PHC

432 Team

13

Osteoporosis & Vitamin D deficiency

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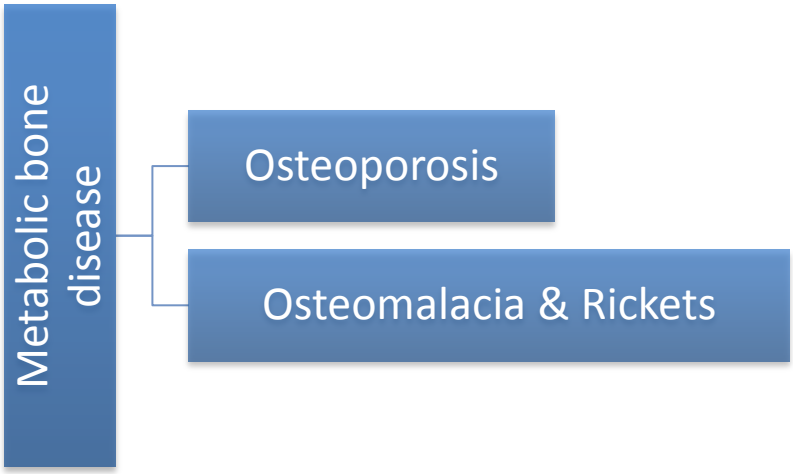
COLOR GUID : Doctor's Notes Team Notes slides Not important Important **431 team work**

Objectives

1. Definition of Osteoporosis and Osteomalacia / Rickets
2. Highlight on Vitamin D deficiency
3. Prevalence in world / Saudi Arabia
4. Factors lead to Osteoporosis and Vitamin D deficiency
5. Vitamin D and Comorbidities
6. How patients could be presented
7. Common fractures with osteoporosis
8. Diagnosis
9. Management & Prevention of Osteopenia and Osteoporosis

   - Prevention and advice
   - Role of Vitamin D and Calcium
   - Vitamin deficiency in pregnancy
   - Role of medications for osteoporosis like Alendronate, StronitiumRanelate, …



Osteoporosis

Definition

Osteoporosis is a progressive systemic skeletal disease characterized by low Trabecular (spongy) bone mass and micro-architectural deterioration of skeletal tissue, despite the normal mineralization.

Prevalence

1. **Worldwide:** According to a study done in 2006, it's been estimated that over 200 million people worldwide have osteoporosis, and the number is yet increasing.
2. **Saudi Arabia:** A study was done in 2012 found that approximately 36.6% of the female ranged from 50 to 79 were osteopenic and 34.0% were osteoporotic. In three other studies **on males**, the prevalence of **osteopenia** was 46.3%and **osteoporosis** 30.7%.

Risk factors

1. Modifiable:

A. Secondary to Medical disease (Hyperthyroidism,…).
B. Drug induced Osteoporosis (Steroids, Phenytoin and Barbiturates).
C. **Smoking**.
D. **Low calcium intake**.
E. Vitamin D deficiency.
F. High Alcohol intake.
G. **Physical inactivityand Prolonged immobility**.
H. Endurance training in females (Amenorrhea).
I. Low BMI.

2. Non-modifiable:

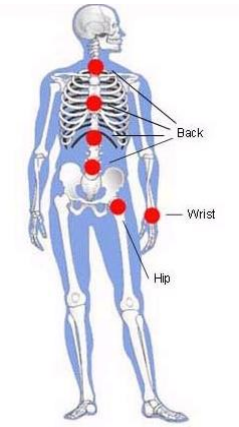
A. Gender (female).
B. Advanced Age.
C. Family History.
D. Previous Fracture.
E. Race (Asian, European).
F. Body build (Small stature).
G. Post-menopausal state.

Symptoms

It is asymptomatic disease so the patient can present with the Complications or we can detect it early by screening.

Complications

1. Fracture.
2. Loss of height over time.
3. Back pain, caused by a fractured or collapsed vertebra.
4. A stooped posture.



Common fractures of osteoporosis

Spine

The most common type of spinal fracture in people with osteoporosis is called a **wedge or compression fracture.**This can cause curvature of the spine known as kyphosis and havea noticeable **loss of height.**

Hip and pelvis

The two most common types of hip fractures:

1) **Femoral neck fractures:** occurring in the narrow section of bone between the main shaft of the femur and the ball.
2) **Intertrochanteric hip fractures:** where the shaft of the femur breaks just below the femoral neck.

In people whose bones are weakened from osteoporosis, **relatively minor impacts** (such as bumping into a piece of furniture) may be enough to cause a hip fracture. About **20-30%** of patients who have a **femur neck fracture die** in the year following the fracture. Half of the survivors remain disabled to some degree.

Wrist and forearm

The two most common types of wrist fracture are:

Colles' fracture: this is a fracture to the lower end of the radius, and very common in people with osteoporosis.

Caphoid fracture: the scaphoid is a wedge-shaped bone located on the thumb side of the wrist, just where it meets the radius. These fractures are less commonly related to osteoporosis.

Screening

Screening is by **dual-energy x-ray absorptiometry (DXA).**

Diagnosis

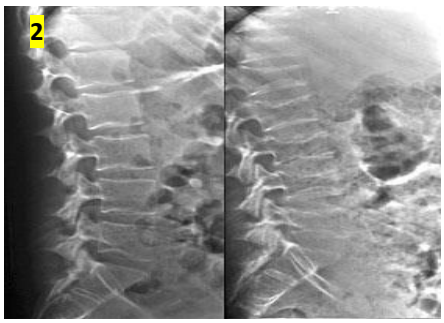
Osteoporosis is a silent disease, the disease is diagnosed by screening methods (will be explained) or the patient may come late to the clinic with a vertebral fracture, at that time when you do screening for the patient, you may find that the patient has osteoporosis, and vertebral fracture is the result of it.

Physical Examination:

We have 4 main steps for examination: look, feel, move and special test, and it depends on the patient presentation, If it's a **fracture** then there is decrease in the range of motion, tenderness, swelling and sometimes deformities.

Investigations

1. X-Ray:



1. Normal Spine X Ray.

2. Two views of the lumbar spine taken 1 year apart demonstrate rapidly developing osteoporosis and multiple compression fractures in this patient on exogenous steroids.

➢ **Signs of Osteoporosis in an X-ray**

- Cortical thinning
- Increased radiolucency

2. Dual energy x-ray absorptiometry (DXA):

Population eligible for screening:

1. Women **aged 65 years and older.**
2. Women **under 65 years** whose **10-year fracture risk is greater than or equal to that of a 65-year-old.**

Women **without additional risk factors** based on the FRAX tool (9.3).

3. Women and men of **any age** who had suffered a low impact fracture.
4. Women and men of **any age** who are at increased risk as a result of selected medical conditions or treatment with specific medications.

Table .1/ Interpretation of bone density test results: (very important)

T score	Interpretation
≥ (-1)	Normal
Between (-1) and (-2.5)	Osteopenia (low bone density).
≤ (-2.5)	Osteoporosis

3. Biochemistry:

a) Complete blood count (CBC)

b) Serum chemistry levels (Calcium, Phosphate and Alkaline phosphatase), **their levels will be normal in case of osteoporosis.**

Management:

The goals of osteoporosis treatment are to:

A. **Prevent bone fractures** with medicines that strengthen bone.

B. Slow down or stop bone loss.

C. Minimize the risk of falls that might cause fractures.

1. Lifestyle modification

General practitioners should recommend the following important lifestyle choices for all postmenopausal women and older men:

- adequate but safe exposure to sunlight as a source of vitamin D
- maintenance of a healthy weight and BMI
- cessation of smoking
- avoidance of excessive alcohol consumption.

2. Non Pharmacological Intervention:

a) Exercise

1) High intensity strength training.
2) Low impact weight bearing exercise.

b) Calcium supplementation (Table.2) Increase BMD

c) Vitamin D supplementation (Table.3)

- Maximizes intestinal calcium absorption and BMD.
- Reduce fractures and falls

Role of vitamin D and calcium:

- Calcium and vitamin D work together to protect your bones—calcium helps build and maintain bones, while vitamin D helps your body effectively absorb calcium.
- So even if you're taking in enough calcium, it could be going to waste if you're deficient in vitamin D.

Table .2/ Recommended Calcium Intake Vs. Age: (Very important)

Age	Recommended Calcium Intake
1. Men age 50-70	1000 mg per day
2. Women age 51 or older & Men age 71 or older	1200 mg per day

Table .1 (Very important)

Age Group	Recommended Dietary Allowance (IU/day)
Infants 0-12 months	400
1-70 years	600 **
>70 years	800

** IOF recommendations for adults aged 60 years and over are 800 to 1000 IU/day for falls and fracture protection

Box .1
Calcium-rich Food
Food like: milk, plain yogurt, cottage cheese, cheddar cheese, vanilla ice cream, orange juice.

Box .2
Vitamin d -rich Food
Sockeye salmon fillet, canned light tuna, mushroom, milk, fortified juice, egg yolk, beef liver, cod liver oil.

3. Pharmacological Treatment:

Who Should Be Considered for Treatment?

Postmenopausal women and men age 50 and older presenting with the following should be considered for treatment:

1) A hip or vertebral **fracture**.
2) **T-score ≤ 2.5** at the femoral neck, total hip or lumbar spine.
3) Low bone mass (T-score between -1.0 and -2.5 at the femoral neck or lumbar spine).

1. Bisphosphonate (Alendronate Sodium):

Is used **for prevention** (5 mg daily),for treatment (10 mg daily), it reduces the incidence of spine and hip fractures by about 50 percent over three years in patients with a prior vertebral fracture, also reduces the incidence of vertebral fractures by about 48 percent over three years in patients without a prior vertebral fracture.

- Inhibit osteoclastic resorption and increase BMD
- S/E: GI disturbance (ulcer rarely)

2. Strontium ranelate:

It reduces the risk of both spine and non-vertebral fractures.

RANK ligand inhibitor: (Denosumab)

- inhibits osteoclast formation and increases osteoclast apoptosis.
- **indicated for:** treatment of osteoporosis in women and men at high risk for fracture.

Estrogen Agonists/Antagonists: (Raloxifene)

- approved for prevention and treatment of postmenopausal osteoporosis.
- decreases vertebral fractures and increases spine and hip BMD.

Calcitonin

- **Indicated for** osteoporosis treatment for women at least 5 years past menopause.
- Decrease vertebral fracture.

Hormone Replacement (Estrogen) Therapy

- **Indicated for:** prevention of osteoporosis in women at significantrisk and for whom other osteoporosis medications cannot be used.

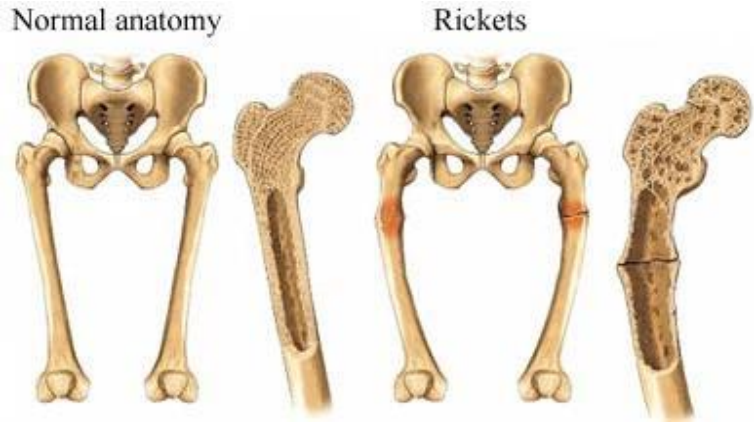
-Premature menopause HRT is recommended for the prevention ofosteoporosis until women reach 51y
-Long-term risks of HRT outweigh the benefits (CAD, breast CA, stroke).

Teriparatide (PTH Analogue)

- Increases bone formation, bone remodeling rate, and osteoblast number and activity
- Reduces fracture risk in postmenopausal women
- Approved for use for only up to 2 years (osteosarcoma)
- **Indicated for:**
- treatment of postmenopausal women at high risk for fracture
- increase in BMD in men with idiopathic or hypogonadal osteoporosis at high fracture risk
- men or women intolerant to other osteoporosis medications
- patients with glucocorticoid-induced osteoporosis

Rickets and Osteomalacia

Bone disease characterized by **bone demineralization** due to **deficiency or impaired metabolism of vitamin D or phosphates,** called rickets in children, Osteomalacia in adult.



*Highlights on vitamin D deficiency (*According to NICE guidelines*)*

Vitamin D is essential for skeletal growth and bone health. Dietary sources are limited. The major natural source of vitamin D is from skin synthesis following exposure to sunlight. Severe vitamin D deficiency can result in rickets and osteomalacia. It has also been associated with some diseases and long-term conditions, such as osteoporosis, diabetes and some cancers. Vitamin D deficiency can occur at any age but is more likely during periods of rapid growth (for example, during childhood), during **pregnancy** and while **breastfeeding**. **A newborn baby's vitamin D status** is largely determined by the mother's level of vitamin D.

Prevalence

1. **United state:** A cross sectional study was done in University of Pennsylvania (N=4495) in 2011 estimated that the overall prevalence rate of vitamin D deficiency is 41.6%.

2. **Saudi Arabia:** A cross sectional study was done in King Abdul-Aziz University (N=834 male aged 20-74 years living in Jeddah area) in 2012 and the prevalence of vitamin D deficiency was 87.8% were.

Risk factors

1. **Modifiable**

a) Less sun expose
b) Low vitamin D supplements.
c) Obesity

2. Non-Modifiable

a) Age
b) Female gender
c) Malabsorption
d) Non-white race
e) Antiepileptic therapy
f) Burns

Symptoms

1. Osteomalacia:

a) Muscle weakness.
b) Bone pain
c) Fracture.

2. Rickets:

a) Muscle weakness.
b) Bone pain.
c) Fracture.
d) Skeletal deformity.
e) Poor growth.

- **A pregnant woman with a vitamin D deficiency raises the risk of developing:**

  - Hypertension
  - Pre-eclampsia
  - gestational diabetes
  - preterm birth
  - impaired fetal skeletal formation (Rickets)

Diagnosis:

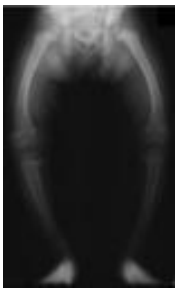
1. Physical Examination

Rickets Signs:

A. Pigeon chest deformity.
B. Rickety rosary.
C. Craniotabes.
D. Genu varium or genu valgum.

2. Investigations

A. X-Ray



B. Biochemistry (Table.4)

Table .4/ Biochemistry findings in Osteomalacia/Rickets:

	Level in the blood
Vitamin D	Low
Phosphate	Low
Calcium	Low
PTH	High
Alkaline Phosphatase	High

Treatment:

1. For people **age 1-18** suggest to treat with 2000IU/d for at least 6 weeks, followed by maintenance therapy of 600-1,000 IU/day.
2. Suggest that all adults who are vitamin D deficient be treated with 50,000 IU of vitamin D once a week for eight weeks, followed by maintenance therapy of 1,500-2,000 IU/day.
3. In obese patients, patients with malabsorption syndromes, and patients on medications affecting vitamin D metabolism, we suggest a higher dose **(two to three times higher; at least 6,000-10,000 IU/day) of vitamin D.**

Summary

1. **Osteoporosis is a silent disease and cannot be diagnosed clinically**
2. **Osteopenia differs from osteoporosis, in which osteopenia is an early stage of osteoporosis.**
3. **Patients with osteoporosis are diagnosed mainly either if they have a fracture (late) or based on DXA if they meet the criteria for screening.**
4. **The most common risk factor for developingosteomalacia is lack of sun exposure.**
5. **Nowadays rickets is not that common as before, because of availability of vitamin D in most of the child food.**
6. **Drug induced Osteoporosis (Steroids, Phenytoin and Barbiturates,L-Thyroxine(high amount), Aromatase Inhibitors and methotrexate ,Thiazolidinediones, Chronic Lithium use).**
7. **Medical disease induced Osteoporosis: Endocrine:**Hypogonadism (e.g. premature menopause, anorexia, androgen blockade, taking aromatase inhibitors), hyperthyroidism, hyperparathyroidism, hyperprolactinaemia, Cushing's disease, type 1 DM.**GI:**Coeliac disease or other causes of malabsorption, inflammatory bowel disease, chronic liver disease, chronic pancreatitis. **Rheumatological:** RA, other inflammatory arthropathies. **Hematologic Diseases:** Leukemia, Lymphoma, Sickle cell, Thalassemia, Hemophilia. **Other:** Immobility, multiple myeloma, haemoglobinopathy, systemic mastocytosis, CF, COPD, CKD, homocystinuria.

From Oxford Handbook of General Practice 4th edition

Referral Consider referral to an appropriate specialist if:

- Another cause for fragility fracture is suspected (e.g. metastasis)—*U*
- Fragility fracture on treatment—*R*
- Unusual presentation of osteoporosis, e.g. pre-menopausal woman—*R*
- For consideration of treatment with IV bisphosphonate, denosumab, or teriparatide—*R*

***U* = urgent referral; *R* = routine referral.**

Questions

1) Osteoporosis is:

a. A disease of children caused by vitamin D deficiency.
b. A condition in which the bones become brittle and fragile from loss of tissue.
c. A condition in which the bones become soft due to decreased in mineralization.
d. All of the above.

2) Which of the following are considered signs of Osteoporosis in X-ray:

a. Decreased Radiolucency
b. Increased Radiolucency
c. Cortical Thinning
d. Cortical thickening
e. A&D
f. B&C

3) The increased incidence of Osteoporosis in post-menopausal women is caused by:

a. Decreased Progesterone
b. Decreased Estrogen
c. Sedentary lifestyle
d. None of the above

4) To diagnose osteoporosis, bone mineral density must be:

a. 1.5 Standard deviations below the mean.
b. 2.0 Standard deviations below the mean.
c. 2.5 Standard deviations below the mean.
d. 3.0 Standard deviations below the mean.

5) Osteoporosis is a common and disabling disease, prevalence of post-menopausal osteoporosis in Saudi Arabia is:

a. 10% to 20%
b. 20% to 30%
c. 30% to 40%
d. 40% to 50%

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Answers:

1st Questions: b

2nd Questions: f

3rd Questions: b

4th Questions: c

5th Questions: c