Patient vignettes in osteoporosis: Fracture prevention with bone formation (anabolic) therapy

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Rosaria

68-year-old woman with 2 silent spine fractures sustained during anti-osteoporosis treatment

Age	68 y	Sex	Female	Weight	60.8 kg	Height	165.0 cm

Fracture history	• 2 silent vertebral fractures observed on a cxr for pneumonia, age 68 y; no history of trauma and cxr 3 y ago was clear/no fracture
BMD T-score	**Lumbar spine** −2.7; **Femoral neck** −2.3; **Total hip** −2.1 **BMD assessment date** ~2 y ago
Fracture risk details	• Multiple spine fractures 1–3 y ago • BMD ≤−2.5, lumbar spine • Secondary osteoporosis cause: early menopause (<45 y) • Father experienced significant height loss by age 80 y and had a severe forward hunch • Physically active: walks daily for ~0.5 hour; cycles on weekends ~3 hours • Prospective height loss (expected) • No falls within past year • Nonsmoker, infrequent alcohol intake

Medications	**Current** Alendronate 70 mg qw (since age 66 y) Calcium 600 mg qd and vitamin D 1000 IU qd **Prior** Nothing significant
Comorbidities	Osteoarthritis (hands) Spontaneous/early menopause (age 44 y)
Additional notes	• Patient was referred for a specialist assessment due to 2 silent spine fractures observed on a cxr while on oral bisphosphonate therapy • Patient does not recall any significant back injury but remembers minor back pain ~6 mo ago, which she attributed to computer work/muscle tension • Patients is vegetarian but eats a lot of dairy • She reports being highly adherent to bisphosphonate therapy and calcium/vitamin D supplements; with her family history, she wants to make sure she does everything she can • Normal initial blood tests ordered by GP: calcium (corrected for albumin), phosphate, creatinine (eGFR), alkaline phosphatase, thyroid-stimulating hormone, serum protein electrophoresis, and 25-hydroxyvitamin D • Patient mentioned losing height over the past year (~2 cm) and that she does not like how her upper back is rounding and does not want to end up looking like her dad

FRAX: 10-y fracture risk calculator based on Canadian data[1]

Clinical FRAX without BMD[a]

Questionnaire:
1. Age (between 40 and 90 years) or Date of Birth — Age: 68; Date of Birth: Y: M: D:
2. Sex — Male / **Female**
3. Weight (kg) — 60.8
4. Height (cm) — 165
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) — Select BMD

Clear | Calculate

BMI: 22.3
The ten year probability of fracture (%)
without BMD
Major osteoporotic: 25
Hip Fracture: 8.6

Osteoporosis Canada, AACE, BHOF, NAMS, and SOGC guidelines indicate that FRAX can be used without entering BMD when not available[2-6]; FRAX without BMD predicts a hip fracture with ~80% chance[7]

≥20% for MOF[2-6,8] (i.e., hip, spine, humerus, or distal forearm fracture) or **≥3.0%** for hip fracture[2-5,8] indicates **high** future fracture risk

FRAX with BMD[a]

Questionnaire:
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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: -2.2

Clear | Calculate

BMI: 22.3
The ten year probability of fracture (%)
with BMD
Major osteoporotic: 17
Hip Fracture: 3.4

If you have a TBS value, click here: Adjust with TBS

Note: outdated DXA scan (2 y ago, high risk, 2 spine fractures since)

Rosaria: Clinical management based on recent North American guidelines[2-6,8,9]

Osteoporosis and fracture risk

- Treatment failure: on-treatment fracture,[b] treatment adherent, and no apparent secondary causes[2,3,5,6,8]
- **Recommended for BF therapy—very high risk: recent fracture ≤1 y[2,3,5,9] (also, ≥2 spine fractures[2-4,8,9] or hip fracture FRAX score >4.5%[2,3])**
- Osteoporosis diagnosed 2 y ago by family doctor based on BMD T-score ≤−2.5[2-6]

After completing BF treatment, guidelines[2-6,8,9] and product monograph[10] recommend switching to antiresorptive therapy to preserve the achieved BMD gains.

What if this patient was a man with a similar risk factor profile? Per product monograph, romosozumab is not indicated in men and teriparatide may be considered after failure/intolerance to prior therapy.[10,11]

Management

- Indicated for **romosozumab**: osteoporosis + fracture or ≥2 risk factors (≥2 fractures and early menopause/<45 y); no hx of MI or stroke and no major CVD risk factors[10]
- Indicated for **teriparatide**: fracture hx or BMD T-score ≤−2.5; no known risk factors for osteosarcoma[11]
- DXA scan: ordered to confirm pretreatment BMD based on recent data
- Vitamin D: continue supplementing 1000 IU/d; calcium: continue supplementing 600 mg/d and consuming dairy
- Blood tests: reordered (prior tests ~2 mo ago) to exclude contraindications/hypocalcemia and secondary osteoporosis causes[2-6]
- Patient preferences: discussed treatment initiation with BF therapy (qd vs qm dosing) and follow-on antiresorptive treatment after completing BF treatment (bisphosphonates vs denosumab)

AACE, American Association of Clinical Endocrinology; BF, bone formation; BHOF, Bone Health and Osteoporosis Foundation; BMD, bone mineral density; BMI, body mass index; CVD, cardiovascular disease; cxr, chest x-ray; DXA, dual-energy x-ray absorptiometry; eGFR, estimated glomerular filtration rate; GP, general practitioner; FRAX, fracture risk assessment tool; hx, history; LS, lumbar spine; MI, myocardial infarction; MOF, major osteoporotic fracture; NAMS, The North American Menopause Society; qd, daily; qw, weekly; qm; monthly; SOGC, Society of Obstetricians and Gynaecologists of Canada; TBS, trabecular bone score.

[a]Additional details for the following FRAX entries: 5. adult fracture occurring with low trauma (excluding hands, feet, and cranium); 6. biological mother/father hip fracture; 7. currently smokes tobacco; 8. current/past oral glucocorticoid use, ≥5 mg qd or equivalent; 9. confirmed diagnosis of rheumatoid arthritis; 10. disorders strongly associated with osteoporosis (including type 1 diabetes, osteogenesis imperfecta in adults, untreated long-standing hyperthyroidism, hypogonadism, premature menopause/<45 y, chronic malnutrition, malabsorption, and chronic liver disease); 11. ≥3 units of alcohol daily; 12. enter the T-score if BMD scan is unknown and leave BMD field blank if BMD results are not available.

[b]Consider treatment failure if no secondary osteoporosis present and ≥2 on-treatment fractures (regardless of adherence) or ≥1 fracture if adherent to therapy.[2,3,5,6,8]

1. FRAX® Risk Assessment Tool, Canada. Accessed July 1, 2024. https://frax.shef.ac.uk/FRAX/tool.aspx?country=19; 2. Camacho PM, et al. *Endocr Pract*. 2020;26(Suppl 1):1-46; 3. Khan AA, et al. *J Obstet Gynaecol Can*. 2022;44(5):527-536.e5; 4. LeBoff MS, et al. *Osteoporos Int*. 2022;33:2049-2102; 5. The North American Menopause Society. *Menopause*. 2021;28:973-997; 6. Morin SN, et al. *CMAJ*. 2023;195(39):E1333-E1348; 7. Hoff M, et al. *Osteoporos Int*. 2017;28(10):2935-2944; 8. Shoback D, et al. *J Clin Endocrinol Metab*. 2020;105(3):dgaa048; 9. Qaseem A, et al. *Ann Intern Med*. 2023;176(2):224-238; 10. EVENITY® (romosozumab-aqqg). Product Monograph. Amgen Inc.; 2020; 11. Pr FORTEO® (teriparatide (rDNA origin) injection). Product Monograph. Eli Lilly and Co; 2021.

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