Osteoporosis and Spine Fractures

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Disclosures

*Industry*—
Honoraria for CME events and/or grants (to my institution) from:

- Amgen
- Eli Lilly

*Non-industry*—
Chair, Osteoporosis Canada Scientific Advisory Council
Chair, Canadian Bone Strength Working Group
Learning Objectives

At the end of the session, participants will be able to:

1) Describe the prevalence of osteoporotic spine fractures

2) Discuss the 2010 Osteoporosis Canada recommendations for the diagnosis and management of osteoporosis and fractures

3) Assess an individual with spine fractures and prescribe exercises to improve truncal strength and to decrease pain according to the 2014 Osteoporosis Canada exercise recommendations
Prevalence of Fractures in Canada

Annual incidence of common diseases:

- Osteoporotic fractures: 153,400
  - Hip*: 30,000
  - Wrist: 32,700
  - Vertebra: 38,900
  - Other: 41,500

- Heart Attack: 49,220

- Stroke: 29,874

- Breast Cancer: 22,700

*Canadian hip fractures from (1); Non-hip fracture data extrapolated from (2).
†Other represents non-osteoporotic fractures sites (humerus, clavicle, hands/fingers, patella, tibia, fibula).²

Prevalence of Fractures in Canada

- At least 1 in 3 women and 1 in 5 men suffer an osteoporotic fracture during their lifetime\(^1\)

\begin{itemize}
  \item \textbf{Women} (3 out of 4)
  \item \textbf{Men} (5 out of 10)
\end{itemize}

Osteoporosis and Fractures
Missing the Bridge?

Angela M. Cheung, MD, PhD
Allan S. Detsky, MD, PhD

l lung disease, early satiety, chronic pain, and low self-esteem. Even asymptomatic vertebral fractures are associated with decreased quality of life, increased hospitalization, and mortality. Women and men who sustain a hip
What Happened?

• The floor was slippery
• I was clumsy
• I lost my balance
• I wasn’t looking where I was going ...

It was an ACCIDENT!
% of all fractures that are fragility fractures

Overall: 81%

Age groups

% of all fractures that are fragility fractures

Incidence of Osteoporotic Fractures Increases with Age

Men
Incidence per 10,000/yr

Women
Incidence per 10,000/yr

△ = Hip
○ = Radiographic Vertebral
■ = Wrist

© American Society for Bone and Mineral Research
Contributed by Nicholas Harvey, Susannah Earl, and Cyrus Cooper

Modified from Bone, vol. 29, van Staa TP, Dennison EM, Leufkens HG, Cooper C, Epidemiology of fractures in England and Wales, pp. 517-522, Copyright 2001, with permission from Elsevier.
Reduced survival after vertebral and hip fracture

Bone is an Organ

Fracture = Bone Failure

“Bone Attack”
Fracture -- Predictor of Future Fractures!
Signs of VCF

Acute Event:
- Sudden onset of back pain with little or no trauma

Chronic Manifestation(s):
- Loss of height
- Spinal deformity ("Dowager’s hump")
- Protuberant abdomen

Gold et al., Osteoporosis 1996, 2001
Physical Impact of VCF

Age 50

Age 75

National Osteoporosis Foundation
Osteoporosis

VCFs

- Back Pain
- Spinal Deformity
- Increased Fracture Risk
- Increased Lung Problems, Co-morbidities
- More Bone Loss
- Increased Mortality
- Decreased Activity
- Decreased Lung Capacity
- Impaired Function
- Sleeping Problems
- Loss of Appetite
Post-fracture Care Gap: Comparison with Heart Attack

- Anti-osteoporosis medication post fracture (Osteoporotic Fractures): ~15%
- Beta-blockers post heart attack: ~80%

2010 clinical practice guidelines for the diagnosis and management of osteoporosis in Canada: summary

Alexandra Papaioannou MD MSc, Suzanne Morin MD MSc, Angela M. Cheung MD PhD, Stephanie Atkinson PhD, Jacques P. Brown MD, Sidney Feldman MD, David A. Hanley MD, Anthony Hodsman MD, Sophie A. Jamal MD PhD, Stephanie M. Kaiser MD, Brent Kvern MD, Kerry Siminoski MD, William D. Leslie MD MSc; for the Scientific Advisory Council of Osteoporosis Canada
FRAX Tool: On-line Calculator

Calculation Tool

Please answer the questions below to calculate the ten year probability of fracture with BMD.

Questionnaire:

1. Age (between 40-90 years) or Date of birth
   Age: 59
   Date of birth: Y: [ ] M: [ ] D: [ ]

2. Sex
   Male [ ] Female [ ]

3. Weight (kg) 55.5

4. Height (cm) 154

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 or more units per day
    No [ ] Yes [ ]

12. Femoral neck BMD (g/cm²)
    T-Score [-2.0]

BMI 23.4
The ten year probability of fracture (%)
with BMD
- Major osteoporotic 7.5
- Hip fracture 1.0
2010 Osteoporosis Canada Guidelines

2010 CAROC tool:
Assessment of Basal 10-year Fracture Risk

<table>
<thead>
<tr>
<th>Women</th>
<th>Men</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low risk (&lt;10%)</td>
<td>Low risk (&lt;10%)</td>
</tr>
<tr>
<td>Moderate risk</td>
<td>Moderate risk</td>
</tr>
<tr>
<td>High risk (&gt;20%)</td>
<td>High risk (&gt;20%)</td>
</tr>
</tbody>
</table>

- Femoral Neck T-Score
- Age (years)
Spine Fracture = HIGH RISK (>20%)
High 10-Year Fracture Risk

Those with:

1) Vertebral Fractures
2) Hip Fractures
3) \( \geq 2 \) fragility fractures
4) \( \geq 1 \) fragility fracture + steroid use
Recommended Biochemical Tests

- Calcium, corrected for albumin
- Complete blood count
- Creatinine
- Alkaline phosphatase
- Thyroid stimulating hormone (TSH)
- Serum protein electrophoresis for patients with vertebral fractures
- 25-hydroxy vitamin D (25-OH-D)*

* Should be measured after 3-4 months of adequate supplementation and should not be repeated if an optimal level ≥75 nmol/L is achieved.
How can we Prevent Fractures?

• Lifestyle modifications
  – Vitamin D
  – Calcium
  – Exercise
  – Falls prevention

• Pharmacologic therapy
  – Bisphosphonates
  – Other anti-resorptives
    • Denosumab
    • Hormone therapy
    • Raloxifene
    • Calcitonin
    – Parathyroid hormone
High 10-year Fracture risk = treat
OC Current Recommendations

Calcium intake = diet + supplements
~1200mg per day

On average,
Good diet (no diary products) = 300mg per day
Good diet (+ dairy products) = 500mg per day
Vitamin D = 800 – 2000iu per day

Aim for a serum 25-hydroxyvitamin D level ≥75nmol/L
**First Line Therapies with Evidence for Fracture Prevention in Postmenopausal Women**

<table>
<thead>
<tr>
<th>Type of Fracture</th>
<th>Antiresorptive therapy</th>
<th>Bone formation therapy</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Bisphosphonates</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Alendronate</td>
<td>Risedronate</td>
</tr>
<tr>
<td>Vertebral</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Hip</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Non-vertebral*</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

* For postmenopausal women, ✓ indicates first line therapies and Grade A recommendation. For men requiring treatment, alendronate, risedronate, and zoledronic acid can be used as first line therapies for prevention of fractures [Grade D].
+ In clinical trials, non-vertebral fractures are a composite endpoint including hip, femur, pelvis, tibia, humerus, radius, and clavicle.
** Hormone therapy (estrogen) can be used as first line therapy in women with menopausal symptoms.
Highlighted newer drugs...

- Actonel DR 35mg po q week (on ODB)
- Prolia 60mg sc q 6 months (LU code)
- Aclasta 5mg iv q year over 30mins (LU code)
- Forteo 20ug sc od for 2 years (EAP)
Zoledronic Acid 5 mg reduced all-cause mortality

Hazard Ratio, 0.72 (95% CI, 0.56–0.93)

$P = .0117$

Absolute Risk Reduction, 3.7%

Are there situations where we should not use antiresorptive therapies?
Three common questions:

• Fracture healing
• Kidney function
• ONJ and AFFs
## FREEDOM Trial – fracture healing

<table>
<thead>
<tr>
<th></th>
<th>Placebo N = 3,876</th>
<th>Denosumab 60 mg Q6M N = 3,886</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nonvertebral Fractures, n</td>
<td>465</td>
<td>386</td>
</tr>
<tr>
<td>Patients With Nonvertebral Fractures, n</td>
<td>364</td>
<td>303</td>
</tr>
<tr>
<td>Delayed Healing, n</td>
<td>5</td>
<td>2</td>
</tr>
</tbody>
</table>

### Other Complications Associated With the Fracture or Its Management

<table>
<thead>
<tr>
<th></th>
<th>Placebo</th>
<th>Denosumab 60 mg Q6M</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-union, n</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Surgical Intervention, n (%)</td>
<td>120 (26%)</td>
<td>79 (21%)</td>
</tr>
<tr>
<td>Any Complication, n/N† (%)</td>
<td>20/364 (5%)</td>
<td>5/303 (2%)</td>
</tr>
<tr>
<td>Most Common: Infection, n/N† (%)</td>
<td>4/364 (1%)</td>
<td>2/303 (&lt;1%)</td>
</tr>
</tbody>
</table>
Renal Dysfunction

- Alendronate
- Risedronate
- Raloxifene
- Denosumab

Reduces fractures in CKD (1-4) patients

* No CKD 5 patients in RCTs
Osteonecrosis of the Jaw

- Exposed bone in the oral cavity for 8 weeks or longer
- Can occur spontaneously or following dental surgery
- Can be associated with antiresorptive therapy
Radiographic Images of AFFs

Transverse fracture line
Subtrochanteric
Mid-diaphyseal
Oblique extension
Focal Periosteal Reaction on Lateral cortex
Medial spike
Figure 1. Risks of major osteoporotic fracture and other rare events

- Bis-ONJ*: 1.03
- Bis-AFF (8 y)*: 78
- Bis-AFF (2 y)*: 2
- Death by murder*: 1.62
- Fatal MVA*: 8.4
- Major osteoporotic fracture in low-risk women**: 650
- Major osteoporotic fracture in moderate-risk women**: 1600
- Major osteoporotic fracture in high-risk women**: 3100

Incidence per 100,000 person-years
Falls Assessment

Patient presents to medical facility after a fall

- Periodic case finding in Primary Care: Ask all patients about falls in past year
  - No Falls
    - No Intervention
  - Recurrent Falls
    - Gait/ balance problems
      - Fall Evaluation
        - Assessment
          - History
          - Medications
          - Vision
          - Gait and balance
          - Lower limb joints
          - Neurological
          - Cardiovascular
        - Multifactorial intervention (as appropriate)
          - Gait, balance and exercise programs
          - Medication modification
          - Postural hypotension problem
          - Environmental hazard modification
          - Cardiovascular disorder treatment
  - Single Fall
    - Check for gait/ balance problem
      - No Problem
OC Current Recommendations

Falls prevention and reduction

- Med check
- Assistive device
- Environmental changes – grab bars, non-slip floors
- Muscle strengthening and balance exercises
- Prevent vertebral fractures
Osteoporosis Canada Launches New Exercise Recommendations

*New multicomponent exercise recommendations combine muscle strengthening and balance training as a means of reducing falls and resulting fractures for people living with osteoporosis*

People with osteoporosis, and those at risk of developing it, can prevent bone loss, fractures and falls by combining specific types of exercises, says new recommendations that Osteoporosis Canada released. Osteoporosis Canada is developing tools related to the new guidelines, including a booklet called *Too Fit to Fracture: Managing Osteoporosis through Exercise*, which covers the importance of exercise; what types of exercise; strength, balance, aerobic and posture training; barriers to exercise and much more.

- [Click here to learn more](#)
Expert consensus and best evidence support:
1. Strength training ≥ 2x/wk
2. Balance training daily
3. ≥ 30min/day aerobic physical activity
4. Exercises for back extensor muscles daily
5. Spine sparing strategies like hip hinge and step-to-turn can ↓ spine loads ➔ how to move, rather than how not to move

WOW! That sounds like a lot

- Recommend they start with a few strength exercises 2x/wk, 1 balance challenge daily

- Aerobic physical activity in 10 min bouts

- Combine activities:
  - 20 min walk + 5 min tandem walking + 5 min strength exercise (wall pushups, half squats)
  - Integrate in day: heel raises waiting for tea, sit-to-stand during commercials
What can a physician do?

- Provide the recommendations
  - Recommend they do balance exercises daily
  - Recommend they do strength exercises ≥ 2 week
  - Recommend they accumulate ≥ 30 min moderate to vigorous physical activity daily

- Refer to community programs/services, Bone Fit trained physio or kin

- Recommend spine sparing strategies, supine lying, getting up every 30 min

Resources: http://www.osteoporosis.ca/osteoporosis-and-you/too-fit-to-fracture/
Core activation in standing – see “Intro to theraband” video:
www.osteoporosis.ca/after-the-fracture/videos/
Strength Training: First-timers Fab Five

• Squats or sit-to-stand exercises or lunges for legs and buttock muscles
• Heel raises for lower legs
• Wall pushups for chest and triceps
• Bow and arrow “pulls” with an exercise band for upper back and biceps
• Diagonal shoulder raises with exercise band for shoulders and upper back.
Balance training exercises:

• Reduce base of support (e.g., feet together, tandem stance, one leg stance)
• Shift weight within limits of stability
• Remove other input needed for balance (e.g., eyes closed)
• Dynamic or 3D movements that challenge balance e.g., Tai Chi, dancing, lunges, tandem walk
TANDEM STANCE WITH SUPPORT

Stand with good posture while holding a sturdy chair. Imagine your torso is a box.

Your shoulders and hips are the corners. Keep the torso box straight.

Place the back of your right heel in front of the toes on your left foot.

☐ Put only two fingers on the chair or support object
☐ Do it without holding on to support object
☐ Do it with eyes closed (keep support object nearby)

HOLD FOR _____ SECONDS • REPEAT THE EXERCISE WITH THE OTHER LEG
WALKING IN A PATTERN

☐ HEEL TO TOE

Try walking in an unusual pattern to challenge your balance.

Walk with this pattern for ______.

☐ STEP AEROBICS - TWO NARROW STEPS, THEN TWO WIDE STEPS

Here are some other ones you can try:
☐ Step over cones or cups
☐ Walk in a figure 8
☐ Walk forward or backward, and count forward by 6s
☐ Walk forward or backward, and count backward by 6s

☐ SIDEWAYS OR GRAPEVINE
Teach “spine sparing” during ADL and physical activity

Recommend that patient modify activities that apply *rapid, repetitive, weighted or end-range flexion* (forward bending) or *twisting* torque to the spine.

**How?**

- Hip hinge
- Step-to-turn
- Avoid lifting from or lowering to the floor
- Slow, controlled twist, not to end of range of motion
- Support trunk when flexing
- Hold weight close to body, not overhead

Video tips on movement: [www.osteoporosis.ca/after-the-fracture/videos/](http://www.osteoporosis.ca/after-the-fracture/videos/)

[Image of a woman demonstrating a hip hinge movement with knees bent, shifting bottom backward]
Recommendations re: ADLs

Older adults with osteoporosis but no vertebral fracture:

• Should be able to do ADLs with proper body mechanics, may need to modify/avoid high risk activities.

Older adults with osteoporotic vertebral fracture:

• Consider need for PT/OT referral esp. with impairments in balance or posture, pain or unsafe movement.
• May need to restrict housekeeping to light activities, and to get help with things or assistive devices e.g., heavy lifting, cleaning gutters, shoveling, or changing light bulbs.
• Avoid sitting or standing for long periods intersperse with 5-10 minute periods lying in supine.

Note step-to-turn here!

Hold the item in front of and close to your body.

Step to turn around, do NOT simply twist, to place the object in another spot.

Once you have turned around, bend at the knees while keeping your back straight and place the item down.

Note hip hinge here!

Fit To Fracture: outcomes of a Delphi consensus process on physical activity and exercise recommendations for adults with osteoporosis with or without vertebral fractures. Giangregorio et al, Osteoporosis Int, in press, With kind permission of Springer Science+Business Media
## Exercise and Activity Recommendations

Locate a Bone Fit trained instructor: **English: 1-800-463-6842 / French: 1-800-977-1778** or www.bonefit.ca

<table>
<thead>
<tr>
<th>Exercise</th>
<th>Frequency</th>
<th>Examples/Comments</th>
</tr>
</thead>
</table>
| Strength Training               | ≥ 2x/week          | • Exercises for legs, arms, chest, shoulders, back  
• Use body weight against gravity, bands, weights*  
• 8-12 repetitions maximum per exercise |
| Balance Training                | ~ 20mins daily     | • Standing still: one-leg stand, semi-tandem stance, shift weight between heels and toes while standing  
• Dynamic movements: Tai Chi, tandem walking, dancing  
• Progress from standing still to dynamic |
| Aerobic physical activity       | ≥ 5x/week (30min/day) | • Do bouts of 10 min or more  
• Accumulate ≥ 30 min per day  
• Moderate- or vigorous-intensity (5-8 on 0-10 scale)* |
| Posture/ Back Extensor Training | 5-10mins daily     | • Lie face up on firm surface, knees bent, feet flat. Use pillow only if head doesn’t reach floor. Do this 5-10 min/day.  
• Progressions 1) lying with gentle head press, without changing chin position, perform 3-5 seconds “holds”; 2) Core activation in standing (see intro to theraband: **Videos**: www.osteoporosis.ca/after-the-fracture/videos/) |
| Spine Sparing Strategies        | During daily activities | • Learn a “hip hinge” and “step to turn” so that you can modify activities that flex (bending forward) or twist spine |

*In presence of vertebral fracture, consult Bone Fit trained physiotherapist/kinesiologist, and emphasize good alignment, and moderate over vigorous intensity aerobic activity*

Exercise and Bone Health

• Strength and balance training
• Walking not adequate
• Exercises to strengthen back muscles
• Adjust activity for condition
Osteoporosis
Exercise Guide
Joyce Pan Mightis BSc (Kin), ACSM, OKA
Angela M. Cheung MD, PhD, FRCP, CCD

A look at proper exercise techniques and safe posture for day to day activities

University Health Network
Existing Tools....

www.osteoporosis.ca

After the Fracture: Information about Pain and Practical Tips for Movement

Spine Fractures

Broken bones in the spine are referred to as vertebral compression fractures or spine fractures. The spine is one of the most common sites of broken bones as a result of osteoporosis. Imagine each bone in your spine as a square block. When the bone breaks, it is like the “box” becomes squashed or compressed or flattened.

A spine fracture can happen very suddenly as a result of a fall, or something more minor such as sneezing, coughing, reaching, lifting or carrying. Some spine fractures do cause pain. The pain can vary from mild to excruciating pain in the back. This pain may bring about a visit to the hospital or doctor’s office where an X-ray may confirm a broken bone in the spine.

Two-thirds of broken bones in the spine happen without causing any pain at all and are found either:

- on an X-ray for another purpose, or
- because your healthcare provider thinks you may have lost height.
• **Height loss** can be a warning sign of a spine fracture (a broken bone in your back).

• A spine fracture may be caused by **osteoporosis**, a condition that causes bones to break easily.

• You may not be aware of a broken bone in your back because 66% are painless.

• If you have a spine fracture, **effective treatment** is available to reduce your risk of another broken bone.
DON'T BEND TO OSTEOPOROSIS

STOOPED BACK?
BACK PAIN?
HEIGHT LOSS?

THESE MAY BE SIGNS OF SPINAL FRACTURES
CONSULT YOUR DOCTOR TODAY

Osteoporosis@uhn.ca

November is Osteoporosis Month
1-800-463-6842
www.osteoporosis.ca
THANK YOU!

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youtube.com/OsteoUHN

Today Slides: www.osteoconnections.com/UHN_MSK_2015