OSTEOPOROSIS

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OSTEOPOROSIS

OSTEOPOROSIS (OP) :

- Systemic skeletal disease
- Low Bone Mass
- Changes in microarchitectural of bone tissue
  \[ \rightarrow \text{Bone Fragility} \rightarrow \text{OP Fx/Fragility Fx.} \]
- New def 2001: Decreased Bone Strength
What is Osteoporosis?

Osteoporosis is defined as a skeletal disorder characterized by compromised bone strength predisposing a person to an increased risk of fracture. Bone strength primarily reflects the integration of bone density/mass & bone quality.

Normal Bone
Osteoporosis

Pictures from: http://www.agelessfoundation.org/osteo/
Trabecular bone
Normal and osteoporotic trabecular structures

(a) Normal trabecular bone

(b) Osteoporotic trabecular bone

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PATHOGENESIS OF OP:

- Adult healthy bone-renewal process-remodelling process → resorption (osteoclast) & formation (osteoblast) process.
- Resorption-Formation process → coupling process.
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- Each year 10% of skeletal bone is replaced by new bone.
- Every 3 – 10 yrs all bones has undergone remodelling process.
- In OP: Remodelling process $\rightarrow$ Uncoupling process $\rightarrow$ Imbalance of resorption & formation process $\rightarrow$ Loss of bone mass $\rightarrow$ Fragile $\rightarrow$ Easy to break.
- Post Menopause $\rightarrow$ Estrogen Def. (Inhibits osteoclast) $\rightarrow$ Resorption $>$ Formation $\rightarrow$ Osteoporosis +.
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TYPE OF OSTEOPOROSIS:

- **PRIMARY**:
  - TYPE I: POSTMENOPAUSAL OSTEOPOROSIS - MEDIATED BY OSTEOCLAST
  - TYPE II: SENILE OSTEOPOROSIS - MEDIATED BY OSTEOBLAST - OCCUR IN MEN & WOMEN > 70 YRS - FORMATION OF BONE <.

- **SECONDARY**:
  - CAUSED BY AN UNDERLYING DISEASE/DRUG THERAPY - OCCUR AT ANY AGE

70 – 80% ARE PRIMARY TYPE
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SECONDARY OP:

- UNDERLYING DISEASE:
  - HORMONAL IMBALANCE-CUSHING SYND.
  - CANCER, CRF, GI DISORDERS CAUSING MALABSORPTION, HYPOGONADISM IN MEN
  - DRUG USE – CORTICOSTEROID- GIOP.
  - POOR NUTRITION

- 30 – 45% OF AFFECTED INDIVIDUAL NO CAUSE CAN BE IDENTIFIED
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Incidence of OP:

- OP: World study: after 50 yrs:
  - Female 1 out of 3
  - Male 1 out of 5

- World study: 200 mill with OP

- USA, EUROPE, JAPAN: > 75 mill
- China: 7% of pop -> > 70 mill
- Indonesia: > 45 yr: men - 20% women - 32%
  > 70 yr: men - 38% women - 54%
Clinical diagnosis

- “Silent Disease”:
- No complain until fracture happens.
- Most common location:- Prox femur, Distal radius, Vertebra.
  Vertebra: due to microfractures/VCF →
  chronic-intermitent back pain, loss of height, increase of dorsal kyphosis-Dowager’s hump-
Radiological Diagnosis

- Rarefaction of metaphysis of long bones,
- Thinning of cortex, vertebral bodies → evidence of deformity.
Laboratory diagnosis

- Serum Ca & Phosphor normal
- Marker of bone formation: SAP/BSAP, Osteocalcin
- Marker of bone destruction: NTX, CTX
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DIAGNOSIS OF OP:

- **GOLD STANDARD**: EXAMINATION OF BMD (BONE MINERAL DENSITY)
- WITH DEXA (DUAL ENERGY X-RAY ABSORPTIOMETRY) METHOD.
- pDEXA - ultra sound method - os calcis- for screening purposes- must be confirmed with DEXA
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- INTERPRETATION OF DEXA EXAMINATION:
  - WHO: Normal: T score: > -1
  - Osteopeni: T score: -1 ~ -2.5
  - Osteoporosis: T score: < -2.5
  - Severe OP: T score < -2.5 with one fragility/insuff. fx.
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- OP - SILENT DISEASE/Asymptomatic
- Clinical Problem → Fracture +
- Fracture → Morbidity-Quality Of Life (QOL)
- Mortality.
- Most common OP Fx: Hip, Vertebra, Wrist
- Most serious: Hip Fractures
Fragility or Osteoporotic Fractures

- Fractures occurring at a site associated with low bone mineral density and which increase in incidence after the age of 50 years.

Sites associated with low BMD

HIP

SPINE

WRIST
HIP FRACTURES

♦ Hip fx is the most serious complication of OP fx in term of Morbidity, Mortality, Economic & Social cost and impact on QOL
Hip Fractures

Hip fracture due to osteoporosis

- Femoral head
- Diseased bone
- Femur
- Femur (cross section)
In spite of up to date tx of hip OP fx:
- 20% died within one year mostly as a result of preexisting medical condition
- 1/3 remain bed/chair ridden
- 1/3 suffer functional limitations and require assistance
- Only 1/3 return to full function

Fractures in elderly OP patients do not only affect quality of life but also life threatening

WHO 2003, Perren SM 2005
Hip Surgery

• Another study:

• 25% full recovery
75% will either:
  ➢ Use a cane or a walker 50%
  ➢ Confined in a nursing home/ 20 – 40 % self-care assistance (care-givers)
  ➢ Die within the first 12 months 15-20% (40%) secondary to other chronic disease and consequences of immobilization, especially among age >50
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VERTEBRAL FRACTURES

- Many are asymptomatic or cause too few symptoms to provoke investigation.
- Localization: mid thoracic or thoracolumbar junction ➔ weakest region
- Quality of life < than hip fx ➔ 4% needs assistance in ADL
- Economic burden: mainly due to outpatient care, provision of nursing care and lost of working days

WHO 2003
Vertebral Fractures

- More commonly occur spontaneously
- May be secondary to minimal trauma from spinal loading during day-to-day activities, such as bending forward, lifting objects, and climbing stairs


- High risk of having another vertebral fracture
  - ~ 20% within the 1st year
Vertebral Fracture: underdiagnosed

- Two thirds of new vertebral fractures are not diagnosed\(^1,2\)
- Often asymptomatic

Dowager's hip results from the fusion of the body and the shaft of the femur, commonly associated with osteoporosis.

Cortical fracture

Vein

Vein
Fig. 57
Progressive loss of height mostly associated with acute and chronic pain (Colvard D et al. 1989).
The Osteoporosis Continuum

Healthy spine

50 Menopausal
Experiencing vasomotor symptoms

55+ Postmenopausal
At greater risk for vertebral fracture than any other type of fracture

75+ Kyphotic
At risk for hip fracture

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Vertebral Fractures
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WRIST FRACTURES- Colles Fx

- Caused by a fall on the outstretched hand
- Peak incidence 60 - 70 yrs
- Less morbidity than hip fx, but painful

Arch Int. Med'91
1% needs assistance for ADL

50%: fair/poor functional outcome at 6 mos

Complication: Algodystrophy/Sudeck atrophy: pain, stiffness, swelling of the hand

Brit J Rheu '94
What are the psychosocial consequences of fragility fractures?
Psychological consequences of osteoporosis

Depression

Overall worsened quality of life

Increased dependency on others

Osteoporosis

General and disease-specific anxiety

Diminished self-esteem

Increased dependency on others

Overall worsened quality of life
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TREATMENT

- **Colles Fx:**
  - undisplaced – cast immob.
  - displaced – closed reduction cast immob.
  - immob: 4–6 weeks
  - avoid prolonged immob → complication ↑

- **Vertebral Fractures:**
  - Lumbar corsett/bracing
  - Vertebro plasty
  - Kyphoplasty
TREATMENT

Hip Fx:

Goal: immediate return to mobility to avoid extended bed rest with its complication

Achieved by Hemi/Total arthroplasty, ORIF to alleviate pain and allow early safe weight bearing

After management of Fx → **DO NOT FORGET TO TREAT OP!**
it is asymptomatic. Symptoms of a reduction in bone mass include:

- low back pain
- loss of height over time often accompanied by stooped posture
- minimal trauma fractures

As bone mass decreases, the risk of fracture grows.

Fractures of the proximal femur, or hip, may occur spontaneously or result from minor accidents. A femoral prosthesis can be used to repair a broken hip.
Economic cost of management OP fractures

- **England**: £ 942 mill/year – probably will ↑ as the number of elderly ↑

- **USA**: $ 13.8 bill in'95 → recently: $ 18 bill/year and increasing

- Highest cost: Hip fractures

WHO 2003; Perren SM 2005
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- USA: - Hip fractures cost $21,000
  - Vertebral fracture $1200
  - Colles fractures $800

- Hong Kong: - Hip fracture: $11,000
  - Colles fracture: $600

Worldwide projection; Annual cost of Hip fractures USD 3.6 bill in men and USD 19.3 bill in women.
Year 2050 would rise to USD 14 bill in men and USD 73 bill in women.
Cost of OP fx: ASTRONOMICAL!.

WHO 2003
Projected number of osteoporotic hip fractures worldwide

Total number of hip fractures:
1950 = 1.66 million
2050 = 6.26 million

Estimated no of hip fractures: (1000s)

Adapted from Cooper C et al, Osteoporosis Int, 1992;2:285-289
- OP has a healthcare impact second only to C.V. disease

- Due to very high cost of OP fx → best policy is avoid/prevent OP fractures → identify and treat OP before fx happens!

I.O.F.
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- First Step: Identify/Evaluation of RISK FACTORS → Case Finding Strategy - CFS - can be done by GP as front liners, then start taking necessary action
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- WITH CFS ➔ BMD EXAMINATION CAN BE CONFINED TO A MINORITY OF WOMEN ➔ 20% OF POP.

- MOST COUNTRIES ADOPT CFS IN THE MANAGEMENT OF OP.

- USA: POP. SCREENING WITH BMD FOR WOMEN > 65 YRS
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Risk Factors for Osteoporosis and Fracture

**Non-Modifiable**
- Age
- Female sex
- Maternal family history of hip fracture
- Low birth weight
- Disease predisposing to osteoporosis

**Potentially Modifiable**
- History of falls
- Body mass index
- Drug therapy (e.g. corticosteroid use, use of anti-convulsants)
- Primary or secondary amenorrhea
- Early menopause
- Smoking
- Excessive alcohol consumption
- Dietary calcium and vitamin D deficiency

Risk factors taken from Jordan & Cooper *Best Practice and Res Clin Rheumatol*, 2002
Categorized by Eli Lilly & Co.
Risk Factors

• Female
• Post-menopause
• Limited physical activity
• Small bone structure
• Low dietary calcium
• Cigarette smoking
• Alcoholism
Combination of several independent clinical risk factors $\rightarrow$ sufficient for treatment w/o BMD exam

Kanis OP Int. 2005
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Treatment

Goal: - Improve bone quality and strength

- Prevent OP fx.

IOF VISION: A World w/o OP Fractures!
• MANAGEMENT OF OSTEOSPOROSIS.

• NON PHARMACOLOGIC

• PHARMACOLOGIC
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• NON PHARMACOLOGIC MEASURES:
  - Adequate exercises,
  - Balanced diet,
  - Intake Ca,
  - Vit D,
  - Life style (smoking, sedentary, alcohol)
  - Fall prevention
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MANAGEMENT OF OP

Pharmacologic measures :

FDA approved :
- Antiresorptives : Biphosphonates, Estrogen, Calcitonin
- Stimulates Bone Formation : Parathyroid Hormon
- Dual Mode Action : Strontium Ranelate.
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NON PHARMACOLOGIC.

Elderly patient: Exercise include balance training → best outcome Tai Chi → reduced fall by 50%

Exercise may increase BMD and strength of bone: 30-50% if start before puberty

Type of activity: - Tennis, Badminton, Aerobics, Dance, etc
   - Endurance training: not as efficient

MOVE IT OR LOSE IT!!

- JBJS’05
- IOF 2005
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NON PHARMACOLOGIC

Elderly: Avoid Fall in the Home

- Eliminate all possible elements of risk which could lead to fall in the home
  - slippery floor, loose carpet, stairs, medication

- Especially if history of previous fx (+)

- Safe environment → falls reduced 30-60%

- Hip protector → Fx ↓ 34% → Compliance difficult

Lancet'99/JBJS'05
Lifestyle change may improve skeletal health: stop smoking, alcohol, maintenance of ideal body weight

Body Mass Index (BMI): Europeans:
Risk of hip fx ↑ if BMI < 19 kg/m²

WHO 2003
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PHARMACOLOGIC.

HRT - Hormonal Replacement Therapy

- Currently not recommended as the primary prevention of OP in most countries
- Long term use: questionable
- Controversy (+)

WHO 2003; JAMA 2002
NEJM 2003
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PHARMACOLOGIC.

* Parathyroid Hormone (PTH): Recombinant
  PTH (teriparatide) → stimulates bone formation

* Strontium ranelate: dual mode of action →
  antiresorptive & stimulates bone formation

* Alfacalcidol and calcitriol (vit D analogues),
  Vit K, growth hormone → can improve BMD
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PREVENTION : ACCORDING TO WOOLF & DIXON :

4 PHASES OF PREVENTION :

1. Embryonal phase : NUTRITION during pregnancy
2. Born ~ Closure of epiphysis : Diet/Nutrition & Exercise very important.
3. Adult : Exercise, optimal Ca, Vit D/Sun exposure

PEAK BONE MASS: Achieved 3rd decade ➔ After this bone loss begin ➔ Max. gain to minimize bone loss after menopause.

4. Menopause : Exercise, Nutrition, Biphosphonate
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- MANAGEMENT OF OP NEED MULTIDISC. APPROACH


- Penyuluh Kesehatan, Ahli Bangunan, Dll.
CONCLUSION

- OP fx is universal problem
- Very high economic cost
- Best policy: - Prevention fx in OP and treat OP before fx happen
  - After tx of the fx: **DO NOT FORGET TO TREAT OP**
- Intervention/treatment of OP should **NOT** be guided solely of on the basis of BMD

THANK U 4 THE ATTENTION :)