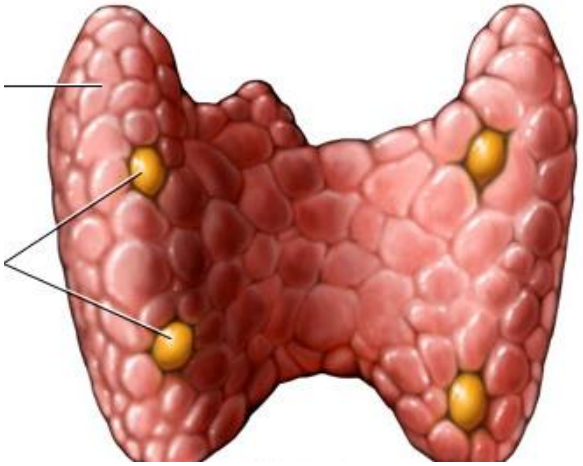
Parathyroid disorders

OBJECTIVES

- understanding physiology of parathyroid hormone and vitamin d
- recognition of causes of hypercalcemia and hypocalcemia
- addressing important diseases such as hypo and hyperparathyroidism , osteoporosis and osteomalacia

Calcium metabolism

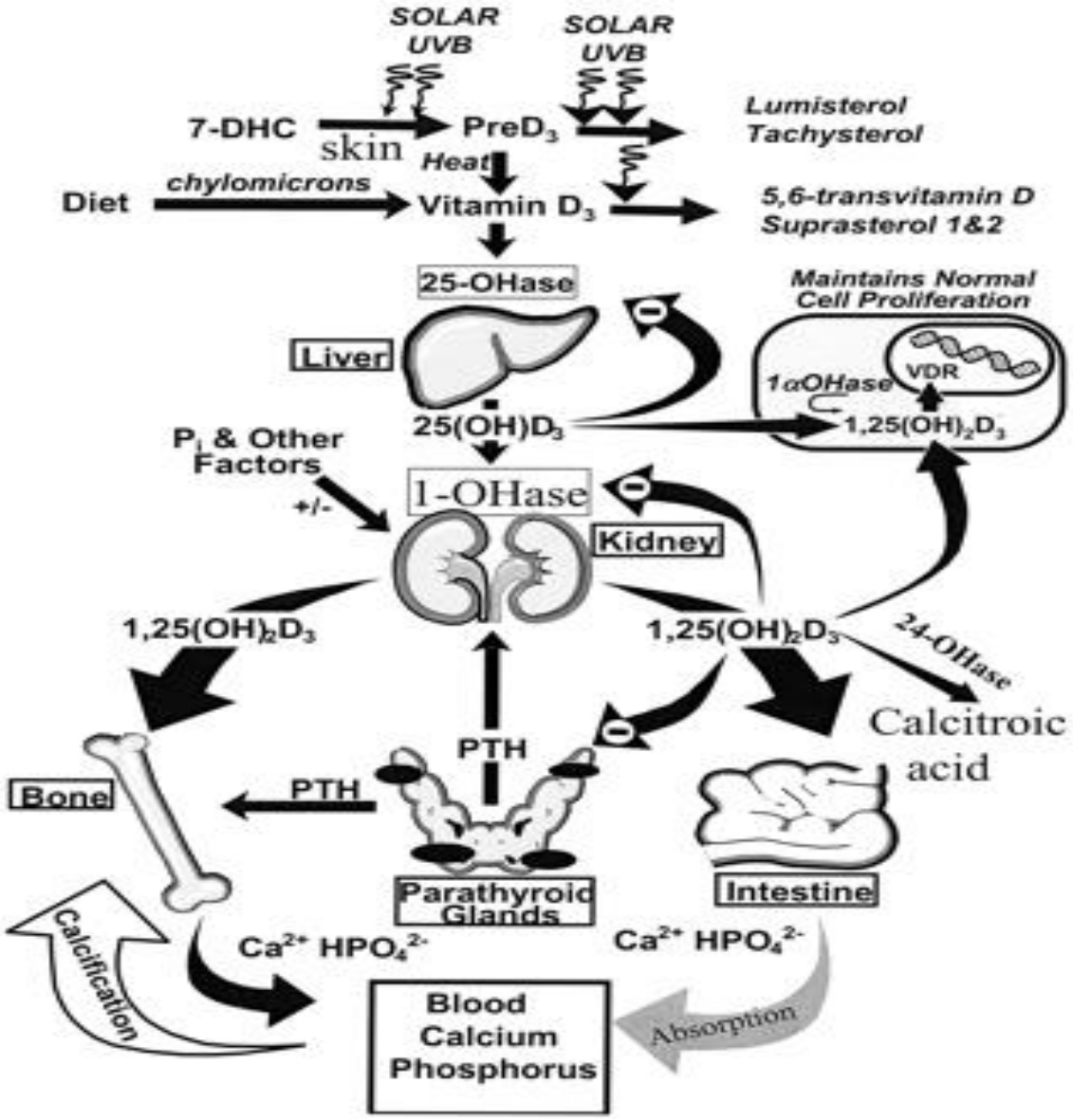


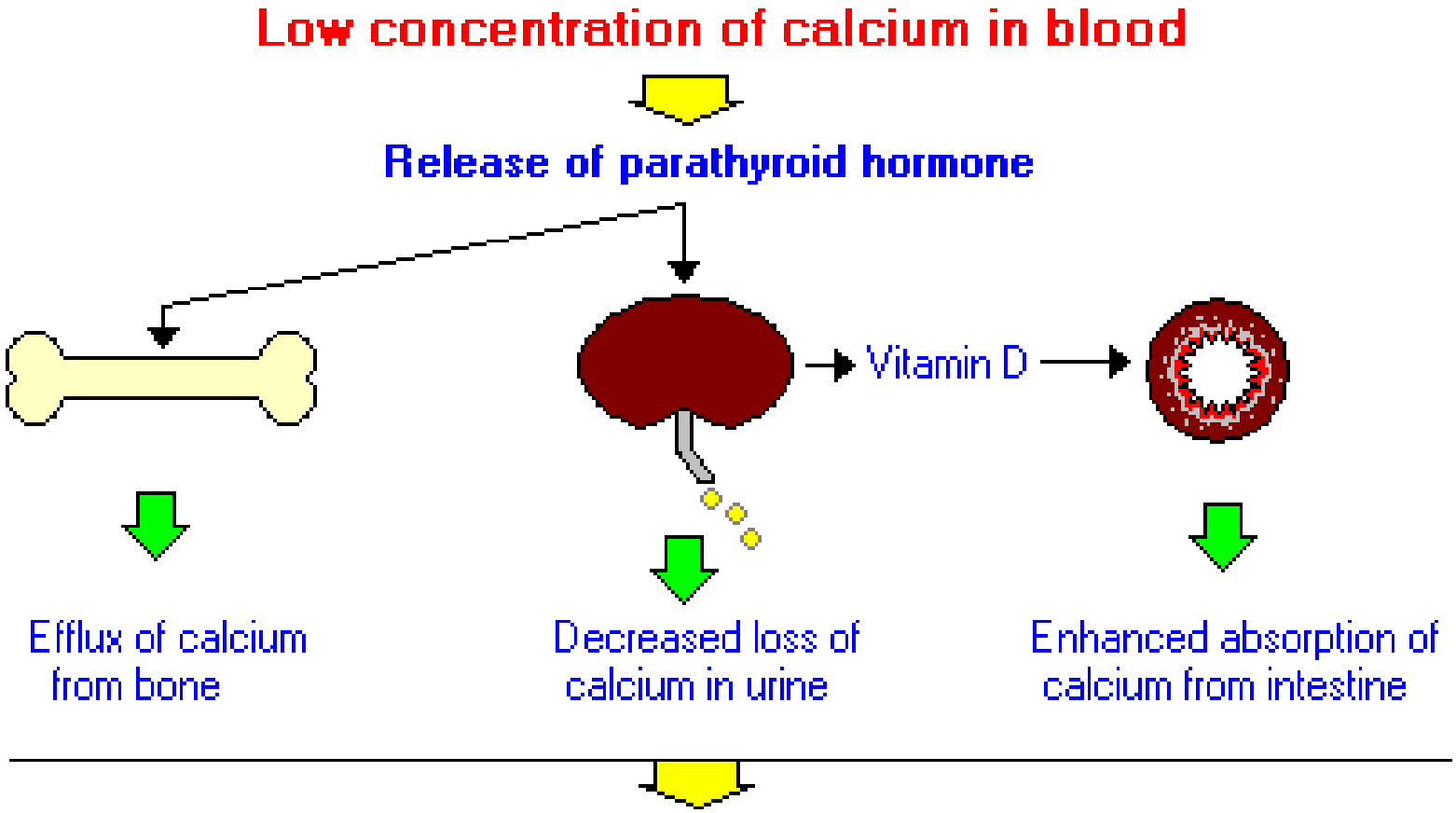
physiology of calcium homeostasis

- PTH (parathyroid hormone)
- Vitamin D
- Calcitonin(parafollicular cells of thyroid gland) : it opposes the effects of PTH by :

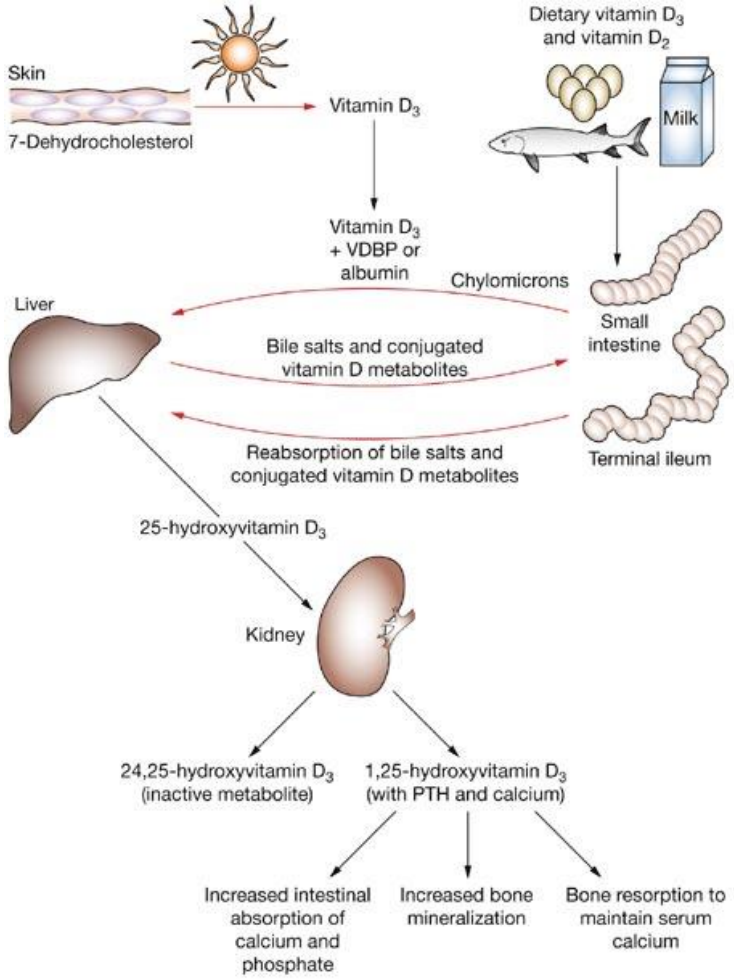
inhibiting osteoclasts from breaking down bone

It inhibits CA reabsorption in renal tubular cells


SOLAR UVB
SOLAR UVB
7-DHC
skin
PreD3
Lumisterol
Tachysterol
Heat
Diet
chylomicrons
Vitamin D3
5,6-transvitamin D
Suprasterol 1&2
25-OHase
Maintains Normal Cell Proliferation
Liver
VDR
1αOHase
25(OH)D3
1,25(OH)2D3
Pi & Other Factors
+/-
1-OHase
Kidney
1,25(OH)2D3
1,25(OH)2D3
24-OHase
Calcitroic acid
PTH
PTH
Bone
Parathyroid Glands
Intestine
Calcification
Ca2+ HPO4 2-
Ca2+ HPO4 2-
Blood
Calcium
Phosphorus
Absorption


Low concentration of calcium in blood
Release of parathyroid hormone
Vitamin D
Efflux of calcium from bone
Decreased loss of calcium in urine
Enhanced absorption of calcium from intestine
Increased concentration of calcium in blood

Vitamin D metabolism



- **Best time for sun exposure in Riyadh**

Summer : 9 am - 10:30 & 2-3 pm

Winter : 10 am -2 pm

Hypercalcemic states

- Causes
- Hyperparathyroidism : presentations
  symptoms
  "stones,bones,abdominal groans&psychic moans"

Impact on bones : osteoporosis , osteotis fibrosa cystica

Impact on kidney : renal stones

Neuromuscular , psychiatric : fatigue , lethargy,depressed mood

Non-specific features : sometimes asymptomatic

Diagnosis

Treatment

Primary hyperparathyroidism

- Most common presentation is asymptomatic hypercalcemia
- “bones,stones,abdominal moansand psychic groans”
- Bone disease : osteoporosis and fractures. Osteitis fibrosa cystica
- Neuromuscular : fatigue and weakness
- Neuropsychiatric : depressed mood,psychosis
- Kidney : nephrocalcinosis , stones(ca oxalate)
- Cardiovascular : hypertension,ventricular hypertrophy

Primary hyperparathyroidism

- Calcium is high
- Phosphorus is low
- PTH is high

Other hypercalcemic states

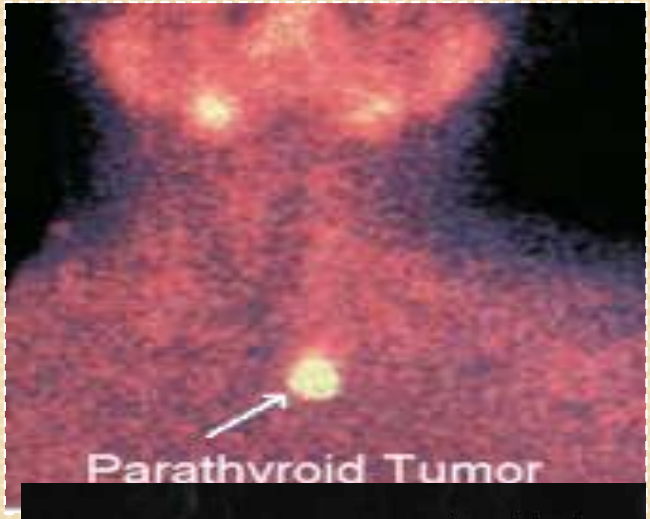
- **Sarcoidosis**
- **Thyrotoxicosis**
- **Adrenal insufficiency**
- **Thiazides & lithium**
- **Hypervitaminosis D**
- **Immobilization**
- **Familial hypocalciuric hypercalcemia(PTH** IS NORMAL) , mild hypercalcemia , hypocalciurea , Mg high normal or high ,autosomal dominanat
- **MALIGNANCY : Increased PTHrp : commonest cause(BREAST CANCER),**
- **MULTIPLE MYELOMA , : production of osteoclast activating factor**
- **LYMPHOMA and SARCOIDOSIS : & 1,25 dihydroxyvitamin D**
- PTH IS NORMAL in malignancy induced hypercalcemia

Treatment of hyperparathyroidism

- In primary hyperparathyroidism : if patient is symptomatic (lithiasis , osteoporosis, pancreatitis)surgery is indicated: bilateral neck exploration or focused parathyroid exploartion if adenoma is localized preopeatively
- Intraopertave PTH monitoring
- endoscopic parathyroidectomy
- Medical treatment : cinacalcet (calcimemetic agent) : if patient is a high surgical risk.

- Preoperative localization : U/S , CT ,MRI ,sestamibi scan
- Removal of adenoma

  If hyperplasia : subtotal (removal of 3 ½ of glands)



SURGERY OF PRIMARY HYPE M

Secondary hyperparathyroidism

- Chronic renal disease causing hypocalcemia
- Severe vitamin D deficiency
- Malabsorption

Tertiary Hyperparathyroidism

After long standing secondary hyperparathyroidism

Hypoparathyroidism

Causes : hypoparathyroidism (autoimmmune or post surgery ,

Hypomagnesaemia : Mg is important for the release of PTH and for its effect)

Polyglandular autoimmune syndrome Type I (mucocutneous candidiasis →hypoparathroidism→hypoadrenalism

- Pseudohypoparathyroidism : type 1A autosomal dominant . Resistance to PTH+ somatic features. Type 1B : isolated resistance . PTH IS HIGH

- Clinical presentations : acute tetany(post surgical)OR chronic :
- Eye : cataract , CNS (calcification of basal ganglia) causing extrapyramidal disorders
- Cardiac : prolonged QT interval .

Hypocalcemia with high PTH :

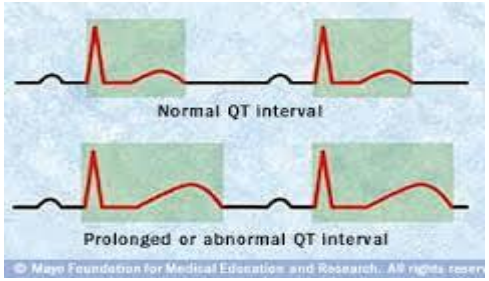
- Vitamin D deficiency
- Renal impairment
- Vitamin D dependent rickets (1-alpha-hydroxylase deficiency) and hereditary resistance to to vitamin D).
- Pseudohypoparathyroidism (resistance to the action of PTH)

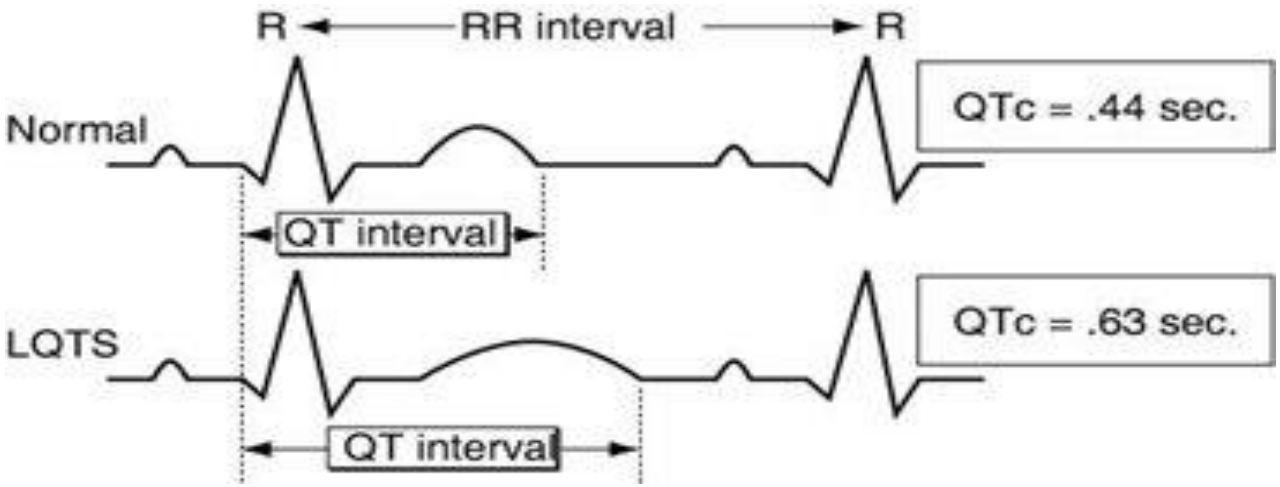
Hypoparathyroidism

- Low calcium
- High phosphorus
- Low PTH

Clinical presentation

- Numbness around mouth , hands and feet)
- If severe hypocalcemia : tetany
- Trosseau sign(carbopedal spasm when inflating sphygmomanometer 20 mmHg above systolic BP)
- Chovstek sign (contraction of facial muscles on tapping on zygomatic arch)
- ECG : prolonged QT interval




R
RR interval
R
Normal
QTc = .44 sec.
QT interval
LQTS
QTc = .63 sec.
QT interval

Treatment of hypocalcemia

- Calcium carbonate : 1-2 gm daily
- vitamin D analogs : calcitriol or alfacalcidol
- If severe and acute with tetany : give 10 cc of 10% calcium gluconate slowly and under ECG monirtoring (careful in patients on digoxin)

Osteoporosis

DEFINITION

DIFFERNTIATIING OSTEOPOROSIS FROM OSTEOMALACIA

CAUSES

DIAGNOSIS

PREVENTION

TREATMENT

DEFINITION OF OSTEOPOROSIS

- Low bone mass with micrarctictural disruption resulting in fracture from minimal trauma.

Causes of osteoporosis

- Menopause
- Old age
- Calcium and vitamin D deficiency
- Estrogen deficiency in women and androgen deficiency in men
- Use of steroids

Exclude secondary causes especially in younger individuals and men

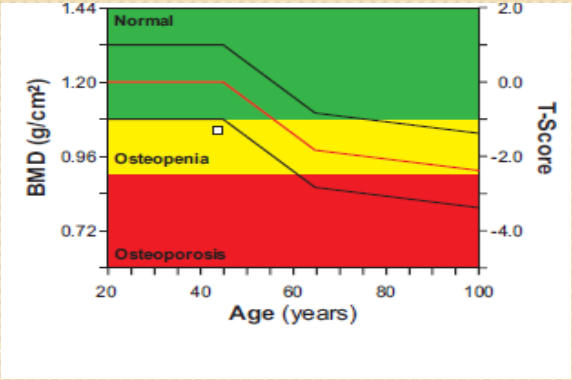
Box 2: Common secondary causes of bone loss

- Hyperparathyroidism (primary or secondary)
- Vitamin D inadequacy
- Malabsorption state (e.g., celiac disease, inflammatory bowel disease, short gut syndrome)
- Hypercalciuria
- Hyperthyroidism
- Chronic lung disease
- Malignancy (e.g., myeloma, bony metastasis)
- Rheumatoid arthritis
- Hepatic insufficiency

Diagnosis of osteoporosis

- Dual-energy x-ray absoptiometry (DXA) measuring bone minaeral density (BMD) and comparing it to BMD of a healthy woman
- More than -2.5 SD below average : osteoporosis

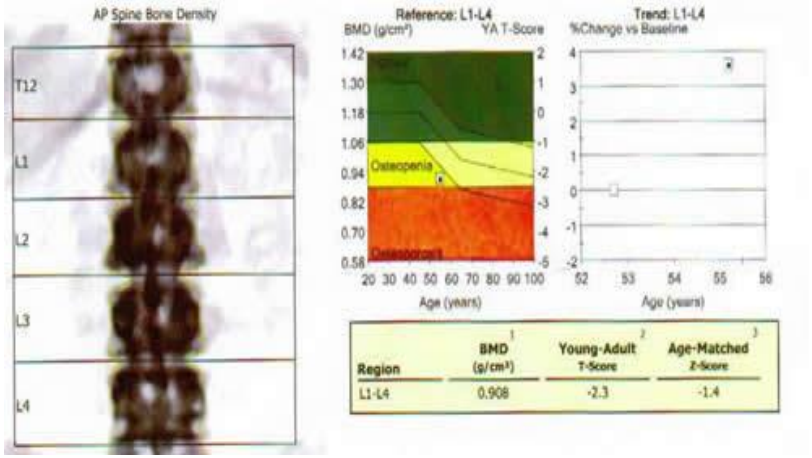
Lumbar spine
Femoral neck



Bone density scanner

WHO Osteoporosis criteria 1994

- Definition based on BMD :
- Normal : greater than or equal to -1 SD
- Osteopenia: BMD which lies between - 1 and -2.5 SD
- Osteoporosis : less than or equal to – 2.5 SD
- Severe osteoporosis : osteoporosis with 1 or more fragility fractures



Treatment of osteoporosis

- Prevention
- Public awareness
- Adequate calcium and vitamin D supplements
- Bisphphosnates : reducing bone breakdown
- Denosumab : reduces bone break down
- Teriparatide : anabolic

Effects

- Steroids for several days causes bone loss more on axial bones (40 %) than on peripheral bones (20%).
- Muscle weakness
- Prednisolone more than 5 mg /day for long time

Management

- Use smallest possible dose
- Shortest possible duration
- Physical activity
- Calcium and vitamin D
- Pharmacologic treatment: bisphosphontaes , ? PTH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Saudi Osteoporosis Society

Osteomalacia

Definition of osteomalacia

- Reduced mineralization of bone
- Rickets occurs in growing bone

Causes of osteomalacia

- Vitamin D deficiency (commonest cause)
- Ca deficiency
- Phosphate deficiency
- Liver disease
- Renal disease
- Malabsorption (Celiac disease)
- Hereditary forms
- (intestinal and gastric surgery) : bariatric surgery
- Drugs : anti epileptic drugs

Clinical presentation

- Two thirds of patients are asymptomatic
- Incidental radiological finding
- Unexplained high alk phosph
- Large skull,frontal bossing,bowing of legs, deafness,erythema, bony tenderness
- Fracture tendency: verteberal crush fractures , tibia or femur. Healing is rapid.

- Bony aches and pains
- Muscle weakness

LAB.

lab

Ca level

Po4 level

Alk phosph

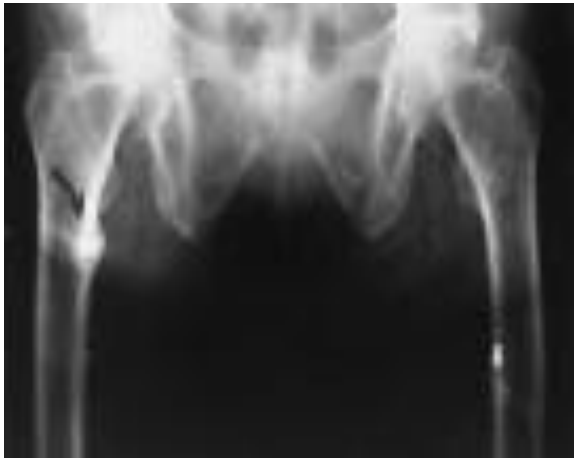
PTH

Vitamin D level

- Low serum vitamin D
- High PTH
- High serum alkaline phosphatase

Radiology

- X-ray: growing bones vs mature bones. Subperiosteal resorption , looser”s zones (pathognomonic).
- Bone scan



Treatment of osteomalacia

- Calcium and vitamin D supplements
- Sun exposure
- Results of treatment is usually very good.
- Correcting underlying cause