Pathology Team

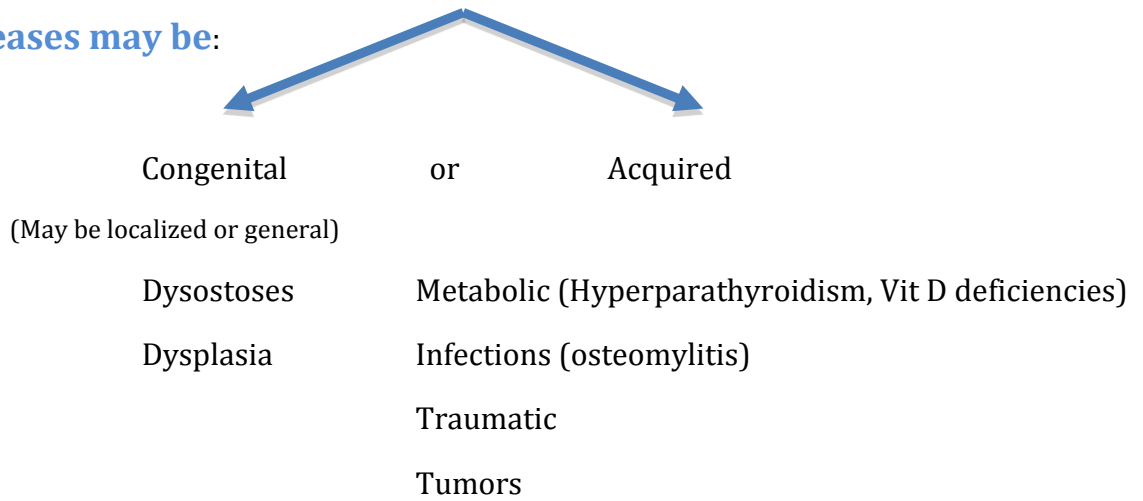## Congenital and Development Bone Disease

المحدد والمكتوب باللون الاحمر هو ما ركزت عليه الدكتور

المحدد و المكتوب باللون الازرق هو ما نراه مهم و معلومات اضافية مهمة للفهم

MUSCULOSKELETAL BLOCK
Pathology

Bone diseases may be:

Congenital   or   Acquired

(May be localized or general)

Dysostoses   Metabolic (Hyperparathyroidism, Vit D deficiencies)

Dysplasia   Infections (osteomylitis)

Traumatic

Tumors

1. Congenital Bone Diseases:

- <u>Localized</u> developmental anomaly caused by defect in the migration of <u>mesenchymal</u> cells and formation of bone.
  Dysostoses: Characterized by the absence of an entire bone.
  Could also include conditions where bones are fused together.

- <u>Generalized</u> in whole of skeleton
  Dysplasia: result from a mutation or defect in a gene.(Abnormal structure of skeletal)
  Examples are:

Ostegogenesis Imperfecta	Achondroplasia	Osteopetrosis
- Also called Brittle bone disease. - Defect in the synthesis of collagen type I (organic part of the bone matrix) - Causing extreme fragility and weakness of skeleton. - Which leads to an increased susceptibility to fractures. - Disease has 4 main types each with it's own clinical manifestations all of which are related to the decreased amount of collagen I. Type 1: characterized by blue sclera in eyes, deformed teeth and loss of hearing ability.	- Dwarfism - An autosomal dominant disease. - Mutation is in fibroblast growth factor receptor 3 [FGFR3] - Leads to inhibition of chondrocyte proliferation (cartilage synthesis) - The defected epiphyseal growth plates in bones will prevent their elongation and therefore are the cause behind the short stature.	- A rare condition - Characterized by reduced osteoclastic activity [resorption] - Lack of resorption causes defective bone remodeling. - Affected bone is extremely dense and "stone-like" causing it to be more fragile and readily broken.
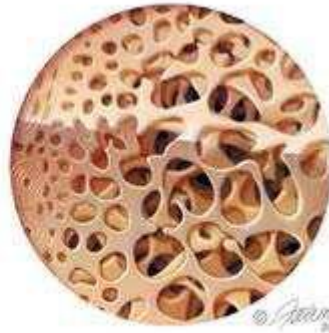
Normal | Osteoporotic bone

Osteoporosis

Normal vertebral bone and marrow is
Demonstrated at low power
microscopically. Note
 The size and number of bone spicules.

2. Acquired Bone Diseases:

Osteoporosis:

Increased porosity of the skeleton resulting from reduction in the bone mass.
Not only have the bone matrix spaces increased in number, but the connections between them have been broken making them also larger in size.
It may be localized, for example, osteoporosis of a limb due to disuse because of a fracture. In this condition it is reversible.
Or it may involve the entire skeleton as a metabolic bone disease.

Generalized osteoporosis can also be **divided** into primary and secondary
- Primary:

Senile and post-menopausal osteoporosis

- Secondary: results from:
  - Endocrine disorders: hyperparathyroidism, hypogonadism
  - GIT problems: malabsorption of Ca, Vit D deficiencies
  - Neoplasia: leukemia, multiple myeloma
  - Drugs: corticosteroids, antiepileptic/anticovulsant drug use

Pathophysiology:

bone resorption > bone formation (osteoclasts don't decrease by aging)

Factors Affecting Disease:

- Genetic: congenital abnormality in Vit D absorption
- Nutritional: malnutrition - low amount of calcium in childhood

Physical: lack of exercise which is important for the buildup of bone (osteoblast stimulation)

- Age:
  decreased synthesis and function of osteoblasts reducing the amount of matrix formed
- Menopause:
  The effect of estrogen on bone mass are normally controlled by cytokines, Il-1 and IL-6. Decreased estrogen due to menopause results in an increased secretion of these cytokines, which, in turn, stimulate osteoclast recruitment and activity.

Clinical Features:

Osteoporosis is difficult to diagnose because it is relatively asymptomatic. Usually it is discovered in patients who have already been exposed to fracture. The most common sites for fractures are the vertebrae and the femoral neck. Bone density is then radiographically measured.

However some patients manifest a slight reduction in height. Since their bone is less dense it tends to decrease in length.

Diagnosis:

Plain x rays are not used for diagnosis because they can't detect changes until 30-40% of the bone mass has disappeared.

The correct diagnosis is by Dual-emission x ray absorptiometry scan (DXA scan) which uses multiple beams to measure the exact bone mineral density.
It is also used to follow up with patients who have already been diagnosed with the disease.

Prognosis:

Osteoporosis itself is not a very lethal disease.

However, patients have an increased mortality rate due to the complications of the fractures accompanied by it.

> fracture in the femoral head will require the patient to be bed ridden. The decrease in motility raises the risk of complications including thrombosis, embolism and pneumonia.

Treatment:

The main way to help patients with osteoporosis is to induce osteoblastic activity.

Upon early onset, Vit D and calcium supplements are given while in severe cases parathyroid hormone is better advised.

However, the best approach to such a disease is prevention.

Prevention strategies include:

(mainly in children and young adults)

> Good diet (include sufficient amounts of Ca and Vit D)
> Exercise (placing stress on the bone helps it become stronger and build up more bone mass)
> Exposure to sun (Vit D)

These will help build up and maintain bone mass as well as provide a good reserve against bone loss later in life.

Vertebrae fracture as a result of osteoporosis