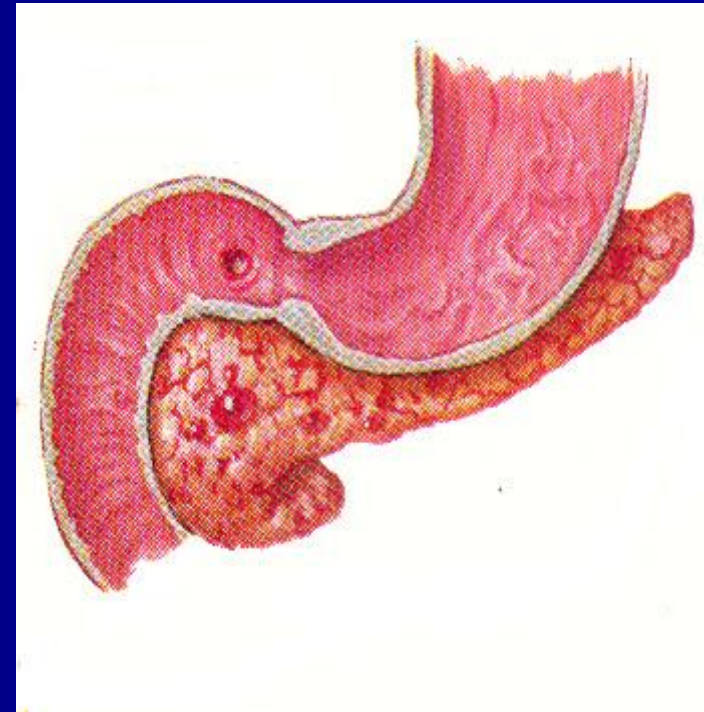
- Multiple, Recurrent Renal Stones.
- Nephrolithiasis – Nephrocalcinosis
- Ectopic Calcification.



Investigate all patients of Multiple and recurrent stones
For Hyperparathyroidism

Abdominal groans

- Dyspeptic cases :
Nauseas,. vomiting,
anorexia.
- Peptic Ulcer
- Pancreatitis



Psychic Moans

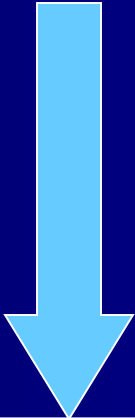
- Uncommon, Lethargy
- Tiredness, Listlessness, irrational behavior
- Wrongly Labeled as Neurotic or Menopausal

Only 50%
present with
these symptoms

Hypercalcemic Syndrome:

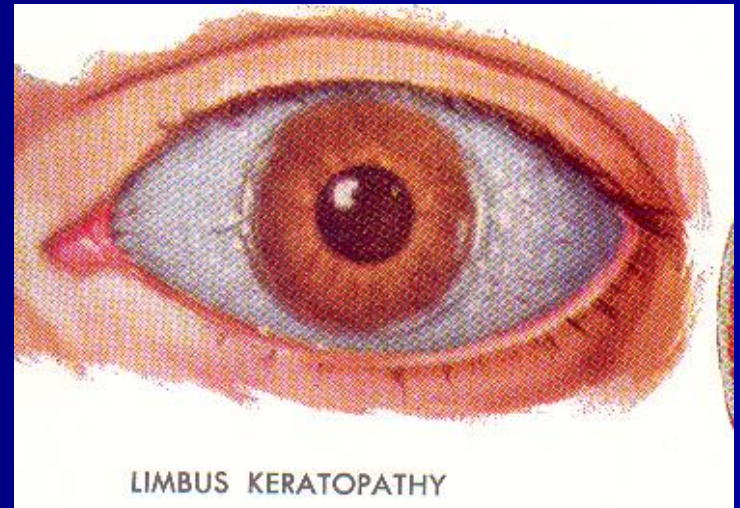
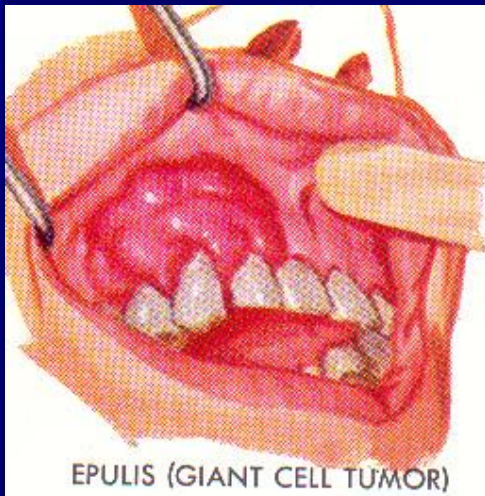
- Minor mental changes, Lethargy
- Polydypsia, Polyurea
- Dehydration, Persistent Irritable GIT
- weigh loss

Acute HPT syndrome

- Nausea, vomiting
 - Abdominal pain
 - Oliguria
 - Coma
- 

Asymptomatic: Detected during biochemical check up.

Parathyroid adenoma is seldom palpable
Corneal calcification may be seen
Hypertension is seen in 50% cases
Shortened QT interval
Diagnosis is Bio chemical



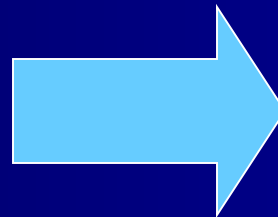
Laboratory Studies

- Serum Calcium : Serial reading for 3 occasions. (9.5 to 11 mg_
- >11 mg% Suspicious of HPT. >12 definite for HPT
 - No tourniquet
 - Long storage
 - Low PO4 diet
 - Diurnal variation 1 to 4%

Cortisone Test

150mg/day/10 days

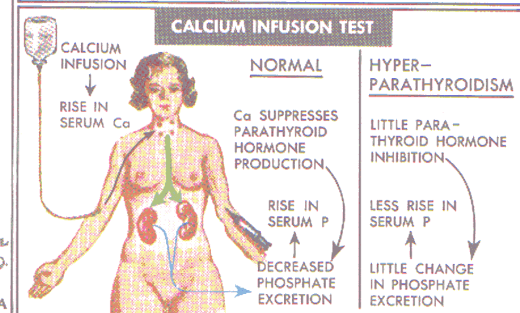
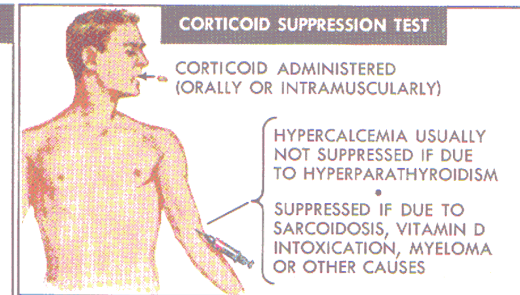
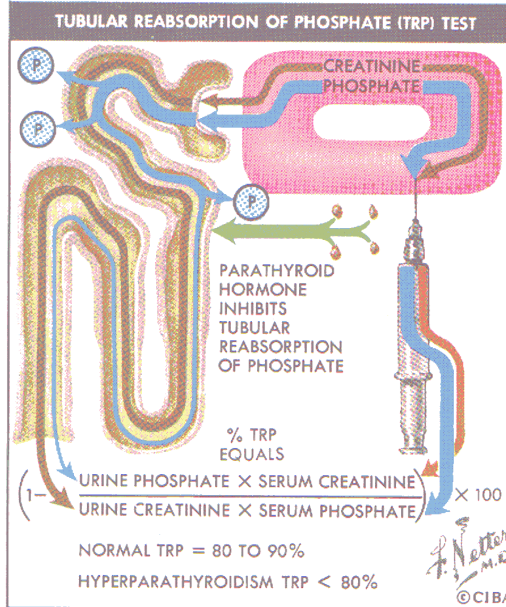
No effect Primary HPT
Calcium levels reduced
all other causes



Secondaries in bone
Carcinoma with endocrine potential
(bronchus, kidney, ovary)
Multiple Myeloma
Sarcoidosis
Thyrotoxicosis,
Hypervitaminosis D

Sulkowitch Test: The patient is given a diet containing 125 mg of calcium daily, for three successive days. In hyperparathyroidism more than 200mg of calcium is excreted in the urine daily (in a normal subject this level will be less than 100 mg).

D/D of Hypercalcaemia



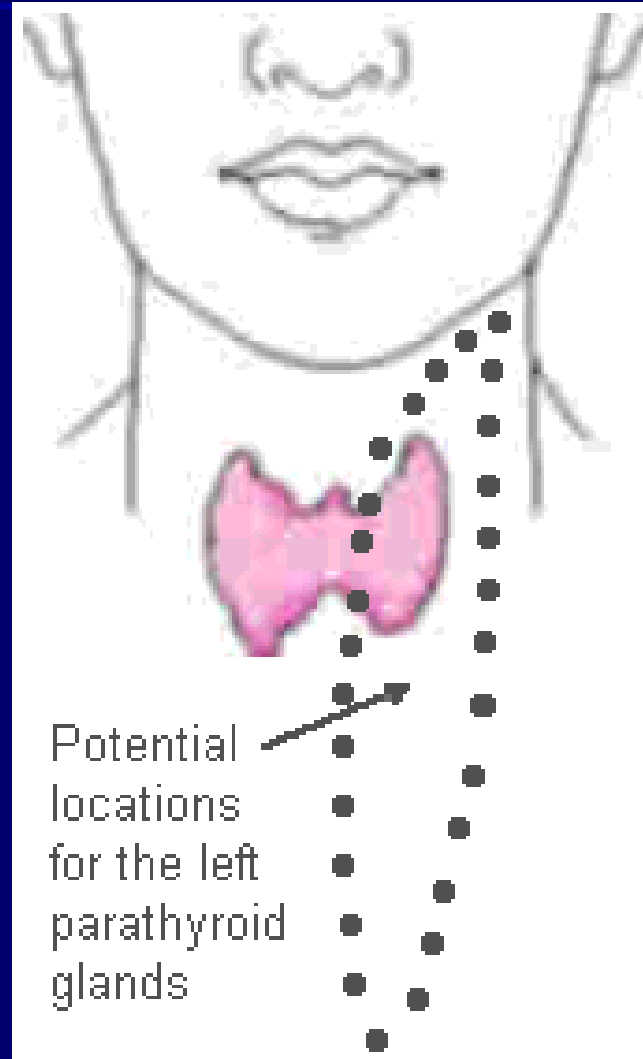
DIFFERENTIAL DIAGNOSIS OF HYPERCALCAEMIC STATES

CONDITION	SERUM Ca	SERUM P	ALK. P'ASE	URINE Ca	TRP	MISC. FINDINGS
HYPER-PARATHYROIDISM	↑	↓	N OR ↑	↑	↓	SUBPERIOSTEAL RESORPTION
MILK-ALKALI SYNDROME	↑	N	N	N OR ↓	N	ULCER HISTORY, SUBCUTANEOUS CALCIFICATION, ALKALOSIS
VITAMIN D INTOXICATION	↑	N OR ↑	N	N OR ↑	N	HISTORY OF VITAMIN D INTAKE
SARCOIDOSIS	↑	N OR ↑	N OR ↑	N OR ↑	N	SERUM GLOBULIN ELEVATED
MULTIPLE MYELOMA	↑	N	N	N OR ↑	N	BENCE JONES PROTEIN IN URINE; SERUM GLOBULIN ELEVATED
METASTATIC CARCINOMA	↑	N	N OR ↑	↑	N	DESTRUCTIVE LESION ON X-RAY
PRIMARY CARCINOMA, NOT INVOLVING BONE	↑	N OR ↓	N	N OR ↑	N OR ↓	PRIMARY LESION, X-RAY, BRONCHOSCOPY
DISUSE ATROPHY (OSTEO-POROSIS)	↑	N OR ↑	N	↑	N	HISTORY OF IMMOBILIZATION
THYROTOXICOSIS	↑	N	N OR ↑	↑	N	LONG-STANDING HYPERTHYROIDISM

Laboratory Studies II

- Serum PO₄ : Lower than normal (<300mg /dl)
- Alkaline PO₄ : increases if there is bone involvement
- Urinary Calcium
 - Low Ca⁺ diet
 - Useful with only high Serum Ca
 - Ser. Ca: Renal Stones.
 - Upper Limit : 250 mg in Males /day 300 mg in Females/day
- Serum Parathormone levels
- Bone biopsy from iliac crest
- CAT Scan
- Ultra Sonogram
- X-Ray Studies.

Localization of Parathyroid Pathology:



Preoperative:

Minimum invasive:

- Ultra Sound operator dependant
- Computed tomography –For localization outside neck
- Barium swallow, and Cine oesophagogram
- Neck massage PTH, urinary cyclic AMP
- Technetium Tc 99m Sestamibi radionuclide 91% to 100% accuracy
- Thallium Technicium isotope Substraction scanning usefull for Adenoma but not for Hyperplasia
- MRI : 64% detection rate Low signal is obtained on T1 weighted images, T2 weighed images give contrast resolution

Localization of Parathyroid Pathology:

- Preoperative: Invasive:
- Selective venous sampling of PTH
- Selective Angiography
- Arterial injection of selenomethionine 15
- Needle aspiration

- Intra operative:
- Methylene blue
- 0-Toluidine blue,
- Urinary Cyclic AMP
- Intraoperative assessment of PTH
- Intraoperative gamma probes for nuclear mapping

MR SHARPHOSPITAL

L10-5 30mm Smparb/thyr

11:13:12 am Fr #75 4.8

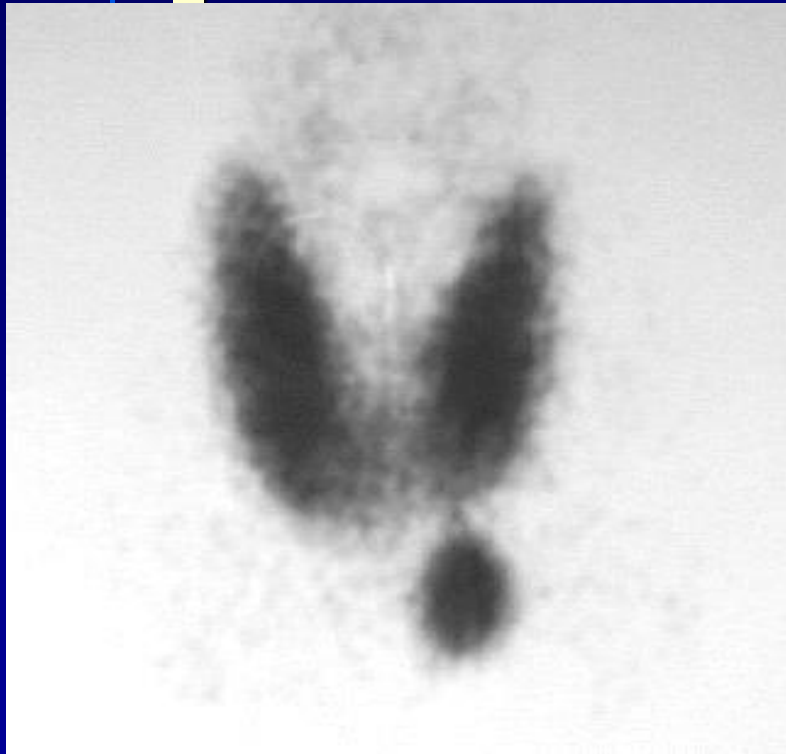
55dB
Med
Med



2.02cm
1.03cm

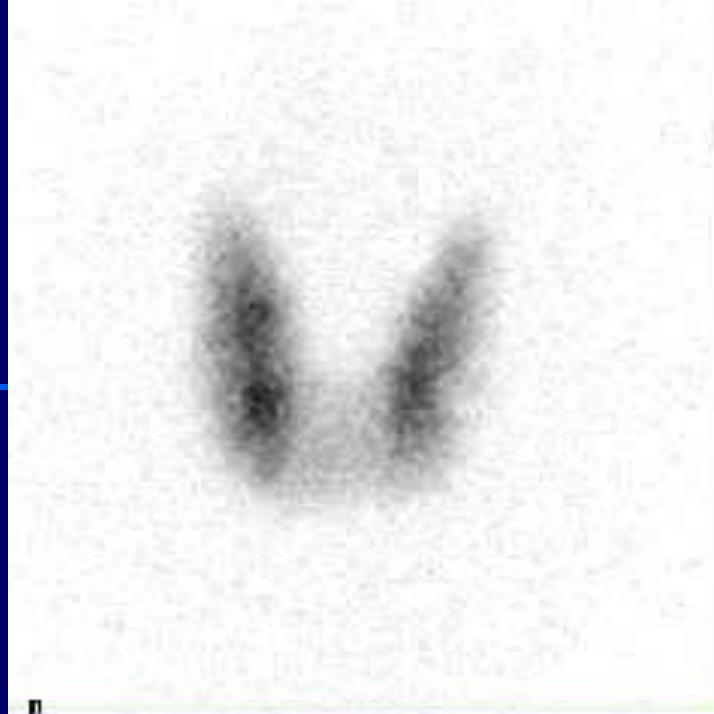
SAG LT PARA THYROID

MIBI scan

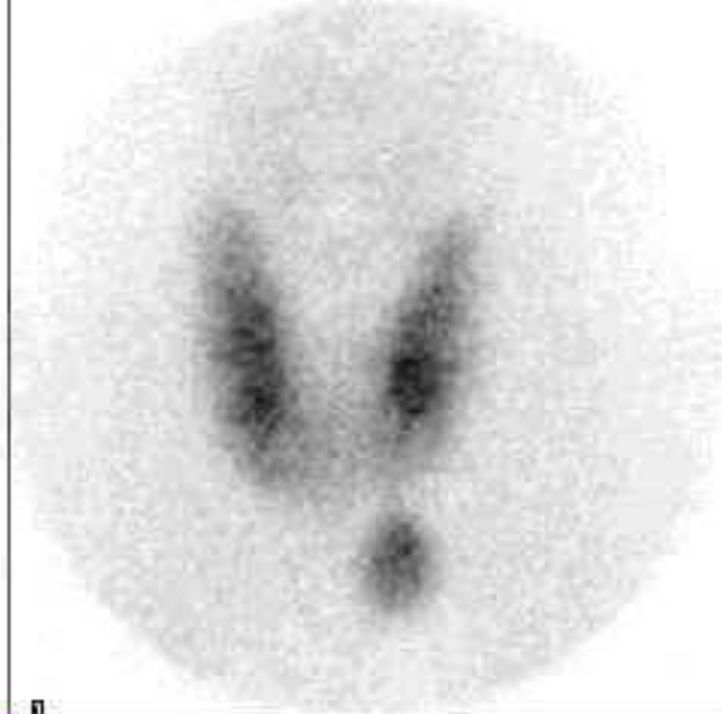


CT scan

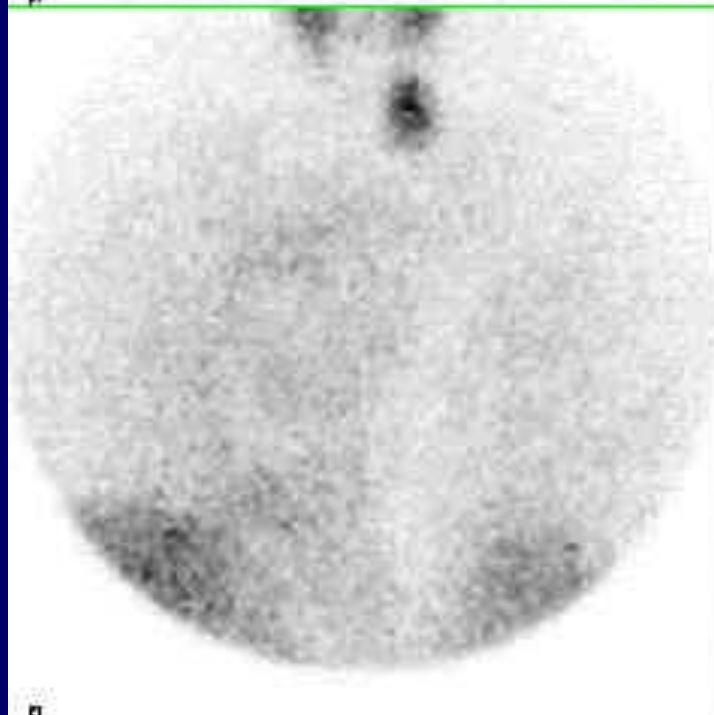




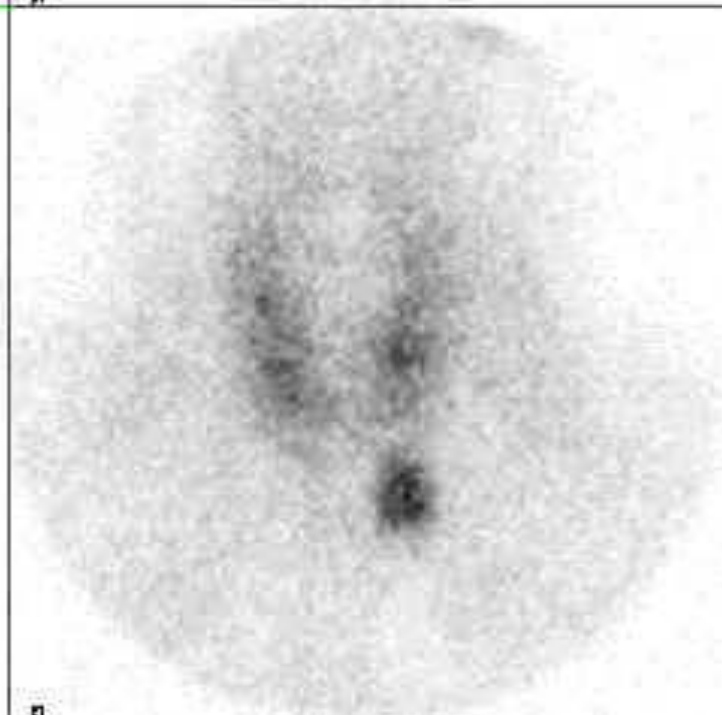
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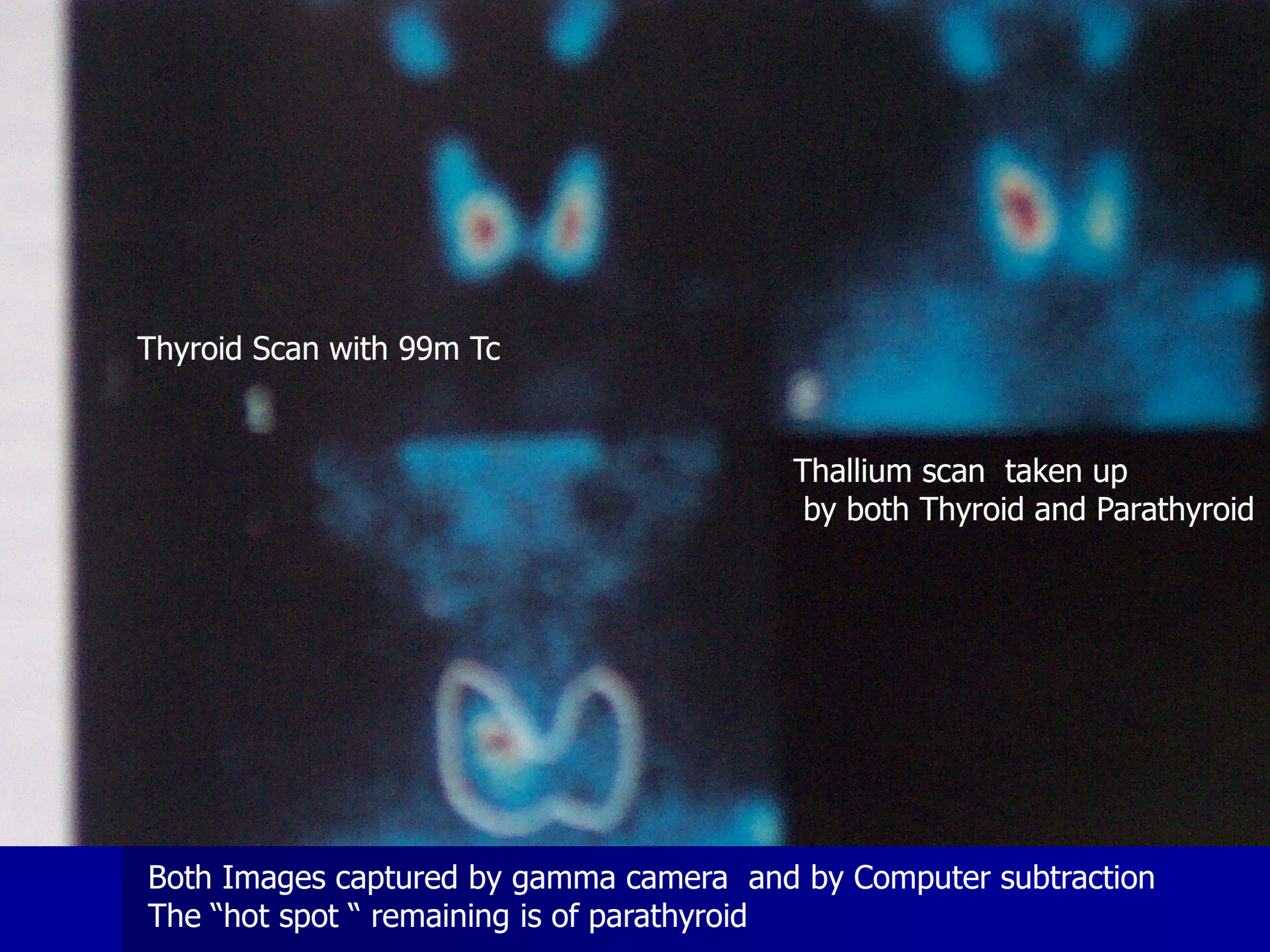
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SESTAMIBI Scan



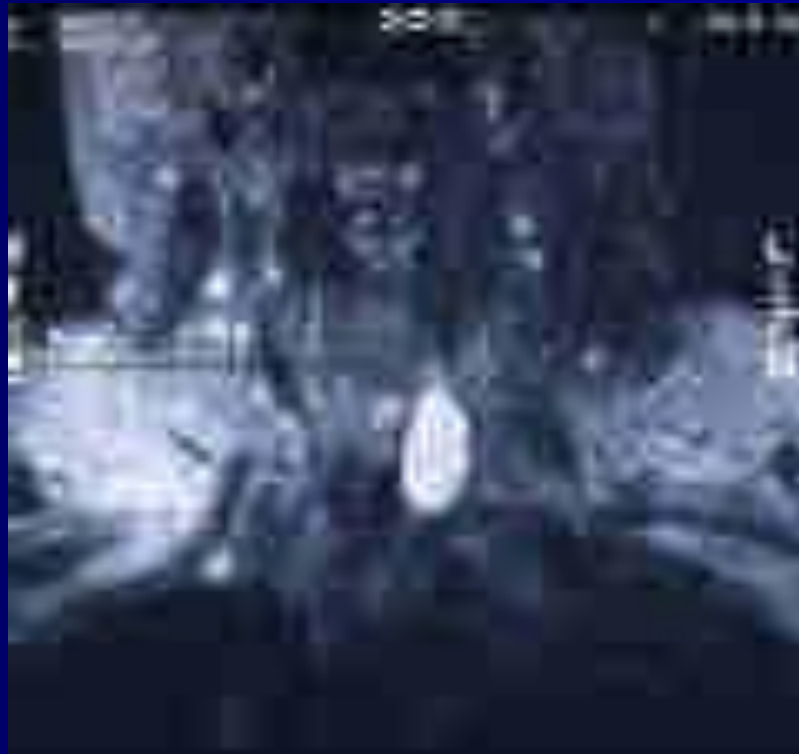


Thyroid Scan with 99m Tc

Thallium scan taken up
by both Thyroid and Parathyroid

Both Images captured by gamma camera and by Computer subtraction
The "hot spot" remaining is of parathyroid

MRI For Parathyroid Adenoma: T2 weighted image



Parathyroidectomy: Indications

1) Primary HPT

Hyperplasia – 3.1/2

Adenoma --- one

Carcinoma – Local Radical Diss.

2) Secondary HPT

– If bone decalcification

- Severe pain.

3) Tertiary HPT

4) Re operative.

Parathyroidectomy History

- Felix Mandl in Vienna, Austria performed the first successful Parathyroidectomy in 1925.
- Endoscopic Parathyroidectomy was pioneered by Dr Michel Gagner at the Cleveland Clinic in 1996

Surgical techniques

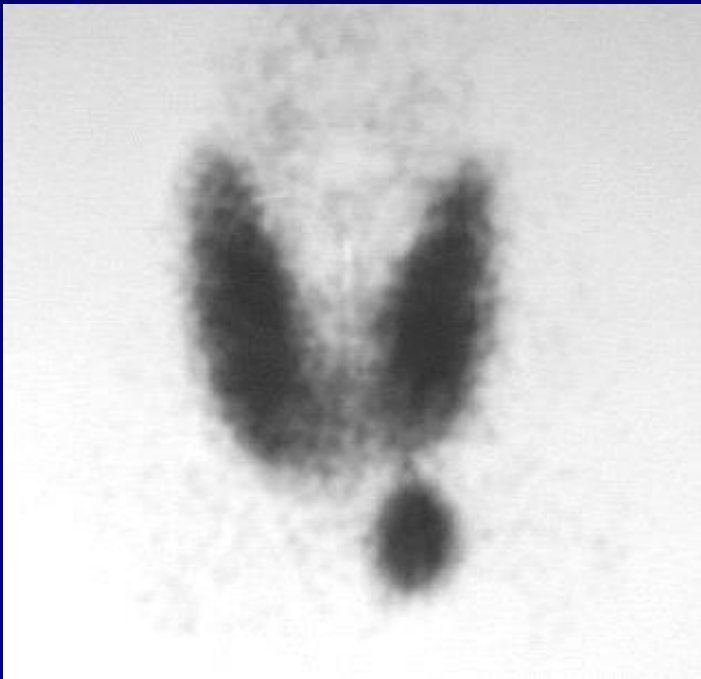
- Open Parathyroidectomy
- Minimally invasive ***Radioguided Parathyroidectomy***
- Endoscopic Parathyroidectomy

Parathyroidectomy

Parathyroidectomy

Radioguided Parathyroidectomy

- The gamma probe is used to localize the maximal area of radioactivity. This correlates with the location of the enlarged parathyroid gland as shown of the sestamibi scan

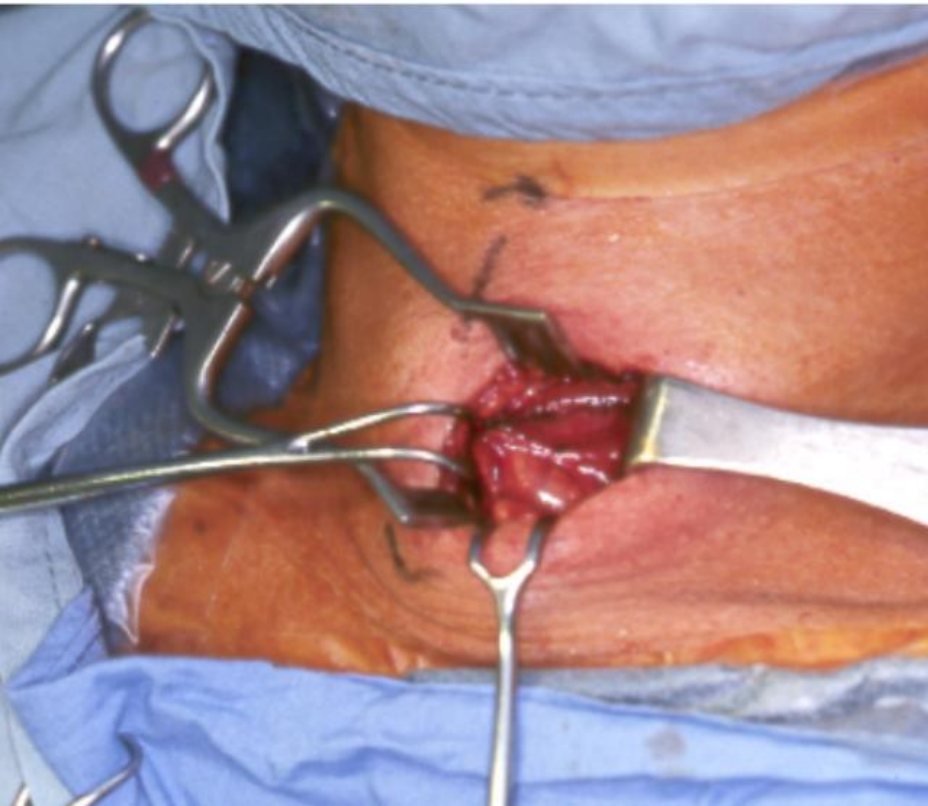


- Marking the incision site. Administration of local anesthesia

Utilization of the gamma probe to guide the surgical dissection.



- Excision of the enlarged parathyroid gland



- Measuring the radioactivity (counts/sec) in the specimen to confirm it is parathyroid tissue.



Auto Transplantation of Parathyroid

- Primary Thyroid hyperplasia
- Secondary HPT
- Re operative HPT
- Total Thyroidectomy for Ca Thyroid

Deferred parathyroid Autotransplantation

- Immediately placed in to sterile saline or tissue culture
- Sliced into 1x1x3mm silvers.
- 3ml Glass vials will accommodate 10 silvers
 - 1 to 1.5 ml
 - 10% DMSO dimethyl sulfoxide
 - 10% autologus serum
 - 80% Tissue culture media
- Frozen 1degree centigrade per minute
- Till you reach -80degree Centigrade
- -190 o C Vapour phase Liquid nitrogen freezer
- Linde BF 4/6 biological freezing system
- Thawing rapidly to 57oC
- Implant in Thigh sub cutaneously

