R.S.LORENC

EPIDEMIOLOGY, MORTALITY and MORBIDITY IN OSTEOPOROSIS

The Children Memorial Health Institute, Warsaw, Poland

Prague, March, 27, 2009
Newest Definition of Osteoporosis: NIH Consensus Conference

- Osteoporosis is a skeletal disorder characterized by compromised bone strength predisposing to an increased risk of fracture

- Bone strength reflects the integration of two main features:
  - bone density
  - bone quality
WHO Classification for Postmenopausal Osteoporosis

The T-score compares an individual’s BMD with the mean value for young normals and expresses the difference as a standard deviation score.

<table>
<thead>
<tr>
<th>T-score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
</tr>
<tr>
<td>Low bone mass (osteopenia)</td>
</tr>
<tr>
<td>Osteoporosis</td>
</tr>
</tbody>
</table>

- Normal: \(-1.0\) and higher
- Low bone mass (osteopenia): Between \(-1.0\) and \(-2.5\)
- Osteoporosis: \(-2.5\) and lower

Epidemiological Studies of Osteoporosis and Low Bone Mass relates to:

• Prevalence that depends on:
  – Definition of low bone mass (WHO)
  – Densitometric technique (DXA)
  – Location and number of skeletal sites measured
  – Study population (age, race)

• United States estimates based on
  – Rochester Osteoporosis Project\(^1\)
  – National Health and Nutrition Examination Survey (NHANES III)\(^2\)

DXA Terminology:
The Skeleton Has Different Regions

- **Central skeleton** (axial skeleton plus hips and shoulders):
  - Spine, ribs, pelvis, hips, shoulders

- **Peripheral skeleton** (appendicular skeleton minus hips and shoulders):
  - Extremities (arms and legs)
Different Skeletal Regions Have Different Type of Bone

- **Cortical** or **compact** bone makes up the outer envelope of all bones and the shafts of the long bones (*appendicular skeleton*)

- **Cancellous** or **trabecular** bone makes up the inner parts of the bones, particularly bones of the *axial skeleton*
## Cancellous and Cortical Bone Differences in Mass, Surface Area and Turnover

<table>
<thead>
<tr>
<th></th>
<th>Mass</th>
<th>Surface area</th>
<th>Turnover each year*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cancellous</td>
<td>20%</td>
<td>80%</td>
<td>25%</td>
</tr>
<tr>
<td>Cortical</td>
<td>80%</td>
<td>20%</td>
<td>3%</td>
</tr>
</tbody>
</table>

*Up to 10% of the skeleton is being remodeled at any one time.
Osteoporotic Fractures in Women and Men

Every 30 seconds someone in the European Union suffers a hip fracture as a result of osteoporosis

A call to action!
Hip Fractures
(continued)

• Diagnosis
  – Most are diagnosed clinically
  – Often confirmed with radiography
  – Most are hospitalized and require surgery
Hip Fractures

Femoral Neck ~40%

Intertrochanteric Region ~40%

Graph modified from Cooper C et al. Trends Endocrinol Metab. 1992;3:224.
Complications of Hip Fracture

• Up to 24-30% excess mortality within 1 year\textsuperscript{1,2}
• Nearly 65,000 American women die from complications of hip fracture each year\textsuperscript{3}
• 50% of hip fracture survivors are permanently incapacitated\textsuperscript{4}
• 20% of hip fracture survivors require long-term nursing home care\textsuperscript{5}

Vertebral Fractures

- Most common osteoporotic fracture (~700,000 per year)
- Vertebral fracture as marker for future fracture risk*
  - Forearm fracture: RR = 1.4
  - Vertebral fracture: RR = 4.4
  - Hip fracture: RR = 2.3
- Risk rises in women at age 50-55, in men at age 60-65, and increases linearly with age

Vertebral Fractures

Images adapted from Watts NB. *Am Fam Phys.* 1988;38:193. © American Family Physician, used with permission
Consequences of Vertebral Fractures

• Back pain
• Loss of height
• Deformity (kyphosis, protuberant abdomen)
• Reduced pulmonary function
• Diminished quality of life (loss of self-esteem, distorted body image, dependence on narcotic analgesics, sleep disorder, depression, loss of independence)
• Increased mortality
Distal Forearm Fractures

Complications of Distal Forearm Fractures

- Pain
- Temporary disability; difficulty dressing, toileting, meal preparation
- Degenerative arthritis
- Reflex sympathetic dystrophy
- Six months after fracture, 23% report fair to poor recovery in functional outcome*

QUALITY OF LIFE

Morbidity and Mortality associated with Osteoporotic Fractures
Fracture and quality of life over the life span

Morbidity

Age

50  60  70  80  90

Colles' fracture

Vertebral fracture

Hip fracture
Survival Rates After Fractures

Consequences of hip fracture

One year after hip fracture

- Death within one year: 20%
- Unable to walk independently: 30%
- Permanent disability: 40%
- Unable to carry out at least one independent activity of daily living: 80%
Patients With Prior Fracture Are at High Risk for Future Fragility Fractures

<table>
<thead>
<tr>
<th>Prior Fracture</th>
<th>Wrist</th>
<th>Vertebra</th>
<th>Hip</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wrist</td>
<td>3.3</td>
<td>1.7</td>
<td>1.9</td>
</tr>
<tr>
<td>Vertebra</td>
<td>1.4</td>
<td>4.4</td>
<td>2.5</td>
</tr>
<tr>
<td>Hip</td>
<td>NA</td>
<td>2.5</td>
<td>2.3</td>
</tr>
</tbody>
</table>
Pathogenesis of fragility fractures

**Fall Risk**
- Neuromuscular function
- Environmental risks
- Age

**Impact of fall**
- Type of fall
  - Energy reduction
- External protection

**Skeletal strength**
- Bone mass
- Bone structure
- Bone quality

**Fracture risk**
FRAX™: The WHO Fracture Risk Assessment Tool

www.shef.ac.uk/FRAX/

Welcome

The FRAX™ tool has been developed by WHO to evaluate fracture risk of patients. It is based on individual patient models that integrate the risks associated with clinical risk factors as well as bone mineral density (BMD) at the femoral neck.

The FRAX™ models have been developed from studying population-based cohorts from Europe, North America, Asia and Australia. In their most sophisticated form, the FRAX™ tool is computer-driven and is available on this site. Several simplified paper versions, based on the number of risk factors are also available, and can be downloaded for office use.

The FRAX™ algorithms give the 10-year probability of fracture. The output is a 10-year probability of hip fracture and the 10-year probability of a major osteoporotic fracture (clinical spine, forearm, hip or shoulder fracture).

This is a beta version

Dr. John A Kanis
Professor Emeritus, University of Sheffield

Links:
- International Osteoporosis Foundation: http://www.osteofound.org/
- National Osteoporosis Foundation: http://www.nof.org/
- Japan Osteoporosis Foundation: http://www.jopf.or.jp/

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ASSESSMENT OF OSTEOPOROSIS AT THE PRIMARY HEALTH CARE LEVEL

Report of a WHO Scientific Group

Organized by the World Health Organization Collaborating Centre for Metabolic Bone Diseases, University of Sheffield Medical School, UK and the World Health Organization
Questionnaire:

1. Age (between 40-90 years) or Date of birth
   
   Age: [ ]
   Date of birth: [ ]

2. Sex
   
   - [ ] Male
   - [ ] Female

3. Weight (kg)
   
   [ ]

4. Height (cm)
   
   [ ]

5. Previous fracture
   
   - [ ] No
   - [ ] Yes

6. Parent fractured hip
   
   - [ ] No
   - [ ] Yes

7. Current smoking
   
   - [ ] No
   - [ ] Yes

8. Glucocorticoids
   
   - [ ] No
   - [ ] Yes

9. Rheumatoid arthritis
   
   - [ ] No
   - [ ] Yes

10. Secondary osteoporosis
    
    - [ ] No
    - [ ] Yes

11. Alcohol 3 more units per day
    
    - [ ] No
    - [ ] Yes

12. Femoral neck BMD
    
    [Select]
    [ ]
Number of fractures per year/10 000 population
### Number of Fractures in Percent

*(ICD-10)*

<table>
<thead>
<tr>
<th>Code</th>
<th>Fracture Description</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>S72</td>
<td>Fracture of femur</td>
<td>61.7%</td>
</tr>
<tr>
<td>S72.0</td>
<td>Fracture of neck of femur</td>
<td>18.6%</td>
</tr>
<tr>
<td>S72.1</td>
<td>Pertrochanteric fracture</td>
<td>16.7%</td>
</tr>
<tr>
<td>S72.2</td>
<td>Subtrochanteric fracture</td>
<td>2.4%</td>
</tr>
<tr>
<td>S72.3</td>
<td>Fracture of shaft of femur</td>
<td></td>
</tr>
<tr>
<td>S72.4</td>
<td>Fracture of lower end of femur</td>
<td></td>
</tr>
<tr>
<td>S72.7</td>
<td>Multiple fractures of femur</td>
<td>0.3%</td>
</tr>
<tr>
<td>S72.8</td>
<td>Fractures of other parts of femur</td>
<td></td>
</tr>
<tr>
<td>S72.9</td>
<td>Fracture of femur, part unspecified</td>
<td>0.3%</td>
</tr>
</tbody>
</table>
Patient selection procedure (M80/M81)

<table>
<thead>
<tr>
<th>LOW RISK</th>
<th>AVERAGE RISK</th>
<th>HIGH RISK</th>
</tr>
</thead>
<tbody>
<tr>
<td>FR = 0 – 10%/10 lat</td>
<td>FR = 10 – 20%/10 lat</td>
<td>FR &gt; 20%/10 lat</td>
</tr>
</tbody>
</table>

- **Low Risk**
  - Presence of vertebral fractures (VFA)
  - High BTM
  - Corticosteroid Therapy

- **Average Risk**
  - Presence of vertebral fractures (VFA)
  - High BTM
  - Corticosteroid Therapy

- **High Risk**
  - Presence of vertebral fractures (VFA)
  - High BTM
  - Corticosteroid Therapy

**Differential Diagnosis**
- Hyperparathyroidism
- Osteomalacia, hyperthyroidism, neoplasma

**Treatment of Secondary Osteoporosis**
- Pharmacotherapy
- Rehabilitation
- Fall Prevention

**Prophylaxis**
- Risk Factors Elimination, VIT.D Supplementation

**Evaluation**
- BMD (2 years)
- BTM after 3 months
Assessment without BMD

Consider BMD measurement

Reassure of patient

Assessment with BMD

Consider treatment

No treatment

10-year fracture probability (%)

Age (years)
RECOGNITION OF
OSTEOPOROSIS IN CLINICAL
SETTING
Are Physicians Treating Osteoporosis after Hip Fracture

<table>
<thead>
<tr>
<th>Center</th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>n</td>
<td>163</td>
<td>148</td>
<td>140</td>
<td>51</td>
</tr>
<tr>
<td>DXA</td>
<td>12%</td>
<td>12%</td>
<td>13%</td>
<td>24%</td>
</tr>
<tr>
<td>Ca-Suppl.</td>
<td>27%</td>
<td>1%</td>
<td>3%</td>
<td>25%</td>
</tr>
<tr>
<td>Estrogens</td>
<td>10%</td>
<td>6%</td>
<td>0%</td>
<td>14%</td>
</tr>
<tr>
<td>Alendronate</td>
<td>8%</td>
<td>2%</td>
<td>4%</td>
<td>10%</td>
</tr>
<tr>
<td>Calcitonin</td>
<td>11%</td>
<td>0%</td>
<td>0%</td>
<td>14%</td>
</tr>
<tr>
<td>Raloxifene</td>
<td>0.1%</td>
<td>0%</td>
<td>1%</td>
<td>6%</td>
</tr>
</tbody>
</table>

Total Treatment 29.1%  8%  5%  37%

Harrington J. et al, Arthritis & Rheum. 2002; 47:651
Failure to Diagnose or Treat Osteoporosis After Hip Fracture

Record review: 170 hip fracture patients in major teaching hospital over 3 years

Unrecognized Vertebral Fractures on X-ray

934 women age 60 and older, hospitalized for various reasons (chest x-rays reviewed for fracture)

Common Chronic Diseases: Prevalence (USA)

Consequences of Chronic Diseases: Incidence

1. Riggs BL and Melton LJ III, Bone. 1995;17(suppl.):505S-511S.
Summary and conclusions:

1. Exist the great need for uniform recommendations for osteoporotic fracture prevention and treatment.

2. General treatment threshold is influenced by the level of governmental and personal resources

3. Threshold of every country is influenced by nation related fracture risk gradient

4. With limited resources important issue is rational utilization of diagnostic potential together with high accepted standards of general education program and prophylactics focused on nutrition, physical exercises and fall prevention.