Strong Risk Factors for Hip Fracture

Steve Cummings, MD
Outline

- Consequences of hip fracture
- Standard risk factors: BMD and FRAX
- Medical conditions and risk of hip fracture
- Prevention of hip fracture: exercise and drugs
Consequences of hip fracture

One year after hip fracture

- Death within one year: 20%
- Permanent disability: 30%
- Unable to walk independently: 40%
- Unable to carry out at least one independent activity of daily living: 80%
Standard approach

• Measure BMD
• Screen for risk of fracture: FRAX
• Consider treatment if 10 year risk of hip fracture is >3%
Recognize patients who warrant treatment to prevent hip fracture

- Some diagnoses indicate a sufficient risk that warrants treatment
- Not included in FRAX. Trumps a FRAX risk.
- BMD would be optional
FRAX underestimates the impact of strong clinical risk factors.

Checking this makes no difference to risk.

**Questionnaire:**

1. Age (between 40 and 90 years) or Date of Birth
   - Age: 65
   - Date of Birth: Y: [ ] M: [ ] D: [ ]
2. Sex
   - Male
   - Female
3. Weight (kg)
   - 68.04
4. Height (cm)
   - 167.6
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/day
    - No
    - Yes
12. Femoral neck BMD (g/cm²)
    - T-Score: -2.0

**BMI:** 24.2
The ten year probability of fracture (%)
with BMD

- Major osteoporotic: 17
- Hip Fracture: 2.8

If you have a TBS value, click here: Adjust with TBS
Age is the strongest risk factor for hip fracture
Risk doubles every 10 years
Included in FRAX
Meta-analyses

• Systematic review of PubMed and Embase
• Every article reviewed by Richard Eastell and I
• Meta-analyses of eligible studies
• Almost all results had significant heterogeneity
Parkinson’s


7% lower hip BMD
Stroke
Risk of hip fracture after stroke is highest soon after the stroke.

Stroke within 6 months

- 3.35 (1.87, 5.99)
- 3.90 (2.09, 7.27)
- 3.60 (2.35, 5.50)
Bone loss after stroke is prevented by zoledronate

Poole et al., Stroke 2007 38: 1519-1525
Type 1 Diabetes

17.80 (5.59, 56.69)
6.90 (2.20, 21.62)
3.28 (2.52, 4.26)
3.54 (2.75, 4.56)
7.10 (4.41, 11.43)
12.25 (5.05, 29.72)
1.70 (1.31, 2.21)
25.40 (4.71, 137.03)
3.23 (2.81, 3.71)
Type 2 Diabetes

2.03 (1.15, 3.58)
1.56 (0.57, 4.28)
1.16 (0.81, 1.66)
0.90 (0.60, 1.34)
1.70 (1.09, 2.66)
0.97 (0.92, 1.02)
1.05 (1.01, 1.10)
2.20 (1.80, 2.69)
1.18 (1.12, 1.24)
1.11 (1.08, 1.15)
1.20 (1.06, 1.35)
1.50 (1.14, 1.97)
1.70 (1.21, 2.38)
1.57 (1.03, 2.39)
1.82 (1.24, 2.68)
1.34 (1.01, 1.78)
1.38 (1.19, 1.61)
1.11 (1.08, 1.13)
Heart Failure

2.55 (2.21, 2.94)

6.30 (3.38, 11.74)

4.40 (3.43, 5.64)

1.59 (0.93, 2.72)

1.41 (0.98, 2.03)

1.82 (1.25, 2.65)

1.58 (1.03, 2.42)
Heart failure and the hip fracture treatment threshold

The unaffected twin had the same increased risk of hip fracture

HIV Infection

5.03 (1.25, 20.22)

8.99 (1.39, 58.07)

6.20 (3.51, 10.94)

3.70 (1.85, 7.40)

1.38 (0.63, 3.02)

3.90 (2.71, 5.60)
Chronic kidney disease (CKD)
(GFR < 60 ml/m)
End-stage Renal Disease (ESRD)

- 4.71 (4.54, 4.89)
- 6.20 (5.68, 6.77)
- 4.11 (2.95, 5.72)
- 3.17 (2.04, 4.93)
- 17.40 (10.51, 28.81)
- 4.40 (4.17, 4.64)
- 4.44 (4.16, 4.74)
Risk of hip fracture increases with number of acute hospitalizations

Prevention of hip fracture

Exercise to prevent falls and fractures

Drug treatments
Who should be treated?
Cut point for ‘high risk, do something!’

• High-dose glucocorticoids (prednisone \(>7.5\) mg/day) are associated with a **2.2-fold risk** of hip fracture

• Generally accepted as an indication for treatment

• Therefore, any higher risk would be considered reason to treat – or at least evaluate for treatment.
Relative risk of hip fracture

End-Stage Renal Disease (5)
Parkinson's Disease (7)
HIV Infection (5)
Type 1 Diabetes Mellitus (7)
Heart Failure (5)
COPD (3)
History of Stroke (15)
Ischemic Heart Disease (4)
Chronic Kidney Disease (6)
Type 2 Diabetes Mellitus (14)

Hazard Ratio (95% CI)
Treatments reduce hip fracture risk 40 to 50%

<table>
<thead>
<tr>
<th>Class</th>
<th>Drug name</th>
<th>Type of fracture</th>
<th>Hip</th>
<th>Nonvertebral†</th>
<th>Vertebral</th>
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</thead>
<tbody>
<tr>
<td></td>
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<td>Treatment relative risk (95% CI)</td>
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<tr>
<td>Bisphosphonates</td>
<td></td>
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<td></td>
<td>Alendronate</td>
<td>0.45 (0.27, 0.68)</td>
<td>0.78 (0.66, 0.92)</td>
<td>0.50 (0.33, 0.68)</td>
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<td>Risedronate</td>
<td>0.48 (0.31, 0.66)</td>
<td>0.68 (0.55, 0.81)</td>
<td>0.46 (0.31, 0.68)</td>
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<td>Zoledronate</td>
<td>0.50 (0.34, 0.73)</td>
<td>0.69 (0.55, 0.84)</td>
<td>0.35 (0.20, 0.64)</td>
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<td>Ibandronate</td>
<td>0.49 (0.20, 1.82)</td>
<td>0.88 (0.43, 1.64)</td>
<td>0.62 (0.37, 0.98)</td>
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<td>Denosumab</td>
<td>0.50 (0.27, 0.86)</td>
<td>0.74 (0.56, 0.94)</td>
<td>0.33 (0.19, 0.65)</td>
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<td>Raloxifene</td>
<td>0.87 (0.63, 1.22)</td>
<td>0.87 (0.63, 1.22)</td>
<td>0.57 (0.39, 0.83)</td>
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<tr>
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<td>Teriparatide</td>
<td>0.50 (0.32, 0.78)</td>
<td>0.42 (0.10, 1.82)</td>
<td>0.30 (0.16, 0.55)</td>
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Efficacy in falls?

- Do treatments prevent hip fractures due to falls, such as in Parkinson’s?
- No direct evidence
- 90% of all hip fractures are due to falls and treatments reduce risk overall and in all subgroups
Meta-analysis of studies of exercise and fractures

- 10 “trials” for falls
- Endpoint: any fracture
- 50% reduction: RR = 0.49 (95% CI, 0.31–0.76)
- However,
  - Included non-randomized studies,
  - Most not blinded. Most collected fractures by self-report, not confirmed by x-ray report
  - Significant publication bias (P<0.001)

Kemmler, Osteoporosis Int 2013;24:1937-50
Conclusions

Ordinary screening and treatment:
• COPD, past stroke, ischemic heart disease, chronic kidney disease, and Type 2 DM

High risk: do something!
• ESRD, Parkinson’s, HIV, Type 1 DM, heart failure, or recent stroke

Prevention
• Treatment with an effective drug
• Exercise program, at least 3 times per week
Thanks

Richard Eastell
Meta-analyses:
Stephanie Harrison, SFCC data analyst
Evans Walker, UCSF Library