* impact mainly on ossification and Mineralization (decrease them)

METABOLIC DISORDERS

- **Osteopenia**: decreased bone mass (1-2.5 SD below the mean).
- **Osteoporosis**: severe osteopenia; ≥ than 2.5 SD below the mean with increase risk for fractures
- Generalized (much more common) or localized

bone decrease (bone density) Standard Deviation

* 1–2.5 (SD) below the mean → osteopenia
* > 2.5 (SD) // → osteoporosis

(involve the entire skeleton)

Types of osteoporosis ??

↓ or

↳ and this types wich we look talk about

PRIMARY OSTEOPOROSIS	SECONDARY OSTEOPOROSIS
Much more common Senile (aging) & postmenopausal ↳ It increases with aging Primary osteoporosis	Much less common Hyperthyroidism, malnutrition, steroids * Secondary osteop... has relations with these diseases.

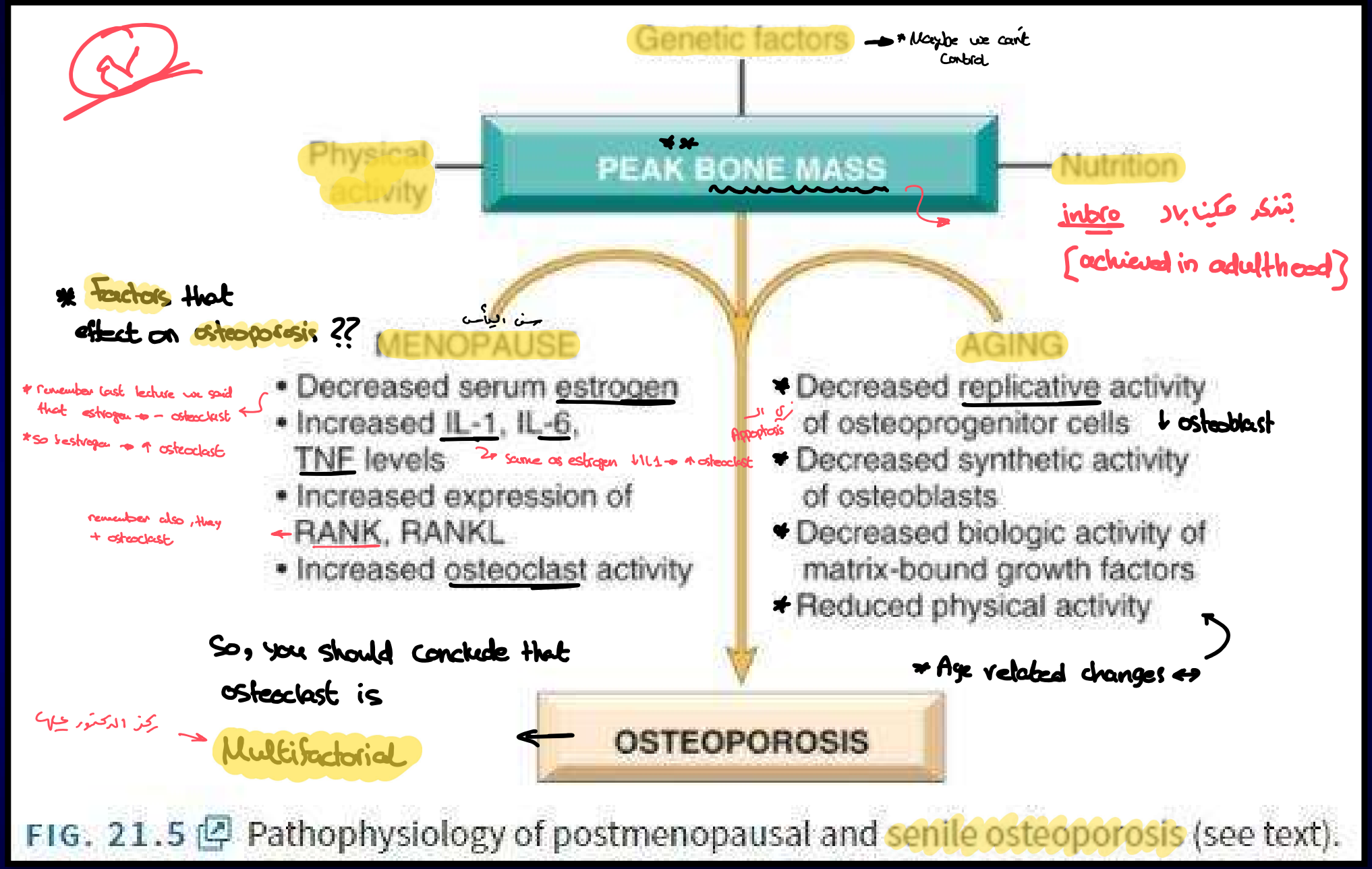


FIG. 21.5 Pathophysiology of postmenopausal and senile osteoporosis (see text).

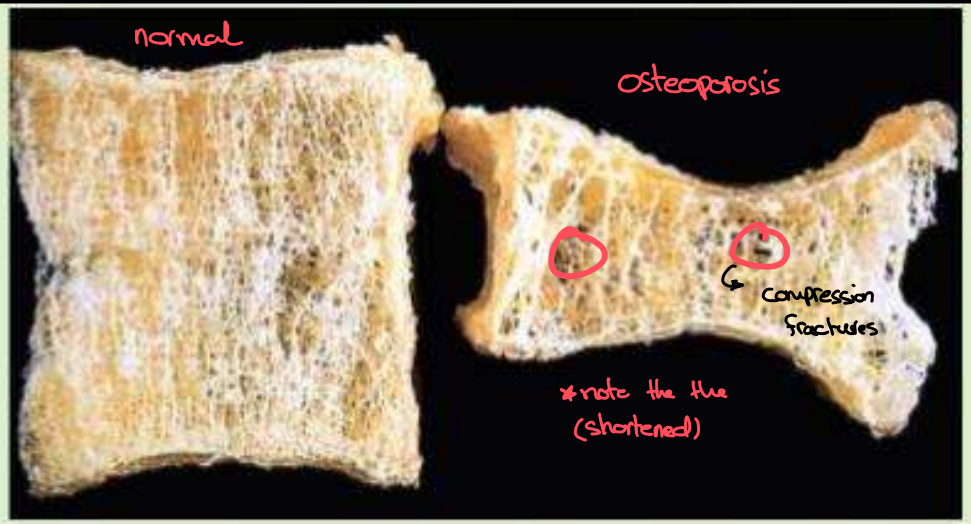
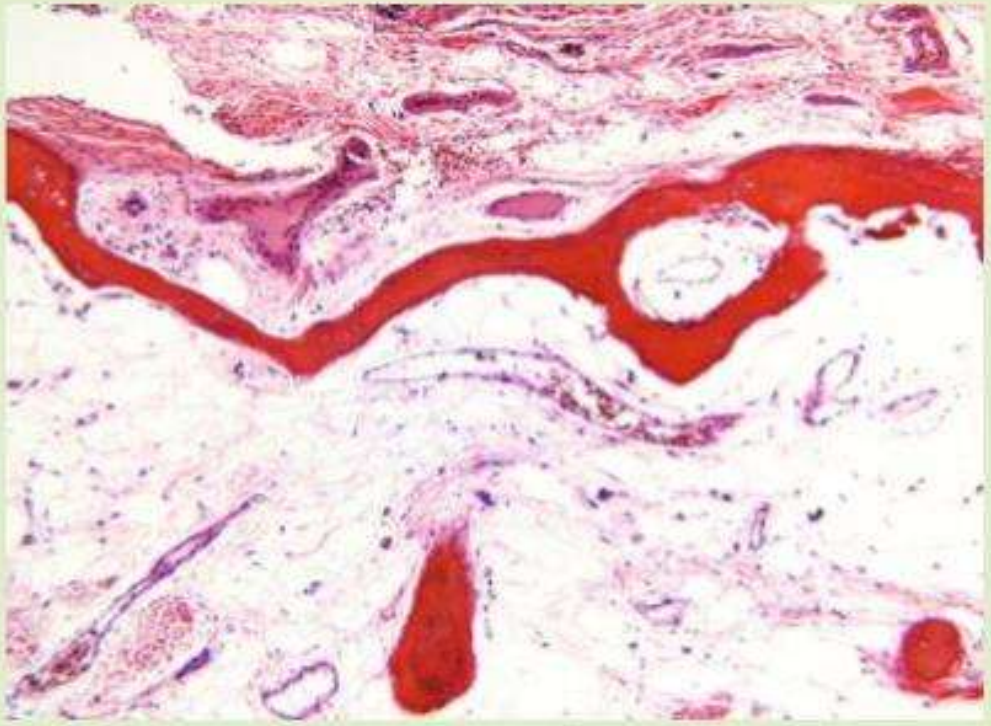


FIG. 21.6 Osteoporotic vertebral body *(right)* shortened by compression fractur..

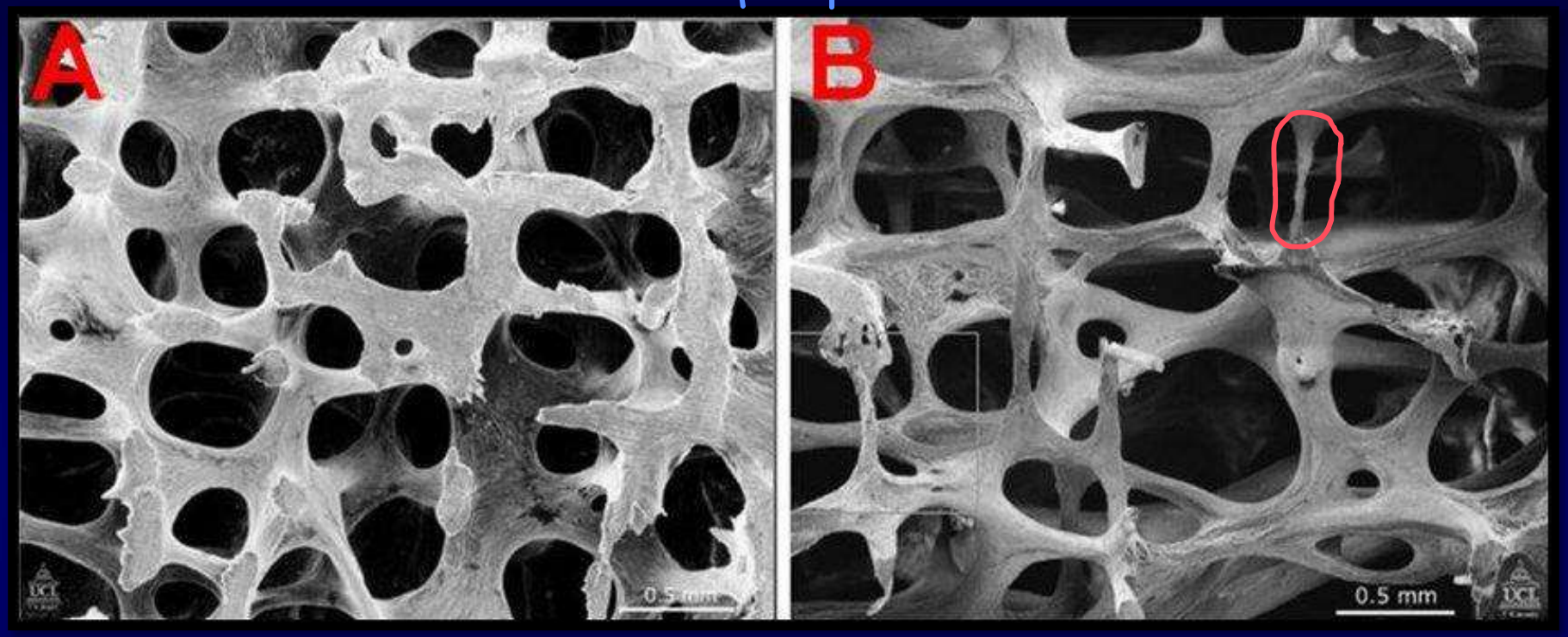


H&E

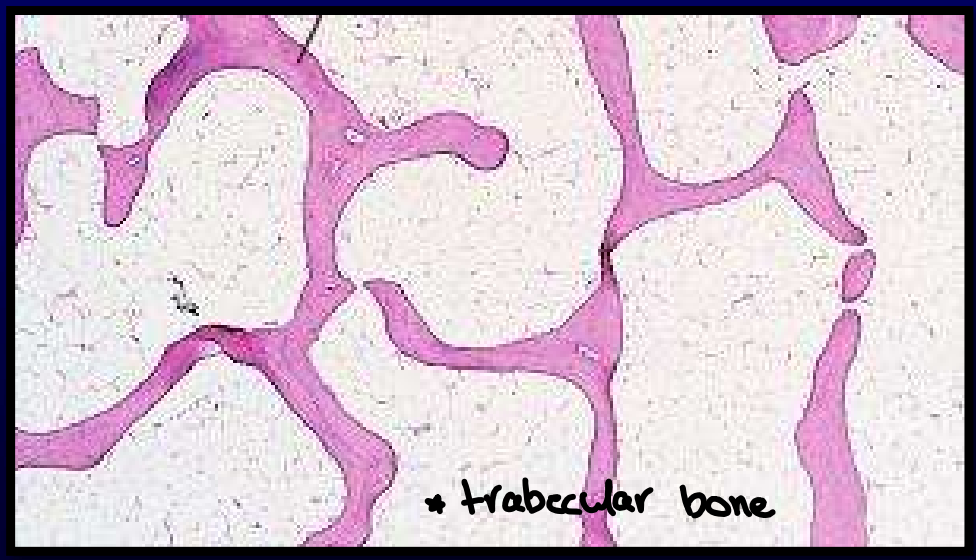
FIG. 21.7 In advanced osteoporosis, both the trabecular bone of the medulla *(b..*

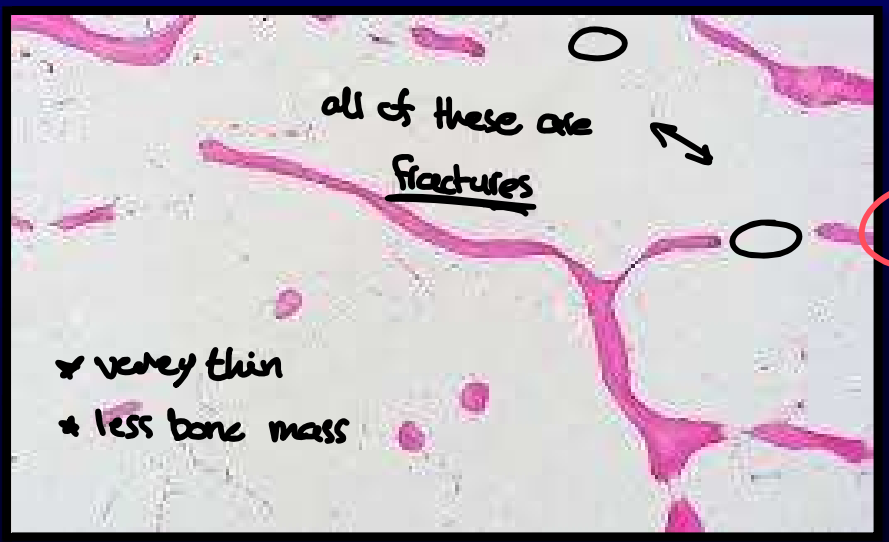
Those 2 pictures are SCAN (EM)

Normal bone : Osteoporosis



A





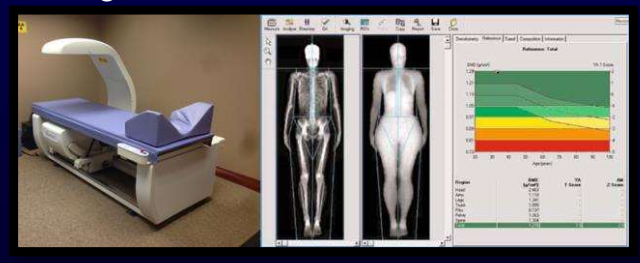
B

OSTEOPOROSIS CLINICALLY

- Vertebral fractures → Frequently occur and will cause
- Femur and pelvic fractures: immobility, PEs, pneumonia (40-50K death/yr in USA)

Pulmonary embolism

- Diagnosis: special imaging technique, bone mineral density (BMD scan): dual-energy X-ray absorptiometry (DXA or DEXA scan) or bone densitometry



PREVENTION AND TREATMENT

prevention more important than treatment

- Exercise → ↑ densit of the bones, ↑ osteoblast ...
- Calcium & vitamin D

} These two are the most important

- Bisphosphonates: reduce osteoclast activity and induce its apoptosis
- Denosumab: anti-RANKL; blocking osteoclast activation → Most common nowadays
- Hormones (estrogen): risking DVT and stroke

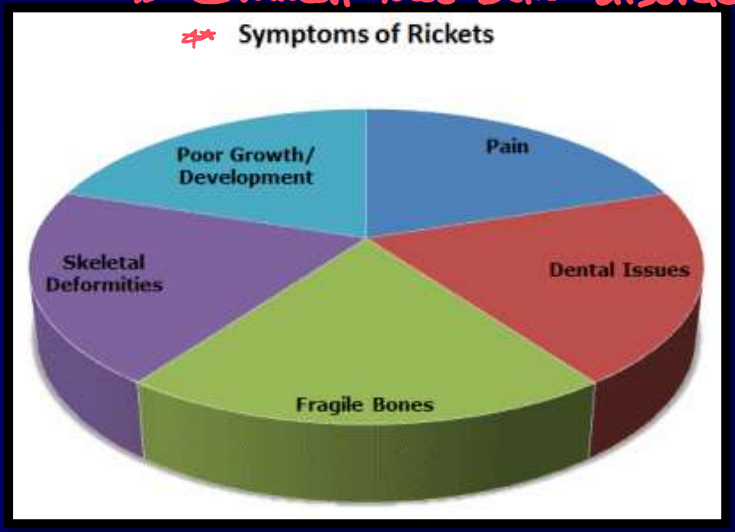
(Deep venous thrombosis)

- osteoclast

but this hormones has a problem ??

RICKETS & OSTEOMALACIA

↳ less common Metabolic disorder



- Vitamin D deficiency or abnormal metabolism of vitamin D.
- in Children: Rickets (called)
- in Adults: osteomalacia (called)
- Decreased mineralization of bone, unmineralized matrix
- **Increase risk of fractures**

* and we should not see it nowadays

+ This is not a Fracture

↑ PTH which lead to ↑ osteoclast, osteopenia

* more common compared with [Rickets & osteomalacia]

** HYPERPARATHYROIDISM (HPT)

* كل اللي بيتشرح in details in endocrine.

* بطلع الـ Ca^{++} من الـ blood للـ serum

So ↑ Ca^{++} serum

Hyperparathyroidism classification

Different causes and features of hyperparathyroidism - raised parathormone (PTH).

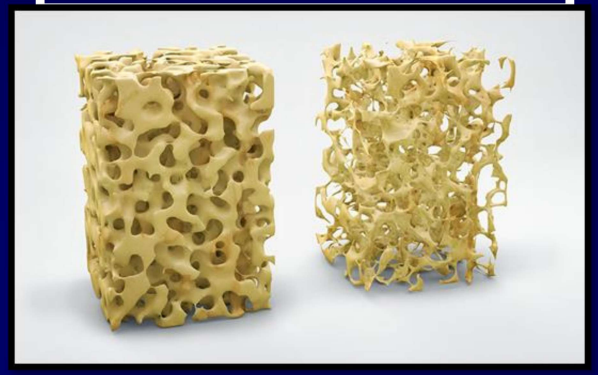
	* primary (very common)	* secondary	* tertiary
pathology	Hyperfunction of parathyroid cells due to hyperplasia, adenoma or carcinoma.	Physiological stimulation of parathyroid in response to hypocalcaemia.	Following long term physiological stimulation leading to hyperplasia.
associations	May be associated with multiple endocrine neoplasia.	Usually due to chronic renal failure or other causes of Vitamin D deficiency.	Seen in chronic renal failure.
serum calcium	high	low / normal	high
serum phosphate	low / normal	high	high
management	Usually surgery if symptomatic. Cincacalcet can be considered in those not fit for surgery.	Treatment of underlying cause.	Usually cinacalcet or surgery in those that don't respond.

NICE have issued guidance for the use of cinacalcet in what they call refractory secondary hyperparathyroidism which is classified as tertiary hyperparathyroidism in this tblable. http://www.nice.org.uk/TA117

* Long term complications → so

HPT CLINICALLY

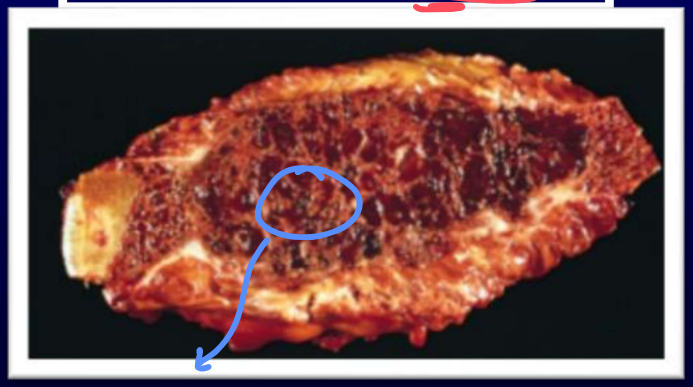
OSTEOPOROSIS



This is an old term, it's not a neoplasmic tumor.

* (non-neoplasm)

BROWN TUMOR



* brown bone filled with blood

↳ result of: vascularity, hemorrhage and hemosiderin

OSTEITIS FIBROSA CYSTICA →→

Severe form of HPT

Abbreviated OFC, also known as osteitis fibrosa, osteodystrophia fibrosa, and von Recklinghausen's disease of bone (not to be confused with von Recklinghausen's disease, neurofibromatosis type I)

** Prevention more important than treatment

Summary

Metabolic Disorders of Bone

- **Osteopenia** and **osteoporosis** represent histologically normal bone that is decreased in quantity. In osteoporosis the bone loss is sufficiently severe to significantly increase the risk of fracture. The disease is very common, with marked morbidity and mortality from fractures. Multiple factors including peak bone mass, age, activity, genetics, nutrition, and hormonal influences contribute to its pathogenesis.
- **Osteomalacia** is characterized by bone that is insufficiently mineralized. In the developing skeleton, the manifestations are characterized by a condition known as **rickets.**
- **Hyperparathyroidism** arises from either autonomous or compensatory hypersecretion of PTH and can lead to **osteoporosis**, **brown tumors,** and **osteitis fibrosa cystica**. However, in developed countries, where early diagnosis is the norm, these manifestations are rarely seen.

Lecture 3

PAGET DISEASE OF BONE (OSTEITIS DEFORMANS)

- Increased badly formed bone structure.
- 3 phases (lytic, mixed, sclerotic)
- 1% in USA; geographic variation
- Genetic and environmental factors
- 50% of familial Paget and 10% of sporadic have SQSTM1 gene mutations (+RANK & -OPG)
- Viruses (measles and RNA viruses)??

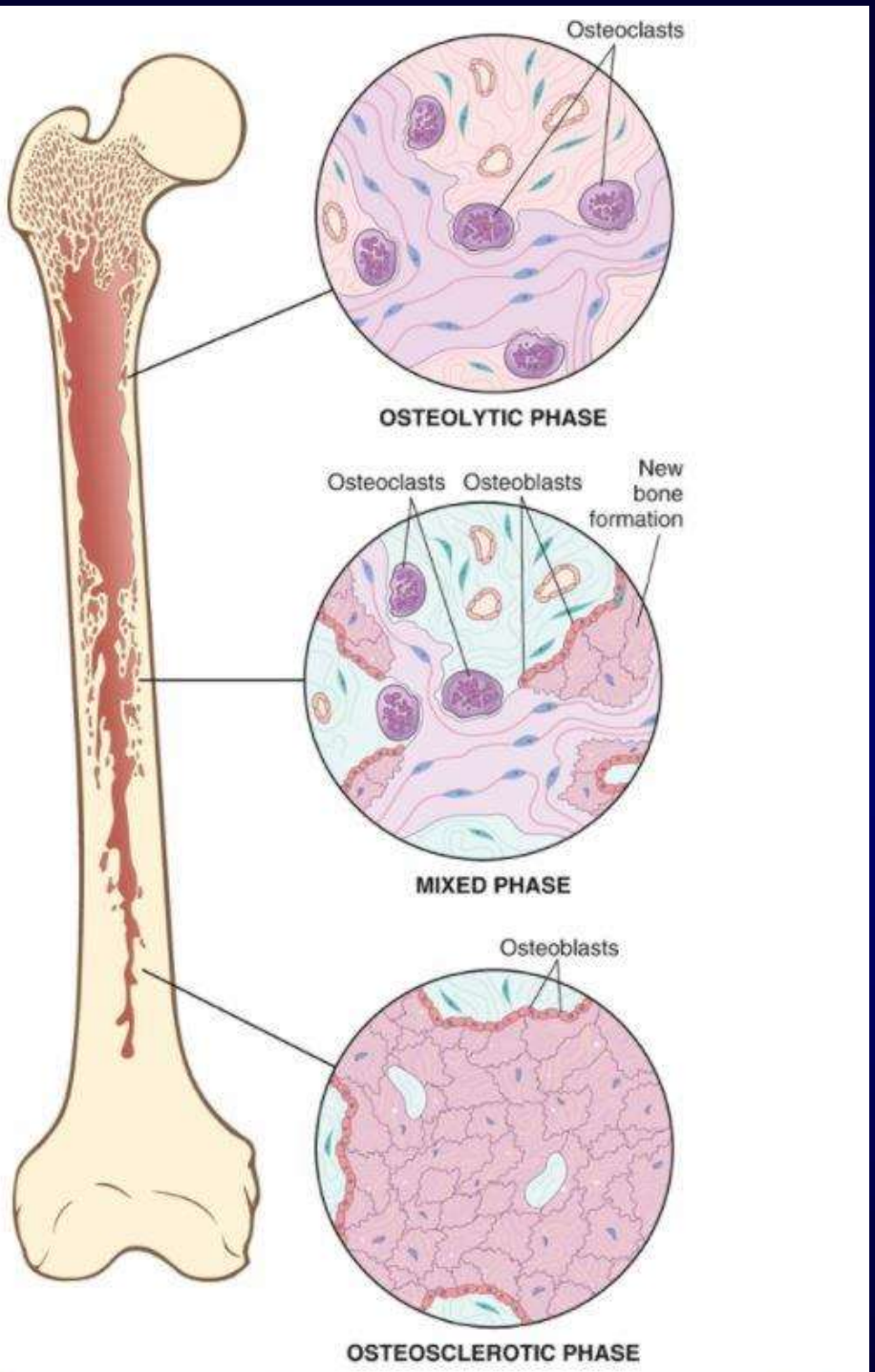
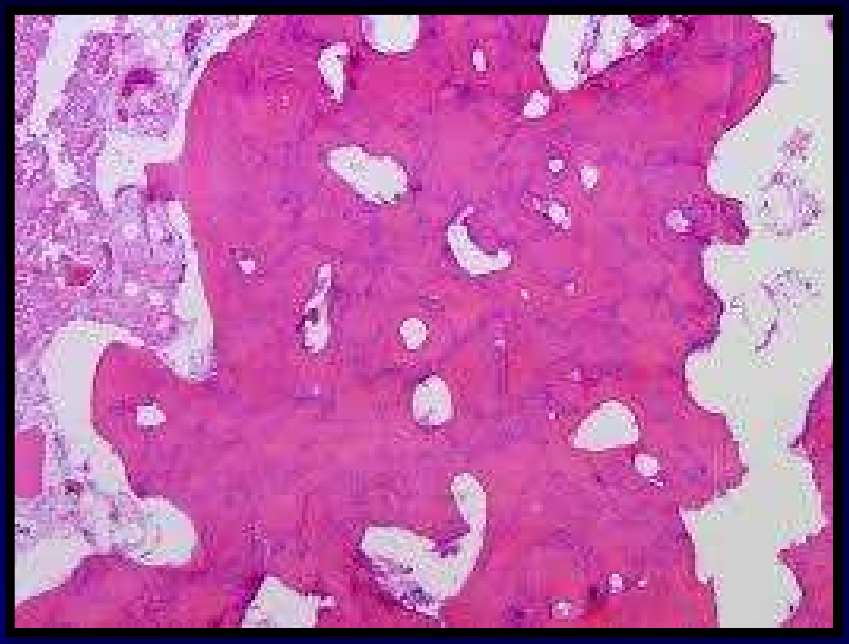
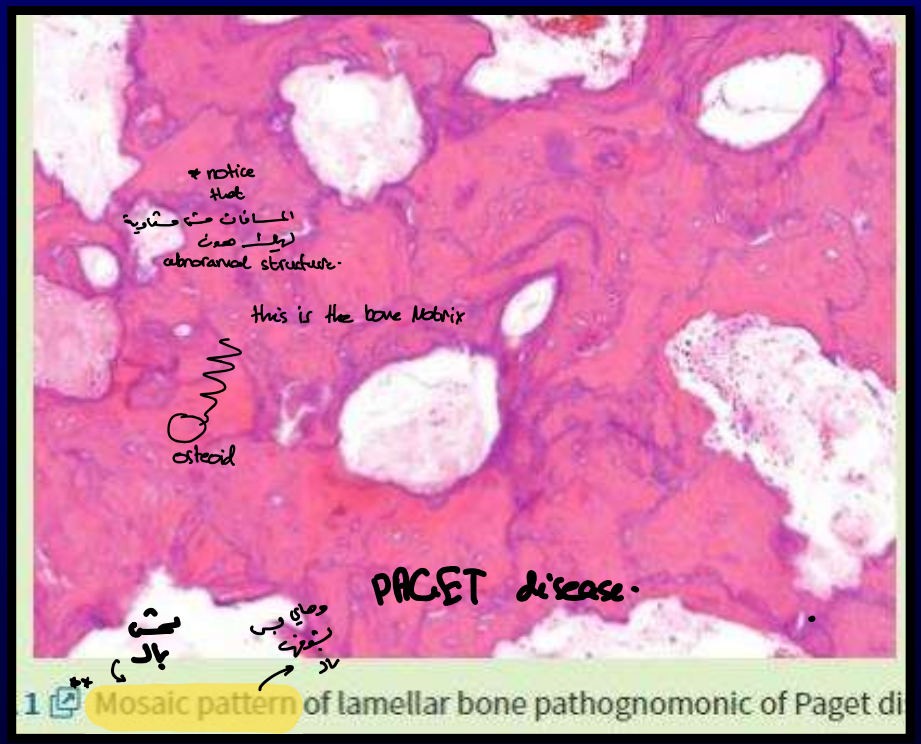
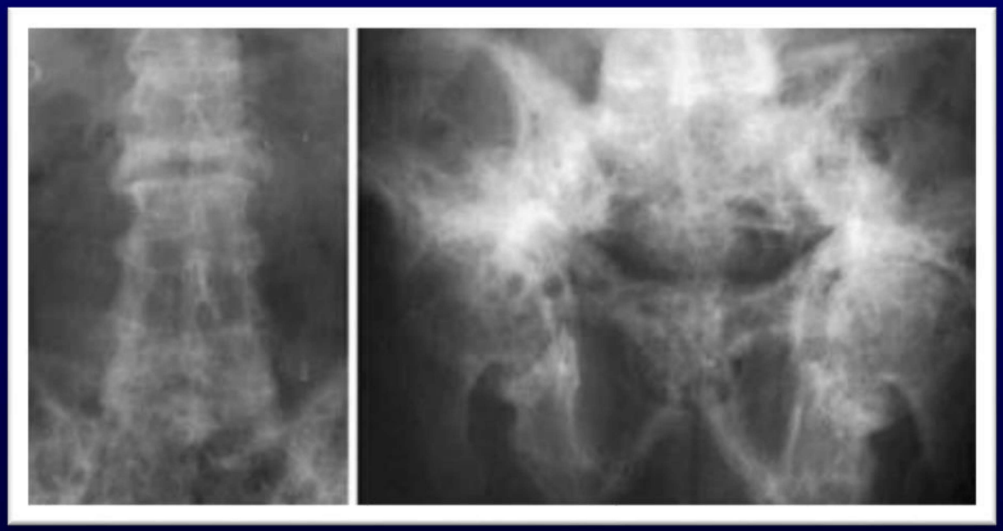


FIG. 21.10 Diagrammatic representation of Paget disease of bone demonstrating the t...





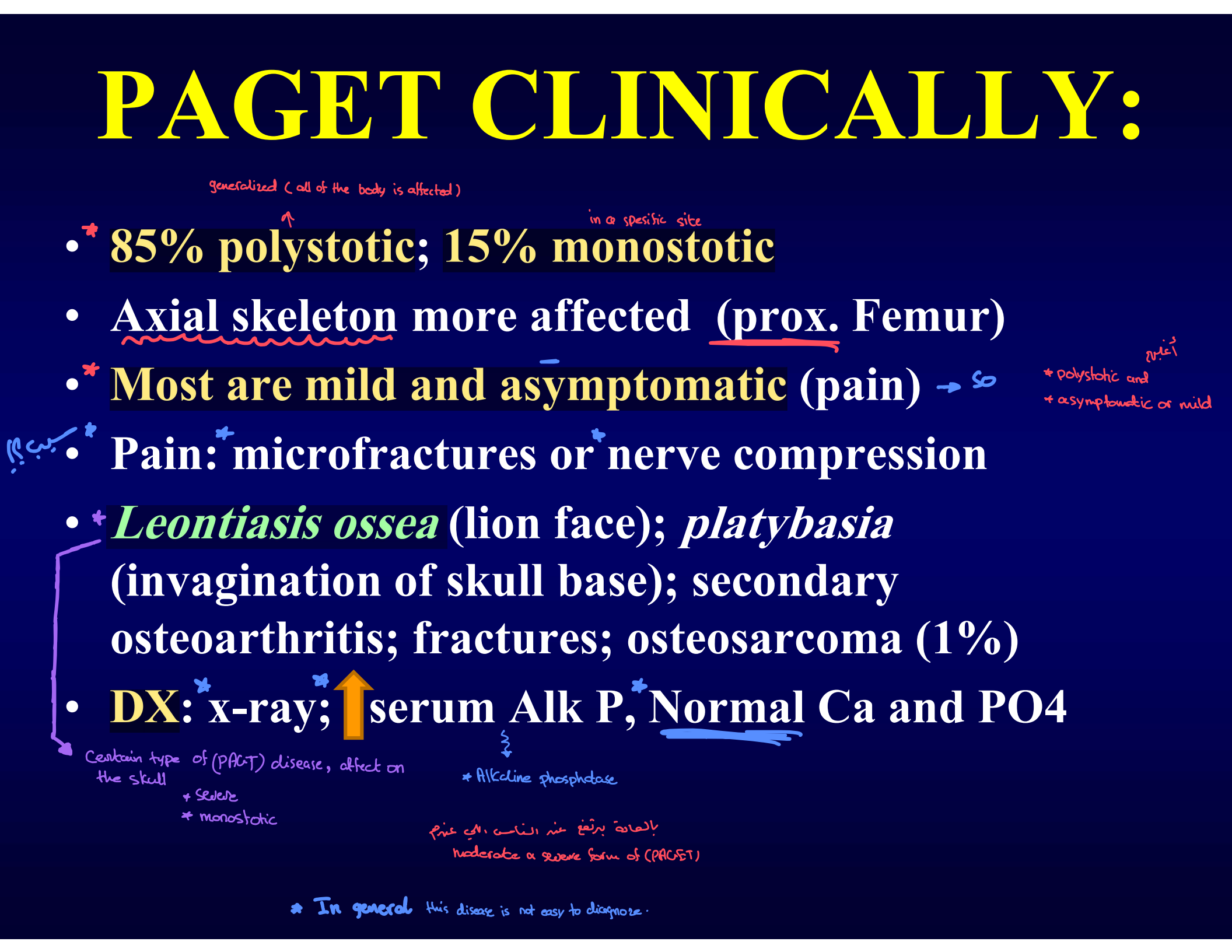
(trabecular bone)



Severe PAGET disease

PAGET CLINICALLY:

- **85% polystotic; 15% monostotic**
- **Axial skeleton more affected (prox. Femur)**
- **Most are mild and asymptomatic (pain)**
- **Pain: microfractures or nerve compression**
- ***Leontiasis ossea*** **(lion face);** ***platybasia*** **(invagination of skull base); secondary osteoarthritis; fractures; osteosarcoma (1%)**
- **DX: x-ray; serum Alk P, Normal Ca and PO4**

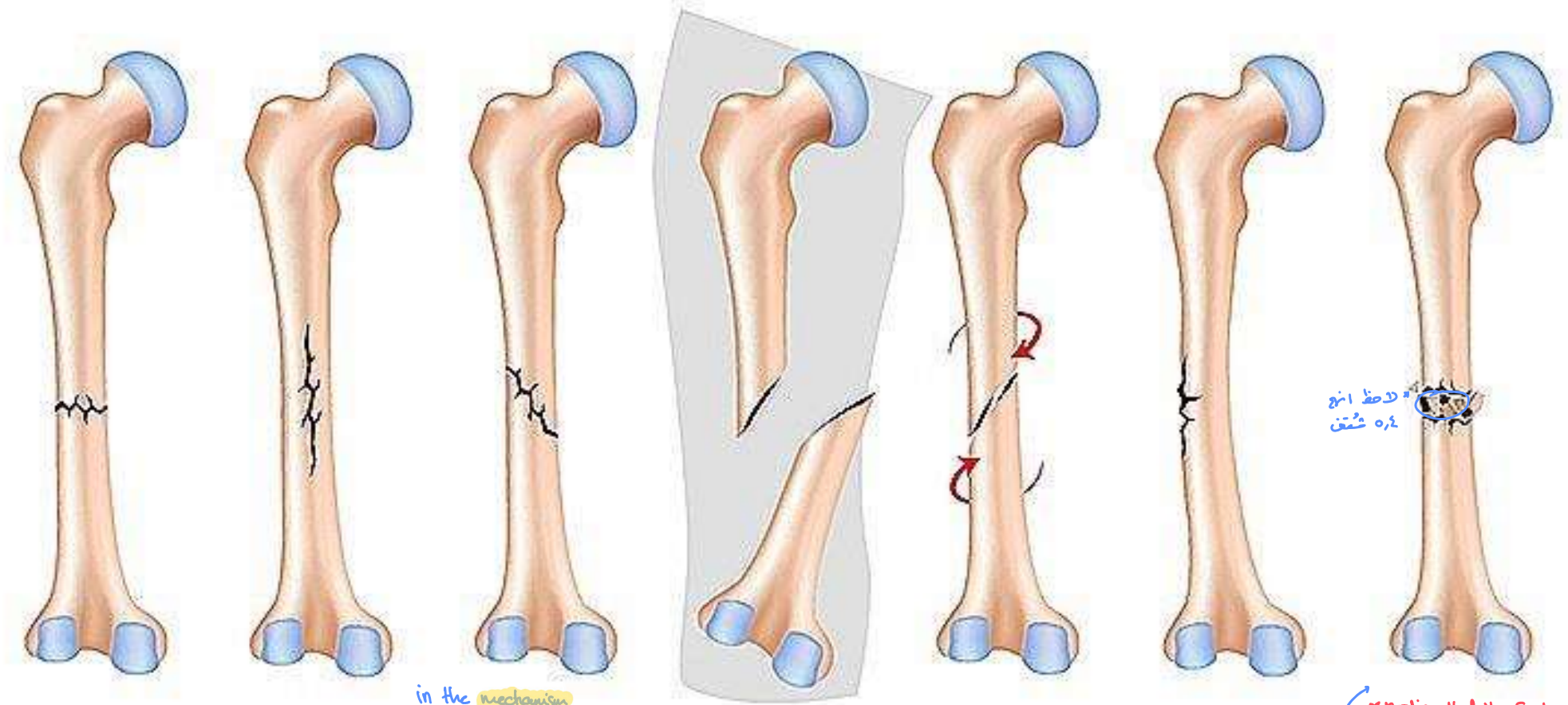


Leontiasis ossea (lion face); platybasia

FRACTURES #:

- Loss of bone integrity from mechanical injury &/or diminished bone strength
- Most common pathology of bone:
  - **Simple** #: skin is intact
  - **Compound** #: communicates with overlying skin
  - **Displaded** #: ends are not aligned
  - **Stress** #: repetitive slowly progressive
  - **Greenstick** #: soft bone fracture
  - **Pathologic** #: bone abnormal (tumor)

Types of Bone Fractures



FACTORS IMPACTING PROPER HEALING:

- Displaced and comminuted #s
- Inadequate immobilization (delayed union or nonunion)
- Pseudoarthrosis
- Infection (open #s)
- Malnutrition
- Steroids/AIDrugs

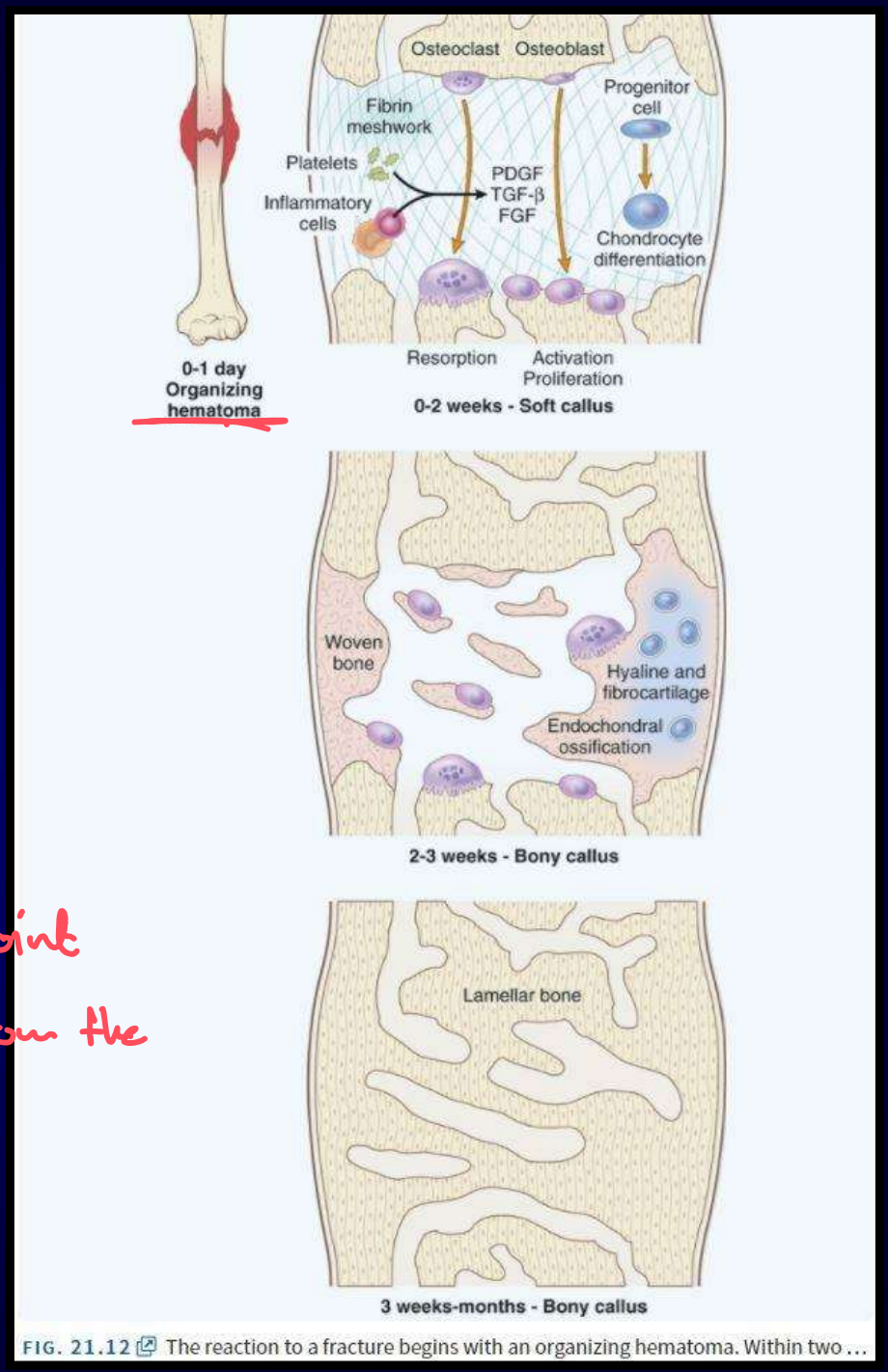


FIG. 21.12 The reaction to a fracture begins with an organizing hematoma. Within two ...

OSTEONECROSIS (AVASCULAR NECROSIS)

Bone death

* خلص آخر صفحة

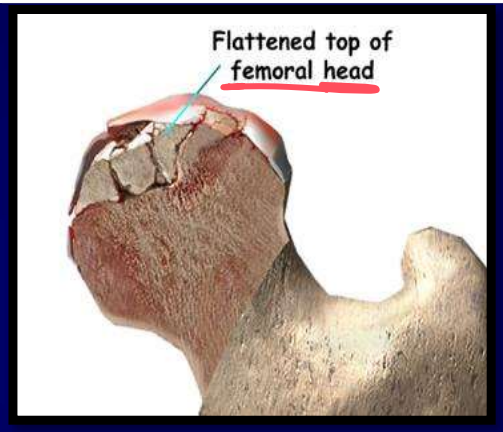
Infarction (ischemic necrosis) of bone and marrow

ASSOCIATED CONDITIONS:

- Vascular injury: trauma, vasculitis
- Drugs: steroids
- Systemic disease: Sickle
- Radiation

MECHANISM:

- Mechanical disruption of vessels
- Thrombotic occlusion
- Extravascular compression



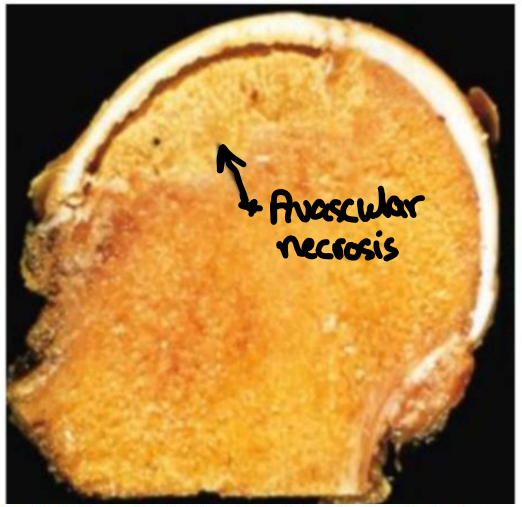


Fig. 21.13 Femoral head with a subchondral, wedge-shaped pale yellow area of osteonecrosis *(arrow)*. The space between the overlying articular cartilage and bone is caused by trabecular compression fractures without repair.