Osteoporosis "Silent disease"

Diagnostic Technology

OsteoSys

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Contents

What is Osteoporosis ? *A threat to health and society*

"Osteoporosis is a systemic skeletal disease characterized by low bone mass and micro architectural deterioration of bone tissue, leading to enhanced bone fragility and a consequent increase in fracture risk."

- WHO Definition

What Causes Osteoporosis?

Risk factors you cannot change include:

✓ **Gender.** Women get osteoporosis more often than men.

✓ **Age.** The older you are, the greater your risk of osteoporosis.

✓ **Body size.** Small, thin women are at greater risk.

✓ **Ethnicity.** White and Asian women are at highest risk. Black and Hispanic women have a lower risk.
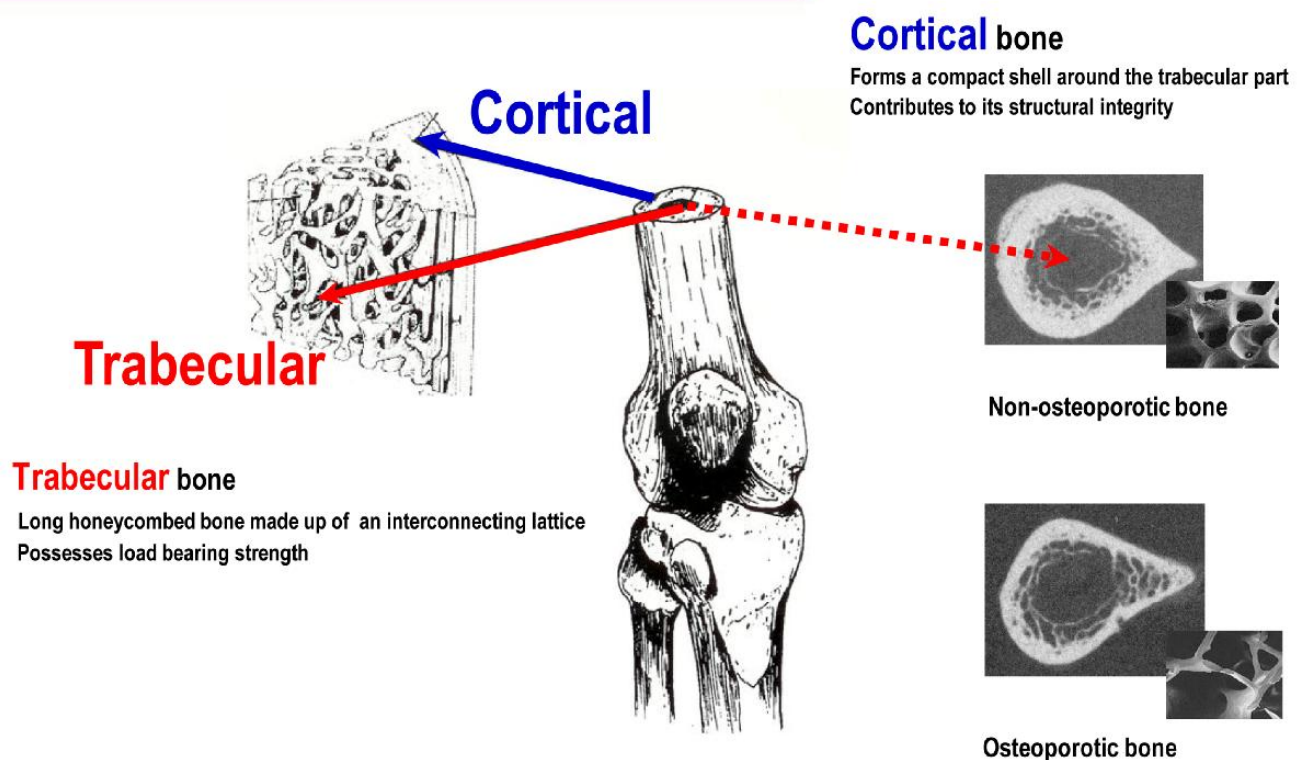
✓ **Family history.**

Other risk factors are:

✓ **Sex hormones.** Low estrogen levels due to missing menstrual periods or to menopause can cause osteoporosis in women.

✓ **Anorexia nervosa.** This eating disorder can lead to osteoporosis.

✓ **Calcium and vitamin D intake.** A diet low in calcium and vitamin D makes you more prone to bone loss.

✓ **Medication use.** Some medicines increase the risk of osteoporosis.

✓ **Activity level.** Lack of exercise or long-term bed rest can cause weak bones.

✓ **Smoking.** Cigarettes are bad for bones, heart, and lungs.

✓ **Drinking alcohol.** Too much alcohol can cause bone loss and broken bones

More about causes of Osteoporosis

- ✓ Osteoporosis is an age related disease causing decreased bone mass

- ✓ Patients may suffer fractures, often of the wrist, spine or hip

- ✓ Osteoporosis is influenced by lifestyle, environment and heredity

- ✓ Most common in women after menopause.

- ✓ Less common in men as they attain a higher peak bone mass

- ✓ 1/3 of all women will develop osteoporosis if untreated

- ✓ Osteoporosis is a growing worldwide social and economic problem

Bone Structure

Cortical bone
Forms a compact shell around the trabecular part
Contributes to its structural integrity

Cortical

Trabecular

Non-osteoporotic bone

Trabecular bone
Long honeycombed bone made up of an interconnecting lattice
Possesses load bearing strength
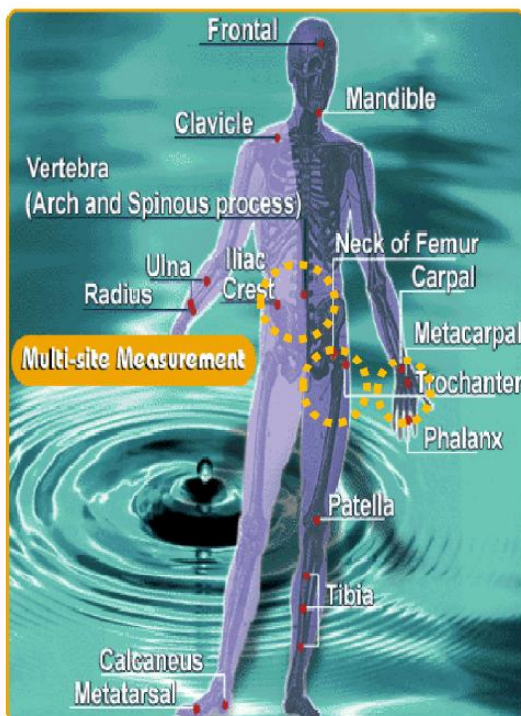
Osteoporotic bone

The Bone Turnover or Bone Metabolism is

repeating the process of Bone Formation and Bone Absorption.
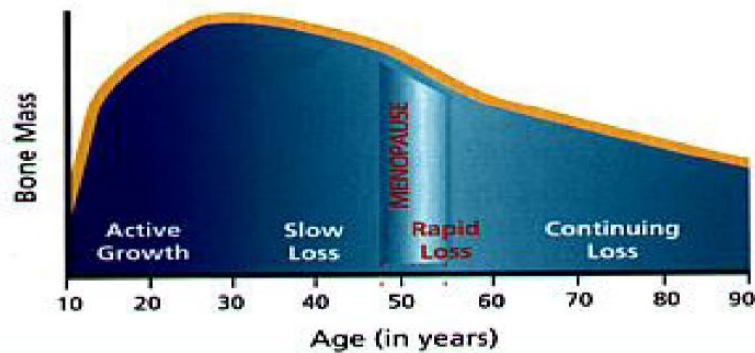
Bone Formation is faster than Bone Absorption

Bone Absorption is faster than Bone Formation
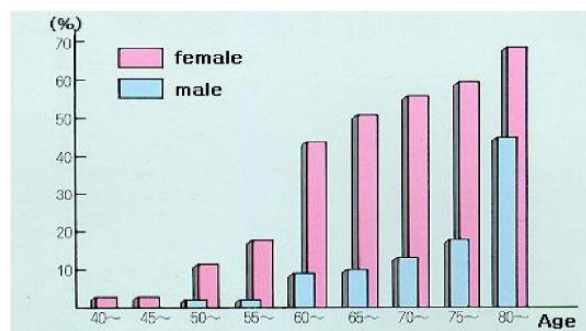
Main Fractures parts

Patients may suffer fractures, often of the **wrist**, **spine** and **hip**

The lifetime risk of osteoporotic fractures

in women aged 50 years is 30-40%

For men the risk is 10%

Process of Osteoporosis

Decrease patient's height

Bone Fracture with a minor shock
and take long time for the treatment of fracture
also suffer psychologically depressed

Especially Femur fracture,
could not have freedom of movement
& social activities and in worth case
the patient could die cause of 2nd infection.

Spine fracture

Wrist fracture

Femur fracture

55 years   65 years   75 years
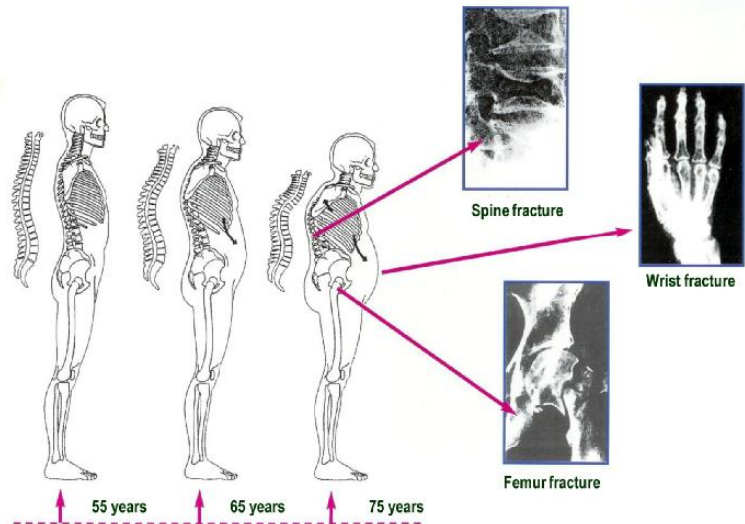
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Prevention and Treatment

✓ Further bone loss may be stopped

✓ The most effective treatment is prevention of bone loss

✓ Optimising peak bone mass

✓ Calcium supplement

✓ Vitamin D supplement

✓ Minimise lifestyle risk factors

✓ Estrogens' therapy (women)

Diagnosis of Osteoporosis

An examination to diagnose osteoporosis can involve several steps:

✓ an initial physical exam

✓ various x rays that detect skeletal problems

✓ laboratory tests that reveal important information about the metabolic process of bone breakdown

  and formation

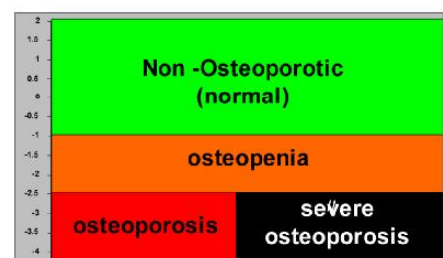✓ a bone density test to detect low bone density.

A simple test to measures bone mineral density (BMD)is for Spine, Hip, Forearm and Calcaneus. Dual Energy X-ray Absorptiometry (DEXA) is the best current test to measure BMD.

Diagnosing Osteoporosis -The Role of BMD

A doctor may recommend a bone mass measurement after a medical assessment

A bone density test can:

✓ Detect low bone density before a fracture occurs

✓ Confirm a diagnosis of osteoporosis

✓ Predict the chances of future fractures

✓ Determine the rate of bone loss and monitor the effects of treatment by measuring at

  intervals of typically 2 years

Bone mass measurements

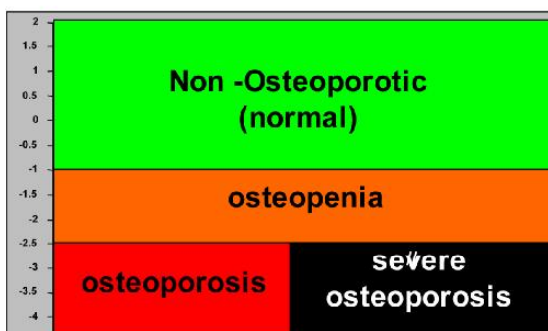✓ Proven correlation between BMD and fracture risk (Melton et al 1993)

Bone strength

✓ Determined by bone mass and quality of bone

Fragility

✓ Affected by bone mass/density

✓ Structural changes in the cortical and trabecular bone

Non Osteoporotic:
T score better than –1 SD in relation to premenopausal women

Osteopenia:
T score between –1 and -2.5 SD in relation to premenopausal women

Osteoporosis:
T score less than -2.5 SD in relation to premenopausal women
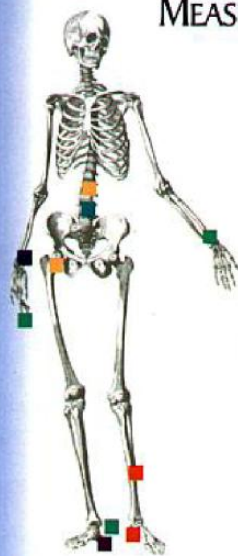
Severe osteoporosis:
T score less than -2.5 SD and an osteoporotic fracture

* **T-Score**: Young Adult mean standard variation
* **Z-Score**: Age-matched mean standard variation

Bone Mineral Density Measurements

BONE MINERAL DENSITY MEASUREMENTS

DXA: spine, hip, total body
pDXA: forearm, finger, heel
SXA: heel
QUS: heel, shin
QCT: spine
pQCT: forearm

Figure 3. BMD measurement sites.

Table 3
Summary of Available Bone Mass Measurement Technologies

METHOD	BODY SITE	ACCURACY	PRECISION	EFFECTIVE RADIATION DOSE‡
DXA Dual-Energy X-Ray Absorptiometry	Hip Spine Total Body	90–99%[9] (1–10%)*	98–99%[9] (1–2%)†	<<Standard Chest X-Ray[9]
pDXA Peripheral Dual-Energy X-Ray Absorptiometry	Forearm Finger Heel	90–99%[9] (1–10%)*	98–99%[9] (1–2%)†	<<Standard Chest X-Ray[9]
SXA Single-Energy X-Ray Absorptiometry	Heel	98–99%[9] (2–5%)*	98–99%[9] (1–2%)†	<<Standard Chest X-Ray[9]
QUS Quantitative Ultrasound	Heel Shin	N/A	92–98%[10] (2–8%)†	None
QCT Quantitative Computed Tomography	Spine	85–97%[9] (3–15%)*	96–98%[9] (2–4%)†	≤Standard Chest X-Ray[9]
pQCT Peripheral Quantitative Computed Tomography	Forearm	92–98%[9] (2–8%)*	98–99%[9] (1–2%)†	<<Standard Chest X-Ray[9]

* Error around actual value.
† Error around repeated measurements.
‡ Effective radiation dose = radiation that reaches internal organs. For comparison: a chest x-ray has an effective dose equivalent of 100-150 µSv. Sv = Sievert = 100 rem.
<< = Significantly less than.

Bone Densitometers

QUS (Quantitative Ultrasound) BMD

SONOST 2000

SONOST 3000

DEXXUM T

DEXA (Dual Energy X-ray Absortiometry) BMD

pDEXA
(peripheral Dual Energy
X-ray Absortiometry) BMD

EXA 3000