OSSTF-Target 1

Medical osteoporosis management

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Overarching objective

Optimize medical management of patients' bone health in the context of instrumented spine surgery in adults aged 50 or older.

The guidelines need to be widely applicable to promote adoption.

Defined specific objectives

1a.	Which patients require evaluation for bone health in a preoperative setting?
1b.	Which investigations need to be done to evaluate bone health?
2.	Algorithm to categorize patients as low-moderate, high, or very high risk.
3.	Which medical management is appropriate if major spine surgery is planned within the next 3 or 12 months?
4.	Which medical management is appropriate after emergency spine surgery?

Patient aged ≥ 50 years considered for elective spine surgery

Risk factor assessment

- Prior fracture at or after age 50 years (hip, spine, pelvis, femur, humerus)
- Known osteopenia/osteoporosis
- Taking oral steroid >7.5 mg
- Radiographic osteopenia and/or old, asymptomatic compression fracture (as defined by orthopedic surgeon)
- Fracture risk assessment tool (FRAX) for major osteoporotic fracture (MOF) ± bone mineral density (BMD) ≥ 20%

Yes

Refer for further investigations* with fracture liaison service / as per local guidelines

No

Schedule surgery

Low - moderate risk

High risk

Very high risk

Treat with antiresorptive** or anabolic** and consider surgical delay

Treat with anabolic** if possible and strongly consider surgical delay

* See Table 1
** See Table 2

Flowchart provided by Neil Binkley, University of Wisconsin, USA

Risk classification and treatment

Risk classification	Treatment approach
Normal bone/low risk	Optimize calcium/vitamin D if needed and proceed with surgery
Osteopenia/intermediate risk	Optimize calcium/vitamin D if needed and proceed with surgery
Osteoporosis/high risk	Optimize calcium/vitamin D; antiresorptive or anabolic therapy and consider delay in surgery
Severe osteoporosis/very high risk	Optimize calcium/vitamin D; anabolic therapy if possible and suggest delay of surgery if possible. If anabolic therapy not feasible, use antiresorptive therapy

Definitions

- Normal: FRAX w/out BMD < 10% or no fracture after age 50 years then no dual energy x-ray absorptiometry (DXA) & no bone health optimization (BHO) referral. For others after BHO evaluation; normal BMD, MOF < 20%, no prior fracture, normal trabecular bone score (TBS) and Hounsfield unit (HU) when available
- Osteopenia/intermediate risk: Lowest T-score -2.4 or better, no prior fracture, MOF risk < 10%
- Osteoporosis/high risk: Lowest T-score -2.5 to -3.4, recent fracture (within 2 years), MOF risk 20–30%
- Severe osteoporosis/very high risk: Lowest T-score ≤ -3.5 OR MOF risk > 30% OR recent fracture OR multiple prior fractures

Table 1

Recommended investigations for patients being assessed for osteoporosis (provided by Suzanne Morin, MD)

Biochemical tests	Imaging
Calcium	BMD measurement (hip and spine) by DXA
Creatinine	Lateral radiograph of the thoracic and lumbar spine or DXA-based vertebral fracture assessment
Alkaline phosphatase	
Thyroid-stimulating hormone	
25-hydroxyvitamin D	
Serum protein electrophoresis in patients with vertebral fractures	

NB: Most guidelines may recommend more advanced tests depending on the local context or type of clinic.

References (Table 1)

1. Osteoporosis Canada: **Papaioannou A et al**. 2010 clinical guidelines for the diagnosis and management of osteoporosis in Canada. *CMAJ.* 2010 Nov 23;182(17):1864−73
2. National Osteoporosis Foundation: **Cosman F et al.** Clinician's guide to prevention and treatment of osteoporosis. *Osteoporos Int.* 2014 Oct;25(10):2359−2381.
3. Scientific Advisory Board of the European Society for Clinical and Economic Aspects of Osteoporosis (ESCEO) and the Committees of Scientific Advisors and National Societies of the International Osteoporosis Foundation (IOF): **Kanis JA et al.** European guidance for the diagnosis and management of osteoporosis in postmenopausal women. *Osteoporosis Int.* 2019 Jan;30(1):3−44
4. National Osteoporosis Guideline Group 2017 https://www.sheffield.ac.uk/NOGG/NOGG%20Guideline%202017.pdf. Accessed 2017.

Table 2

Anti-osteoporotic medication: summary of time to onset and scale of benefit at the spine (provided by Kassim Javaid, MD)

Agent	Time to benefit as measured by nadir/ peak bone turnover marker change	Benefit at spine as measured by spinal bone density at 1 year	Comments
Alendronate(1)	3-6 months(2)	4.5%	Weekly antiresorptive oral agent. Requires no swallowing issues and good adherence
Risedronate(3)	3-6 months(2)	4%	Weekly antiresorptive oral agent. Requires no swallowing issues and good adherence
Zoledronate(4)	< 1 month(5)	3.9%	Annual antiresorptive infusion. Requires good renal function.
Denosumab(6)	< 1 month	7.4%	6 monthly antiresorptive subcutaneous injection. Concerns about off-effect
Teriparatide(7)	< 1 month	6.5%	Daily anabolic subcutaneous injection for up to 2 years then switch.
Denosumab and Teriparatide(7)	< 1 month	8.4%	
Romosozumab(8)	< 1 month	14%	Monthly anabolic subcutaneous injection for 1 year then switch. Contraindicated if previous/ recent myocardial infarction or stroke.

References (Table 2)

1. **Black DM, Cummings SR, Karpf DB, et al.** Randomised trial of effect of alendronate on risk of fracture in women with existing vertebral fractures. *Lancet.* 1996 Dec 7;348(9041):1535−1541.
2. **Hosking D, Adami S, Felsenberg D, et al.** Comparison of change in bone resorption and bone mineral density with once-weekly alendronate and daily risedronate: a randomised, placebo-controlled study. *Curr Med Res Opin*. 2003;19(5):383−394.
3. **Harris ST, Watts NB, Genant HK, et al.** Effects of risedronate treatment on vertebral and nonvertebral fractures in women with postmenopausal osteoporosis: a randomized controlled trial. Vertebral Efficacy With Risedronate Therapy (VERT) Study Group. *JAMA*. 1999 Oct 13;282(14):1344−1352.
4. **Black DM, Delmas PD, Eastell R, et al.** Once-yearly zoledronic acid for treatment of postmenopausal osteoporosis. *N Engl J Med*. 2007 May 3;356(18):1809−1822.
5. **Reid IR, Brown JP, Burckhardt P, et al.** Intravenous zoledronic acid in postmenopausal women with low bone mineral density. *N Engl J Med.* 2002 Feb 28;346(9):653−661.
6. **Cummings SR, San Martin J, McClung MR, et al.** Denosumab for prevention of fractures in postmenopausal women with osteoporosis. *N Engl J Med*. 2009 Aug 20;361(8):756−765.
7. **Leder BZ, Tsai JN, Uihlein AV, et al.** Denosumab and teriparatide transitions in postmenopausal osteoporosis (the DATA-Switch study): extension of a randomised controlled trial. *Lancet*. 2015 Sept 19;386(9999):1147−1155.
8. **Saag KG, Petersen J, Brandi ML, et al.** Romosozumab or alendronate for fracture prevention in women with osteoporosis. *N Engl J Med.* 2017 Oct 12;377(15):1417−1427.