

osteoporosis update



Osteoporosis
Society
of Canada

La Société
de l'Ostéoporse
du Canada

a practical guide for Canadian physicians

Winter 2003 vol. 7 no. 1

Osteoporosis Society leads the way

*2002 clinical practice guidelines
for the diagnosis and management
of osteoporosis in Canada*
help you deliver optimal care



special guidelines issue

Osteoporosis Update
is published four times a year
by the OSTEOPOROSIS
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Osteoporosis Update is made possible with
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ISSN 1480-3119

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editorial comment



Canada and the OSC lead the way

The key lies in early detection and treatment

Despite the many scientific advances in osteoporosis research in recent years, current clinical practice does not always reflect this knowledge. Many high-risk patients continue to be undiagnosed and untreated. Osteoporosis affects 1.4 million Canadians — both women and men — and the estimated annual cost of treating the disease, along with the debilitating fractures it can cause, runs in excess of \$1.3 billion. Not only that, but with the aging population over the next 25 years, the prevalence of osteoporosis is expected to rise sharply — translating into more suffering and an even greater cost burden to society.

Osteoporosis is often called the “silent thief” because bone density can fall even before any obvious symptoms appear. But it should not just be considered a normal part of aging. Rather, it can strike individuals at all ages — even those who do not seem to be at high risk. Your patients need to be informed about ways to reduce lifestyle-related risk factors: maintaining a balanced diet that includes adequate calcium and vitamin D, participating in physical activities (especially weight-bearing activities), limiting their intake of caffeine and alcohol and avoiding smoking. While there is no cure for osteoporosis, you can reassure your patients that a variety of treatment options now exist, and help them to choose the type of therapy most suited to their individual case and needs.

The OSC guidelines are the first evidence-based guidelines on osteoporosis

ever published worldwide. They were developed according to the most rigorous protocol: an explicit, comprehensive, systematic, evidence-based review with carefully stated criteria utilizing the McMaster University guidelines approach. This approach makes them an important decision-making tool for clinicians. They will help alleviate the problem of underdiagnosis and undertreatment by providing the most current, best evidence from clinical research, so that decisions can be adapted to patient needs and improve care and optimal health outcomes.

This issue of *Osteoporosis Update* provides an overview of the updated guidelines, presenting the key points and recommendations of the various committees in a clear and concise format. It is accompanied by a handy reference card that will allow busy physicians to quickly review the major risk factors for osteoporosis as well as for fracture, indications for BMD testing and the main points regarding optimal treatment. In our ongoing commitment to supporting clinicians and patients, the Scientific Advisory Council of the OSC hopes that these tools will help you keep the guidelines in mind when it comes to offering the best possible care to your patients with osteoporosis. Having established an effective process, we have already begun to review the new literature and expect to be able to update the guidelines more frequently. Stay tuned!

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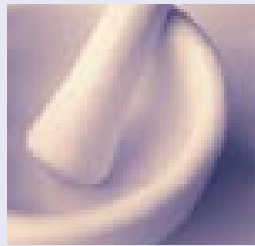
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2002 Clinical Practice Guidelines

Power lies in early detection and prevention

New guidelines point the way

What your patients need to know

- In Canada, one in four women and one in eight men over 50 years of age have osteoporosis.
- 25% of Canadians will be over 65 by the year 2041 — as the population ages, the osteoporosis rate is expected to increase sharply.
- A 50-year-old Caucasian woman has at least a 40% risk of developing a new fracture in her remaining lifetime.
- Among women who sustain a hip fracture, 50% fail to regain their previous level of functional ability and require long-term care.
- There is an excess 20% mortality within the year following a hip fracture.
- Estimated acute care costs for osteoporosis in Canada in 1993 were \$1.3 billion.
- Osteoporosis is not an inevitable part of aging! While there is no cure for the condition, it is often preventable through early detection of fracture risk, treatment to avoid additional fractures, and education about appropriate lifestyle measures that include healthy diet and exercise.

This issue of *Osteoporosis Update*, based on the 2002 Clinical Practice Guidelines published in *Canadian Medical Association Journal (CMAJ) 2002;167[10 suppl]:S1-S34*, offers physicians a succinct overview of the new OSC recommendations and strategies proposed for the clinical management of osteoporosis. It traces the main lines, providing a summary and highlights of the key recommendations of interest to the medical community involved in osteoporosis patient care — what is new in risk assessment, what is the position on current diagnostic technologies, what is the state-of-the-art in terms of prevention and therapeutic interventions? Applying the most effective diagnostic and management methods for osteoporosis can help reduce fracture occurrence, improve quality of life for patients as well as reduce the medical and societal costs the disease exacts.

WHAT IS OSTEOPOROSIS?

The World Health Organization (WHO) defines osteoporosis as a skeletal disease, “characterized by low bone mass and a micro-architectural deterioration of bone tissue with a resultant increase in fragility and risk of fracture.” The OSC continues to use the WHO study group’s criteria for interpreting bone mineral density (BMD) results, which identify osteoporosis by a BMD 2.5 standard deviations (SD) or more below the mean for young adult women. (See WHO diagnostic criteria, page 8.)

Recently, a US National Institutes of Health (NIH) consensus conference defined the condition as “...a skeletal disorder characterized by compromised bone strength predisposing a person to an increased risk of fracture. Bone strength reflects the integration of two main features: bone density and bone quality.” Currently, there is no available means for measuring bone quality; bone density remains the most commonly used measurement for diagnosing osteoporosis and identifying patients at risk for fracture.

While osteoporotic (fragility) fractures — clinically defined as ones that result from a minor trauma, such as a fall from a standing height or less, or no identifiable trauma — are an important cause of disability and death, the good news, for both patients and physicians, is that some can be prevented.

METHODOLOGY

The OSC appointed a Steering Committee to identify the major areas related to osteoporosis and to direct the work of organizing the guidelines. Committees, comprised of SAC members and medical and scientific experts from across the country and divided into sections corresponding to each of the key areas, then conducted an extensive literature search.

Of the 89,804 abstracts resulting from the search, close to 7,000 full citations were selected for review. Recommendations were developed on the basis of the research data, graded by level of evidence, and expert consensus (see Tables 2 and 3, page 13, for criteria for assigning levels of evidence and grades of recommendation).

Is my patient at risk?

Clinical evaluation of osteoporosis risk factors

The new OSC guidelines feature a revised set of fragility fracture risk factors that identify individuals who should be assessed for osteoporosis, summarized in Table 1, opposite. The SAC established this list to help physicians make informed decisions about which patients require further assessment, and when medical intervention is appropriate. The major focus in risk assessment is now on identifying patients at risk of fracture. Common fracture sites are the wrist, humerus, ribs, vertebral body, pelvis and hip. Systematic review of population studies and osteoporosis clinical trials has led to the identification of key factors for predicting osteoporotic (fragility) fracture risk and to the development of recommendations that will help in case finding.

HIGHLIGHTS AND RECOMMENDATIONS

The current OSC position recommends that all postmenopausal women and men over 50 years of age be assessed for the presence of osteoporosis risk factors. Risk factors for fractures should not be considered independently of one another. The more major risk factors individuals have, the more likely they are to experience a fracture. Evidence shows that combining clinical evaluation with BMD testing out-performs any other single method of risk-assessment. Age, BMD, fracture(s) and family history of osteoporosis are the best predictors of fracture risk. Individuals with a major risk factor, in combination with low BMD, have the greatest risk for fracture. For example, a 55-year-old with low BMD is at significantly lower risk than a 75-year-old with the same BMD. Based on their clinical judgment and the patient's personal preferences, physicians should discuss the various treatment options with those patients they consider to be candidates for therapy (Figure 2, page 9).

Key predictors of osteoporotic fracture

Four major factors identify individuals at risk for fracture and those requiring possible pharmacologic treatment.

- **Low BMD.** Numerous studies link low BMD to fracture risk in individuals without prior fragility fracture. The relative risk approximately doubles for each standard deviation of bone density below baseline (either mean peak bone mass or mean based on the individual's age and sex). The OSC recommends BMD measurement for everyone age 65 and older and for targeted case finding in individuals under 65.
- **Prior fragility fracture after age 40** increases an individual's risk for another one from 1.5-9.5 times, depending on age at



assessment, and number and site of prior fracture occurrence. Studies with respect to vertebral fractures have yielded the best data. Combined results from all studies, for both women and men and for all fracture sites, demonstrate that the risk of future fracture goes up by 2.2-fold among those with previous fragility fracture, compared to those with no history of fracture.

- **Age.** The average 10-year probability of experiencing a fracture of the forearm, proximal humerus, spine or hip

table 1 Factors that identify people who should be assessed for osteoporosis

Major risk factors

- Age \geq 65 years
- Vertebral compression fracture
- Fragility fracture after age 40
- Family history of osteoporotic fracture (especially maternal hip fracture)
- Systemic glucocorticoid therapy > 3 months
- Malabsorption syndrome
- Primary hyperparathyroidism
- Propensity to fall
- Osteopenia apparent on x-ray film
- Hypogonadism
- Early menopause (before age 45)

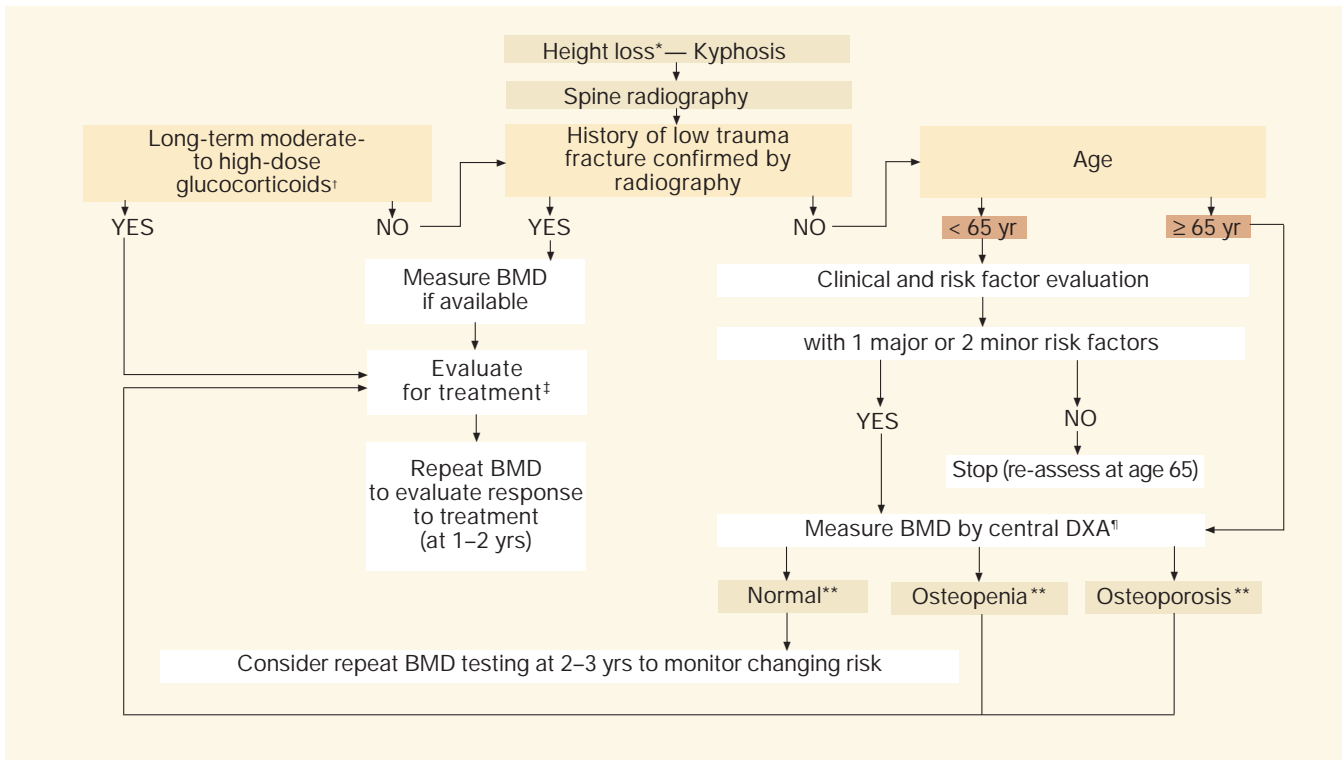
Minor risk factors

- Rheumatoid arthritis
- Past history of hyperthyroidism
- Chronic anticonvulsant therapy
- Low dietary calcium intake
- Smoker
- Excessive alcohol intake
- Excessive caffeine intake
- Weight < 57 kg
- Weight loss > 10% of weight at age 25
- Chronic heparin therapy

Note: Postmenopausal women and men over age 50 with at least 1 major or 2 minor risk factors should undergo testing for BMD.

Adapted from Table 3 of Brown et al. *CMAJ* 2002;167(10 suppl):S5. With permission from the publisher.

figure 1 Who should be tested for osteoporosis?



Note: *4 cm historical height loss; 2 cm prospective height loss [Grade D]. † Low to moderate: 2.5–7.5 mg prednisone/day; moderate to high: > 7.5 mg prednisone/day. ‡ See Figure 2, page 9. †Central DXA = spine and hip. **As defined by the World Health Organization.

Adapted from Figure 1, Brown et al. *CMAJ* 2002;167(10 suppl):S6. With permission from the publisher.

rises up to eight-fold for women and five-fold for men, between ages 45 and 85 (for details, refer to Table 4 of Brown et al. *CMAJ* 2002;167(10 suppl):S7).

- **Family history of osteoporotic fracture.** Genetic influences play an important role in osteoporosis, with heredity accounting for 50-80% of the variability in bone density. The Study of Osteoporotic Fractures has established maternal history of hip fracture as a key risk factor for hip fracture in a population of elderly women. While trials exploring genetic factors have mainly focused on female relatives, male first-degree relatives should also be included in the assessment. It is now quite clear that osteoporosis is not just a women's disease. Other factors include body weight < 57 kg, weight loss since age 25, high caffeine consumption and inadequate calcium intake (not as strong predictors of fracture risk as those listed above).

Falls

Falling is a risk factor for fracture even in the absence of osteoporosis. Since people with osteoporosis have an even higher risk of fracture if they also have a propensity to fall, risk factors for falling should form part of the assessment process. These include certain problems associated with general frailty, such as

reduced muscle strength (inability to rise from a chair without assistance) or impaired balance, low body mass and poor vision.

Common causes of secondary osteoporosis

Some medications or clinical conditions are known to be associated with bone loss and secondary osteoporosis. Patients with hypogonadism or early menopause (before age 45), malabsorption syndromes, rheumatoid arthritis, a past history of hyperthyroidism, or who are on chronic heparin or glucocorticoid therapy, should be evaluated for other risk factors. The additional presence of low bone density or a prior fragility fracture makes them eligible for therapeutic intervention.

- **Glucocorticoids.** Studies show that systemic glucocorticoid therapy is a major risk factor for osteoporosis, especially for postmenopausal women and for men over 50 years of age.

The OSC makes the following recommendations:

- Patients receiving > 2.5 mg prednisone daily for more than three months are at higher risk for fragility fractures and should be considered for BMD measurement.
- Patients receiving > 7.5 mg prednisone daily for more than three months should be assessed for bone-sparing therapy, especially if postmenopausal or over age 50.

The latest in diagnosis

Ground rules for measurement and interpretation of results

Advances in diagnostic technologies for bone mineral density (BMD) measurement enable earlier detection of this “silent disease” in its asymptomatic phase, before a fracture occurs. Testing can be used to establish a diagnosis of osteoporosis, predict future fracture risk and monitor treatment response.

WHO DIAGNOSTIC CRITERIA FOR BMD

Diagnosis of osteoporosis is derived from the following classification of BMD measures by a WHO Working Group, based on fracture risk:

Normal BMD: T-score* between +2.5 and -1.0, inclusive (2.5 SDs above and 1.0 SD below the young adult mean)

Osteopenia (low BMD): T-score between -1.0 and -2.5

Osteoporosis: T-score \leq -2.5

Severe osteoporosis: T-score \leq -2.5 plus fragility fracture

* “T-score” is the number of standard deviations (SD) the patient’s BMD is above or below the mean value for that of normal young adults.

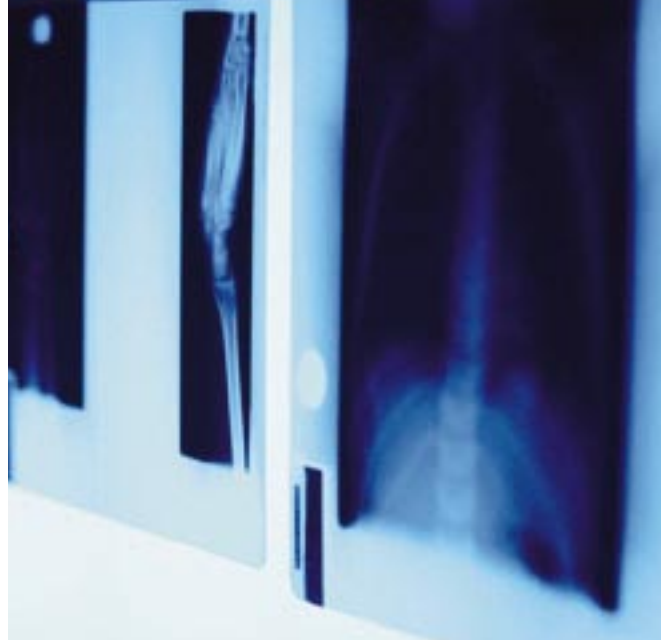
GENDER AND RACE DIFFERENCES

Evidence for the WHO classification was based on studies with postmenopausal Caucasian women. Only a small number of prospective studies of diagnostic technologies for bone measurement have been reported compared with the number of intervention trials, and few data are available for men and non-Caucasian women. Further research is needed to establish the relationship between BMD and fracture risk in premenopausal women, non-Caucasian women and men.

EARLY DETECTION THROUGH RADIOGRAPHY

Clinicians use radiographs to diagnose osteoporosis fractures, but uncertainty exists about what constitutes a vertebral fracture. Improved recognition and measurement of vertebral deformities will better the chances of detecting osteoporosis at an early stage.

- Spinal fractures causing compression often result in loss of height — a prospective (or measured) height loss of 2 cm or more in one year or a previous height loss of more than 4 cm should trigger a spinal x-ray to determine the presence of vertebral fractures.
- A radiographic finding of one vertebral fracture deformity caused by osteoporosis predicts a risk of further fractures.
- Although low BMD is a key risk factor, individuals who have suffered a vertebral or other osteoporotic fracture



should be considered to have osteoporosis even without BMD in the “osteoporosis” range.

WHO SHOULD BE TESTED FOR BMD?

Indications for BMD testing include:

- Targeted case finding in people over the age of 50 with at least one major or two minor risk factors.
- Screening with central dual energy x-ray absorptiometry (DXA) at age 65 and over regardless of additional risk factors. BMD measurement should only be done if the results will have an impact on patient management. Figure 1 (page 7) presents an algorithm showing who should be tested for osteoporosis.

TECHNIQUES FOR MEASURING BONE DENSITY

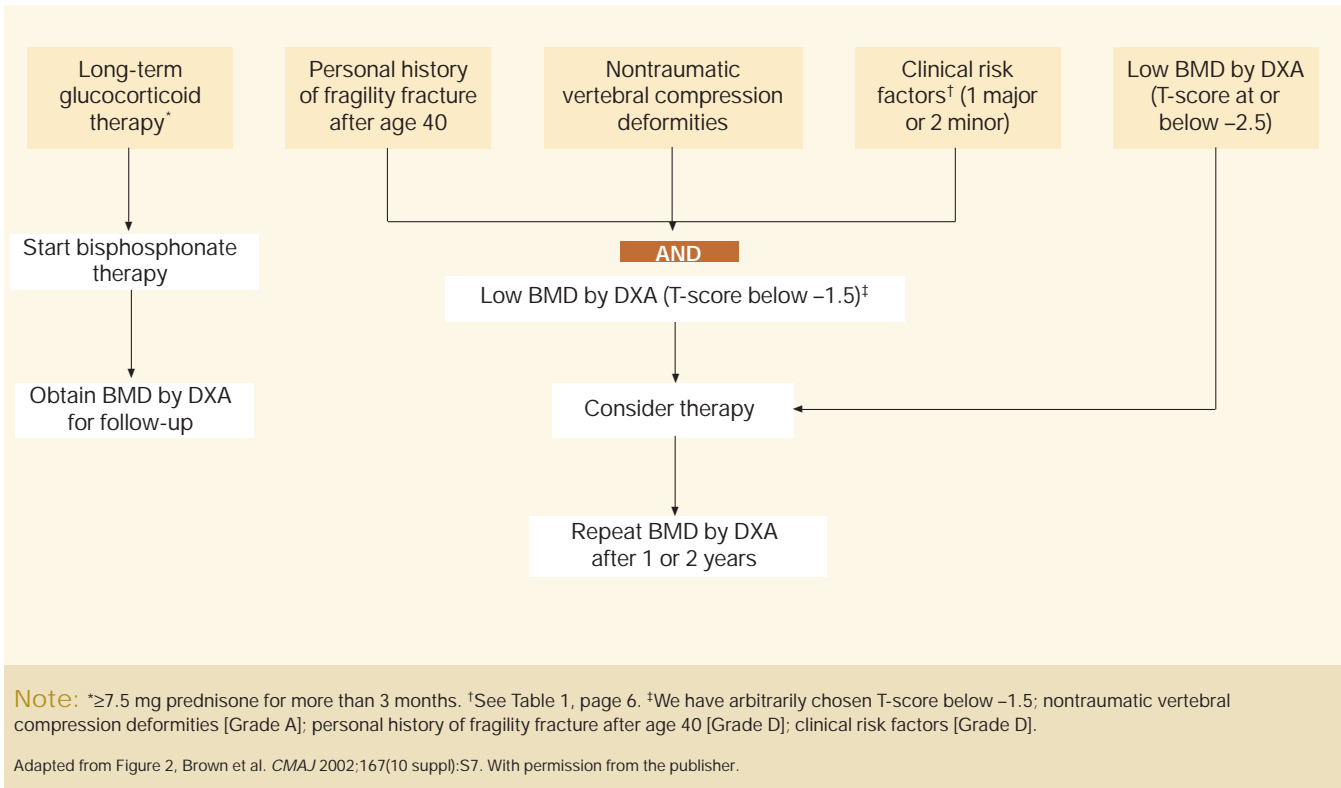
Methods of measuring BMD target either the central skeleton (spine, proximal femur, whole skeleton) or some part of the peripheral skeleton. All bone measurement techniques can accurately predict the risk of all low-trauma fractures. The 2002 guidelines provide statements and recommendations to keep physicians informed of new testing methods and appropriate use of the technologies.

Dual energy x-ray absorptiometry

Currently, DXA remains the most accurate and widely used tool for BMD measurement of the central skeleton in the clinical setting. DXA provides high-resolution images using low radiation and can evaluate BMD at multiple sites.

- The spine and hip are the most common sites for osteoporotic fractures. DXA provides the best measurements of bone at these sites, making it the current gold standard for risk assessment.
- The accuracy of DXA makes it a useful follow-up tool for assessing responsiveness to therapy in various sites in individuals undergoing treatment.
- Therapeutic progress using central DXA should be monitored in clinical settings one or two years after initiating therapy.

figure 2 Who should undergo a fracture risk assessment and be treated for osteoporosis?



Quantitative ultrasound

QUS is a widely reported, radiation-free technique used to examine bone in the calcaneus (heel) and forearm for two values: the speed of sound in bone (SOS) and broadband ultrasound attenuation (BUA). Both the SOS and BUA are higher in healthy bone than in osteoporotic bone.

Quantitative ultrasonometry may be considered for fracture risk assessment when DXA is not available, but presently it is not precise enough to be used for follow-up BMD testing.

Calcaneal ultrasound prediction of fracture risk at sites such as the wrist and spine yields approximately the same results as direct measurement at these sites; however, the best predictor of relative risk of hip fracture remains BMD of the hip.

While calcaneal QUS appears to be effective for estimating risk in postmenopausal women 65 years and over, evidence is limited for its use in men and premenopausal women.

Other techniques

Less expensive portable devices such as ultrasound, radiogrammetry, radiographic absorptiometry and peripheral photon absorptiometry are available in areas where DXA equipment may not be readily accessible. Although these alternatives can predict fracture risk, there is a lack of reliable data to recommend their widespread use. Further studies are required to

assess their validity and use for follow-up in response to therapy.

Repeat BMD testing can be conducted in one year if there are concerns about rapid progressive bone loss, and less frequently — every two to three years — in individuals already on therapies that increase BMD only slightly.

ASSESSING BONE LOSS OVER TIME

The ability to compare BMD changes over time for each specific site helps clinicians assess the rate of bone loss and response to therapy. Percentages can be used to illustrate change (for doctors or patients), but the determination of the least significant change has to be expressed in units of g/cm^2 .

- When possible, testing should be done on the same machine for baseline and follow-up, to avoid variations in scanner calibration that can significantly affect results.
- BMD laboratories should use their own measurement precision to interpret change for each site assessed in a typical clinical population.
- Implementing a quality assurance program to monitor operator and equipment performance can help to optimize testing. Developing skill in interpreting serial measurements will help to differentiate measurement error from real change and to detect the least significant change that is clinically meaningful.

Standards for densitometry

In conjunction with the OSC osteoporosis guidelines, the *CMAJ* released a summary of new recently published, international standards for BMD testing (Khan AA et al. *J Clin Densitometry* 2002;5(3):247-57). This important document, based on a review of the extensive densitometry literature, represents the consensus of leading Canadian experts on the minimum acceptable level of quality in BMD performance.

Bone densitometry is a tried-and-true technology, widely used for early detection and management of osteoporosis, and adherence to these standards will assist physicians and technologists by promoting excellence in decision making, scanning techniques, interpretation, application and reporting of results. Assuring patients of the accuracy and reliability of their test results will help boost their confidence and contribute to treatment compliance. Key messages include:

- Central DXA is the current technology of choice for BMD measurement of the lumbar spine and hip.
- Diagnosis of osteoporosis cannot be made using techniques like ultrasound that assess sites such as the hand and the heel.
- BMD results should be considered along with other important risk factors for fracture.
- Decisions to complete BMD testing should take into account how the results will affect patient management (e.g. while a menopausal woman with no osteoporosis risk factors does not require testing, a woman with a history of fragility fracture after age 40 does).
- High-risk individuals over age 50 (presenting at least one major or two minor risk factors) should be targeted for testing, along with those over 65 even if they do not have other risk factors.
- Quality control with respect to instruments, scanning techniques and analysis is essential to maximize clinical performance. To cut down on precision error, repeat measurements should be taken with the same instrument and scanning procedure, by the same technologist.
- Consider retesting after one year if there is concern about rapid bone loss (i.e. glucocorticoid-induced osteoporosis, immobilization, acute gonadal insufficiency, primary hyperparathyroidism) or when a new intervention is introduced. Every two to three years is sufficient in individuals on therapies that minimally increase BMD (e.g. calcitonin, raloxifene) or whose medications seem to be working. It is important to remember, however, that little or no measureable change in BMD does not necessarily imply treatment failure.

case study A patient inquires about her risk of osteoporosis and fracture

My 59-year-old female patient — a non-smoker and occasional drinker — had a low-trauma radial fracture from a fall from standing height, with no family history of fractures. Her body mass index is 25 kg/m². Physical examination including evaluation of the spine and baseline blood work were normal. BMD revealed a T-score of -1.3 at the lumbar spine and -0.6 at the hip. How should I advise this patient? How often should her BMD test be repeated?

Assessment: A personal history of low-trauma fracture after age 40 indicates that your patient may suffer from osteoporosis and be at risk for another fracture. The normal BMD results are reassuring and show the current risk to be low, but this will increase with age, due to bone loss as well as other factors such as increased tendency to fall.

Your patient would benefit from preventive lifestyle measures. Make sure she takes enough calcium (1500 mg/day from all sources) and vitamin D supplements (800 IU/day), and does regular weight-bearing exercise. She should have another BMD test in two to three years. Serial assessments are valuable to alert for rapid progressive bone loss and monitor effectiveness of therapy, but their interpretation needs to take into consideration the precision error of the study at the testing centre.

Adapted from Khan et al. *CMAJ* 2002;167(10):1141-5. With permission from the publisher.


LABORATORY TESTS

In keeping with the OSC's 1996 clinical practice guidelines, the revised ones recommend that all patients with osteoporosis undergo the following tests in order to exclude secondary causes: complete blood count, serum calcium, total alkaline phosphatase, serum creatinine and serum protein electrophoresis.

THE FUTURE FOR BIOCHEMICAL MARKERS

Biochemical markers are important in evaluating bone turnover rates over time. Bone formation markers are serum osteocalcin, bone specific alkaline phosphatase and procollagen 1 carboxyterminal propeptide (PICP). Markers of bone resorption include urinary hydroxyproline, urinary pyridinoline (PYR), urinary deoxypyridinoline (D-PYR) as well as collagen Type 1 cross-linked N telopeptide (NTX) and collagen Type 1 cross-linked C telopeptide (CTX).

Population studies point to the value of these markers in determining fracture risk in elderly women. Low BMD in conjunction with high bone resorption markers may give a better indication of fracture risk than when either factor is used alone.

Although they should not yet be used for routine clinical management, biochemical markers have a potential future role in predicting and monitoring response to antiresorptive treatment. Additional studies are needed to evaluate their use in individual patients and in men. 



Pharmacologic interventions

A look at the options

While currently approved therapies for osteoporosis are anti-resorptive and designed to halt or slow bone loss and reduce fracture risk, newer drugs undergoing trials aim at increasing bone formation. OSC recommendations are based on scientific evidence to help guide physicians in making the appropriate pharmacologic treatment choices for their at-risk patients. Physicians should discuss the available options with their patients, including issues such as individual preferences, tolerance to therapy and cost in their decision-making.

The new OSC guidelines define “first-line” therapy as treatment that is appropriate when the highest level of evidence exists for fragility fracture (mainly vertebral fracture) prevention. The designation “second-line” therapy indicates that there is enough evidence pointing to prevention of BMD loss but insufficient data for fracture prevention, or that underlying problems exist with the study or its interpretation.

Pharmacologic options include bisphosphonates, calcitonin, hormone replacement therapy (HRT) and selective estrogen receptor modulators (SERMs). The treatment and regimen recommendations outlined are intended for men and women, as well as patients with glucocorticoid-induced osteoporosis.

BISPHOSPHONATES

The bisphosphonates inhibit bone resorption through their effects on osteoclasts. The bisphosphonates currently approved in Canada as therapies for osteoporosis include alendronate, etidronate and risedronate. Although they all belong to the same class of drugs, they vary considerably in potency, ability to inhibit bone resorption, toxicity and dosing regimens.

Oral absorption of bisphosphonates is poor even when they are taken on an empty stomach. Gastrointestinal side effects are commonly associated with this drug class, and these are often dose-related. To minimize the risk of adverse GI effects and to enhance absorption, bisphosphonates should always be taken according to specific instructions.

Alendronate

- Alendronate, a nitrogen-containing bisphosphonate, is administered continuously in a dose of 5 mg/day for the prevention of osteoporosis and 10 mg/day for the treatment of established osteoporosis. A new weekly regimen is available: recent studies report alendronate 70 mg given once a week produces effects on BMD that are comparable to the 10-mg daily dose and is becoming the preferred treatment regimen.
- It is generally well tolerated, with only rare cases of esophagitis reported. Abdominal pain can also occur.

- Data from extensive research show that alendronate is beneficial in the prevention of vertebral, hip and wrist fractures in postmenopausal women, consistently increasing bone mass at all sites measured. In a post-hoc analysis, clinical vertebral fracture rate reduction was demonstrated as early as one year into the study.

Etidronate

- Etidronate, the first bisphosphonate to show benefit in the treatment of osteoporosis, is typically given in a cyclical dose of 400 mg/day for two weeks, every three months.
- It is usually well tolerated, with few reports of gastrointestinal upset (abdominal pain and diarrhea being the most common complaints). If administered continuously for prolonged periods, etidronate may impair bone mineralization.
- Studies indicate that etidronate has some effect in preventing new vertebral fractures in postmenopausal women with severe osteoporosis.

Risedronate

- Many studies demonstrate efficacy for both daily and once-weekly doses of risedronate.
- Risedronate is generally well tolerated. Although not commonly reported, possible side effects include headache and diarrhea.
- Trials over three years show that risedronate significantly reduces vertebral, nonvertebral and hip fracture risk in postmenopausal women with established osteoporosis. Further, these studies are the first to disclose, in a pre-planned analysis, a clinically important reduction in the incidence of vertebral fractures within one year of therapy.

Combination therapy

In several studies of postmenopausal women, combined bisphosphonate and estrogen therapy has manifested increases in BMD, although there is no direct evidence of improved fracture rate reduction. One four-year randomized trial investigating the use of cyclic etidronate together with estrogen

table 2 Criteria for assigning level of evidence to published citations

Level	Criteria
Studies of diagnosis	
1	i. Independent interpretation of test results ii. Independent interpretation of the diagnostic standard iii. Selection of people suspected, but now known, to have the disorder iv. Reproducible description of the test and diagnostic standard v. At least 50 people with and 50 people without the disorder
2	Meets 4 of the level 1 criteria
3	Meets 3 of the level 1 criteria
4	Meets 1 or 2 of the level 1 criteria
Studies of treatment and intervention	
1+	Systematic overview or meta-analysis of randomized controlled trials
1	1 randomized controlled trial with adequate power
2+	Systematic overview or meta-analysis of level 2 randomized controlled trials
2	Randomized controlled trial that does not meet level 1 criteria
3	Nonrandomized clinical trial or cohort study
4	Before-after study, cohort study with noncontemporaneous controls, case-control study
5	Case series without controls
6	Case report or case series of <10 patients
Studies of prognosis	
1	i. Inception cohort of patients with the condition of interest, but free of the outcome of interest ii. Reproducible inclusion and exclusion criteria iii. Follow-up of at least 80% of subjects iv. Statistical adjustment for confounders v. Reproducible description of the outcome measures
2	Meets criterion 'i' and 3 of the 4 other level 1 criteria
3	Meets criterion 'i' and 2 of the 4 other level 1 criteria
4	Meets criterion 'i' and 1 of the 4 other level 1 criteria

table 3 Grades of recommendation for clinical practice guidelines

Grade	Criteria
A	Need supportive level 1 or 1 + evidence plus consensus*
B	Need supportive level 1 or 2 + evidence plus consensus*
C	Need supportive level 3 evidence plus consensus
D	Any lower level of evidence supported by consensus

*An appropriate level of evidence was necessary, but not sufficient to assign a grade in recommendation; consensus was required in addition

Adapted from Tables 1 and 2, Brown et al. *CMAJ* 2002;167(10 suppl):S3. With permission from the publisher.

reported a greater increase in BMD at both the spine and the hip than with either agent alone.

Another study combined alendronate and estrogen in postmenopausal women who had been receiving estrogen replacement therapy for at least one year. While patients on alendronate 10 mg/day plus estrogen had significantly greater increases in BMD of the spine and hip than those given placebo, no conclusions about fracture rate reduction were drawn.

Key recommendations for bisphosphonates

- Bisphosphonates are a first-line preventive therapy in postmenopausal women with low bone density: alendronate, etidronate [Grade A]; risedronate [approved in Canada for prevention, but data thus far only published in abstract form].
- Bisphosphonates are a first-line treatment for postmenopausal women with osteoporosis, especially those with pre-existing vertebral fractures: alendronate, risedronate [Grade A]; etidronate [Grade B].
- Bisphosphonates are the first-line therapy for the prevention of glucocorticoid-induced osteoporosis: alendronate, risedronate, etidronate [Grade A].
- Bisphosphonates are the first-line therapy for the treatment of glucocorticoid-induced osteoporosis in patients requiring prolonged glucocorticoid therapy: alendronate, risedronate [Grade A]; etidronate [Grade B].
- Bisphosphonates are the first-line treatment for men with low bone mass or osteoporosis: alendronate [Grade A]; etidronate [Grade B].
- In premenopausal women with osteopenia or osteoporosis, the use of bisphosphonates has not been examined and is not yet recommended in the absence of an identified secondary cause of osteoporosis. In certain circumstances, however, they may be considered. In the absence of evidence of safety of these drugs in pregnancy, contraception would be prudent and treatment should be stopped in the event of pregnancy [Grade D].

Osteoporosis in men

Bisphosphonates present an important therapeutic option for men with osteoporosis. Studies of alendronate in men indicate significant increases in BMD together with a reduction of vertebral fractures. Risedronate is effective in preventing vertebral fractures in men with glucocorticoid-induced osteoporosis.

Glucocorticoid-induced osteoporosis

This class of drugs is recommended as a first-line therapy for the prevention of glucocorticoid-induced osteoporosis and

the treatment of those on long-term therapy. All three bisphosphonates increase BMD at the spine and maintain or increase BMD at the hip. Benefits in reducing fracture risk in high-risk patients are seen within a year of the onset of therapy. Alendronate and risedronate are also efficacious in preventing vertebral fractures in postmenopausal women with glucocorticoid-induced osteoporosis.

CALCITONIN

Calcitonin is a naturally occurring peptide hormone that inhibits bone resorption by acting directly on osteoclasts. Recombinant salmon calcitonin is now the standard form of the drug, since fish forms of calcitonin are more potent than the human version.

Initially, administration of calcitonin through injection was associated with side effects that limited its long-term use. A nasal spray formulation causing fewer side effects is now preferred.

Research findings

— Reports of randomized controlled studies, most using nasal salmon calcitonin, in postmenopausal women with osteoporosis produced modest but reproducible reductions in bone resorption and increases in BMD.

— The Proof (Prevent Recurrence of Osteoporotic Fractures) trial reported a change in fracture rates, showing that salmon calcitonin nasal spray reduced vertebral fractures by 33 to 36%. Although this was a prospective, randomized controlled trial, there were concerns about the absence of a dose response and the high discontinuation rate. Several other studies also detected a drop in vertebral fracture rates in calcitonin-treated groups, but failed to produce Level 1 evidence.

— Calcitonin has been examined for both the prevention and treatment of glucocorticoid-induced osteoporosis, but it is not a drug of first choice. While this medication did reduce bone loss in prevention studies, it did not lead to the same net BMD gain seen in patients with osteoporosis or on chronic steroid therapy. Contrary to trial results with other drugs, neither injectable or nasal calcitonin have reported fracture-outcome data.

— While reliable evidence exists for both injectable and nasal salmon calcitonin in the significant alleviation of pain from acute vertebral fractures, there are no conclusive data concerning pain relief in other types of fractures or in chronic vertebral fractures.

Side effects

Adverse effects occur more often with injectable than with nasal calcitonin, and these include nausea or vomiting, flushing and skin rash at the injection site. While not serious, these manifestations can lead to discontinuation of therapy. Nasal calcitonin is associated with few if any systemic adverse effects. Most side effects, including nasal irritation, minor

nosebleeds, assorted nose symptoms and nasal ulceration, are mild or moderate and do not lead to noncompliance. Serious side effects, such as anaphylaxis and other severe allergic reactions, have been reported, but they are rare for both formulations. Calcitonin should be avoided in pregnancy and breastfeeding.

Calcitonin recommendations

- The OSC recommends nasal calcitonin as a second-line therapy for postmenopausal women with osteoporosis [Grade B].
- Nasal or parenteral calcitonin is a first-line treatment for reducing pain associated with acute vertebral fractures [Grade A].
- Because of its safety profile, nasal calcitonin can be considered for use in nonpregnant premenopausal women with osteoporosis [Grade D].
- Nasal calcitonin is an option for treating men with osteoporosis [Grade D].

NEW POSITION ON HORMONE REPLACEMENT THERAPY

The OSC maintains its position that postmenopausal women are not hormone “deficient,” but rather that their estrogen and progesterone levels are low (i.e. making “replacement” an inaccurate term). In keeping with current international usage, however, the OSC has decided to switch its choice of terminology from ovarian hormone therapy (OHT) to the more common HRT, the acronym for hormone replacement (combined estrogen and progestin/progesterone) therapy.

HRT is commonly used to treat hot flashes and night sweats (vasomotor symptoms) caused by lower levels of estrogen/progesterone. HRT also plays an important role in preventing bone loss that begins in perimenopause (several years leading up to and one year after the final menstrual period) and can continue for up to 10 years after menopause. Since women who experience a relatively early menopause (before age 45) are at increased risk for osteoporosis, HRT is a preventive therapy of choice for this population group.

Until recently considered the primary treatment for osteoporosis, HRT has been replaced by alendronate, risedronate and raloxifene as the gold standard treatment when there are no menopausal symptoms.

Studies demonstrate that continuous combined HRT significantly decreases the risk of clinical vertebral fractures and nonvertebral fractures at all sites including the hip in postmenopausal women with osteoporosis. HRT is also effective in increasing bone mineral density at all measured sites.

Side effects

Recently, the US Women's Health Initiative trial — a large randomized, double-blind placebo-controlled study — published evidence of increased risk of coronary heart disease, breast cancer, stroke and venous thromboembolism in women on combined estrogen–progesterone therapy. The risks of irregular vaginal bleeding and endometrial cancer rise with the use of estrogen without or with inadequate doses of progestin/progesterone.

SELECTIVE ESTROGEN RECEPTOR MODULATORS

SERMs are nonhormonal agents that bind to estrogen receptors. These agents have the same positive effects as estrogen for halting bone loss in postmenopausal women, while avoiding some of estrogen's adverse effects on the breast and uterus.

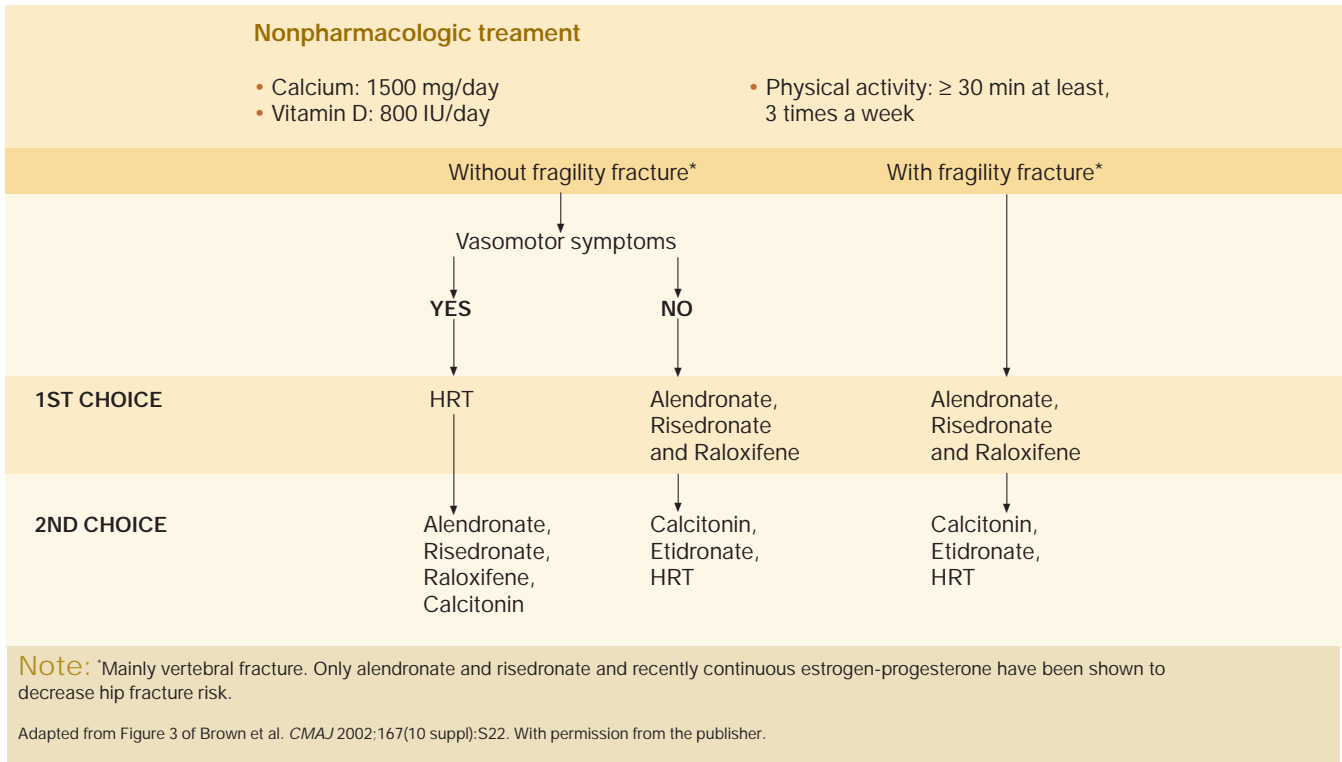
HRT recommendations

- HRT is a first-line therapy for the prevention of osteoporosis in postmenopausal women with low bone density, but the risks may outweigh the benefits [Grade A].
- HRT is a first-line preventive therapy for women who undergo menopause before age 45 [Grade D].
- HRT is a second-line treatment for postmenopausal women with osteoporosis [Grade B]. The substantial risks for cardiovascular (CV) events, stroke and invasive breast cancer may lead to an unfavourable risk–benefit ratio with long-term use of HRT when it is taken only for the treatment of postmenopausal osteoporosis.

table 4 Recommended first- and second-line therapies for osteoporosis prevention and treatment

	First-line therapy (Grade A evidence)	Second-line therapy (Grade B evidence)
Bisphosphonates <i>Alendronate</i>	<ul style="list-style-type: none"> • Prevention of osteoporosis in postmenopausal women with low BMD • Prevention of glucocorticoid-induced osteoporosis • Treatment in postmenopausal women with osteoporosis, especially with pre-existing fractures • Treatment of glucocorticoid-induced osteoporosis in patients on long-term glucocorticoid therapy (≥ 7.5 mg prednisone > 3 mos) • Treatment for men with low BMD or osteoporosis 	N/A
<i>Etidronate</i>	<ul style="list-style-type: none"> • Prevention of osteoporosis in postmenopausal women with low BMD • Prevention of glucocorticoid-induced osteoporosis 	<ul style="list-style-type: none"> • Treatment in postmenopausal women with osteoporosis, especially with pre-existing fractures • Treatment of osteoporosis in patients on long-term glucocorticoid therapy (≥ 7.5 mg prednisone > 3 mos) • Treatment for men with low BMD or osteoporosis
<i>Risedronate</i>	<ul style="list-style-type: none"> • Prevention of osteoporosis in postmenopausal women with low BMD [data published in abstract form] • Prevention of glucocorticoid-induced osteoporosis • Treatment in postmenopausal women with osteoporosis, especially with pre-existing fracture • Treatment of glucocorticoid-induced osteoporosis in patients on long-term glucocorticoid therapy (≥ 7.5 mg prednisone > 3 mos) 	N/A
Calcitonin	<ul style="list-style-type: none"> • Alleviation of pain associated with acute vertebral fractures (nasal or parenteral) 	<ul style="list-style-type: none"> • Treatment of postmenopausal women with osteoporosis
HRT	<ul style="list-style-type: none"> • Prevention in postmenopausal women with low BMD 	<ul style="list-style-type: none"> • Treatment of postmenopausal women with osteoporosis
SERMs (Raloxifene)	<ul style="list-style-type: none"> • Prevention of further bone loss in postmenopausal women with low BMD • Treatment in postmenopausal women with osteoporosis 	N/A

figure 3 What is the optimal treatment for osteoporosis in my postmenopausal patient?



Raloxifene

Raloxifene is the only SERM that has been approved for the prevention and treatment of osteoporosis. The recommended dose is 60 mg once a day, taken in tablet form without regard to meals, calcium and vitamin D supplements or time of day.

Research findings

— Raloxifene, along with bisphosphonates, is currently a preferred choice for both prevention and treatment of osteoporosis in postmenopausal women. Studies confirm that raloxifene helps prevent vertebral fractures and increases BMD at the spine and hip in this population group. In a post-hoc analysis, raloxifene decreased the risk for new clinical vertebral fractures at one year. If additional studies confirm its positive extraskelatal effects, raloxifene could contribute to the overall efficacy of treatment in postmenopausal women with low short-term risk of fracture.

— While raloxifene therapy over four years had no marked effect on the overall risk of CV events in the total population, it did significantly reduce the CV risks in women at high risk and those with established cardiovascular disease. Compared to HRT, there is no evidence that raloxifene causes an early increase in risk of CV events in postmenopausal women.

— Raloxifene was associated with a significant reduction in the risk of invasive breast cancer among postmenopausal

women with osteoporosis who were at low risk of breast cancer. More long-term studies are needed in women at high risk before this drug is used for the prevention of breast cancer.

Side effects

Reported side effects, including hot flashes and leg cramps, were generally mild to moderate and did not cause women to discontinue therapy. In contrast to estrogen or tamoxifen, raloxifene does not raise the risk of endometrial hyperplasia or endometrial cancer.

A rare but serious side effect is an augmentation in the relative risk of venous thromboembolism, similar to that seen with women using HRT. Raloxifene is contraindicated in patients with a history of this condition. In addition, patients should discontinue raloxifene three days prior to a prolonged immobilization. 🌿

Raloxifene recommendations

- Raloxifene is a first-line preventive drug for postmenopausal women with low bone density [Grade A].
- Raloxifene is a first-line treatment for postmenopausal women with osteoporosis [Grade A].

Consensus on therapeutic alternatives for osteoporosis

Be prepared when your patient asks

Patients seeking advice on alternative therapies not considered part of mainstream medical practice need clear and reliable information based on existing evidence. At present, ipriflavone and vitamin K are the only two adjunct therapies for which the guidelines committee deemed enough data were available on BMD and fracture outcomes to include them in clinical guidelines. Parathyroid hormone (PTH) — a promising new bone-building treatment, now licensed in the United States, that has demonstrated efficacy in several studies — is currently under review in Canada.

IPRIFLAVONE

Ipriflavone is a synthetic form of phytoestrogen, a weak estrogen-like chemical substance found in plants. The naturally occurring phytoestrogens are isoflavones (found principally in soybeans and other legumes), lignans (derived from flax seed, fruits and vegetables) and coumestans (found in bean sprouts). Studies point to a lower incidence of hip fracture in Asia, where diets are higher in phytoestrogen, compared to North America. But currently, there is insufficient evidence for evaluating the protective effect of phytoestrogens on BMD in humans.

While more data exist for ipriflavone, conclusions cannot be drawn on its prevention of bone loss and fractures in postmenopausal women. More research is needed to study the potential of ipriflavone to protect against vertebral fractures as well as any possible long-term effects on other estrogen-sensitive tissues such as the breast and uterus.

Taking 200 mg of ipriflavone three times daily is reported to be effective in maintaining BMD in the spine in postmenopausal women.

Recommendations

— Ipriflavone is not recommended for treatment in postmenopausal women with osteoporosis, but is considered a second-line preventive therapy in postmenopausal women [Grade B].

— Patients taking ipriflavone should be monitored closely, because of inconclusive evidence regarding long-term safety [Grade B].



— Ipriflavone has not been studied, and is not recommended, in men or premenopausal women [Grade D].

Studies point to a lower incidence of hip fracture in Asia, where diets are higher in phytoestrogen, compared to North America

VITAMIN K

Vitamin K — found in plants (K1) and in meat, cheese and fermented products (K2) — plays an important role in the function of bone proteins. Studies looking at the role of vitamin K in preventing hip fractures suggest that patients who consumed more vitamin K in their diet are at lower risk. Randomized controlled trials that examined the efficacy of vitamin K treatment on BMD and fractures are limited because of their failure to consider calcium or vitamin D intake in either the treatment or placebo arms.

While vitamin K may slow down bone loss in postmenopausal women with osteoporosis and has shown positive effects in the treatment of postmenopausal women with severe osteoporosis, it has not been proven superior to calcium and vitamin D.

Recommendations

— Vitamin K is currently not recommended for the prevention or treatment of postmenopausal osteoporosis [Grade B].

— Vitamin K is not recommended for use in men or premenopausal women [Grade D].

FLUORIDE

Sodium fluoride stimulates bone formation. Although studies evaluating fluoride therapy for osteoporosis began in the

1960s, fluoride compounds have yet to undergo investigations adhering to modern evidence-based standards.

Sodium fluoride therapy has not been shown to be effective in preventing fractures in postmenopausal women with osteoporosis. Despite consistent and significant increases in spinal BMD, there is no evidence for a reduction of vertebral or nonvertebral fractures. Fluoride has the ability to maintain the level of BMD or yield slight increases at the femoral neck.

Increases in spinal BMD with fluoride therapy in glucocorticoid-induced osteoporosis were too small to show a significant anti-fracture effect.

Adverse effects of fluoride are mainly dose-related, and vary with different formulations. They include GI irritation (gastric pain, nausea) and skeletal effects (lower extremity pain, stress fractures). Enteric-coated preparations and slow-release fluoride cause fewer gastrointestinal side effects.

Recommendations

- Fluoride is not currently recommended for treatment of postmenopausal women with osteoporosis [Grade A].
- In the absence of any demonstrated anti-fracture efficacy, the conclusions regarding fluoride are the same for men as for women. Fluoride therapy is not recommended for treatment in men or premenopausal women [Grade D].

PARATHYROID HORMONE HOLDS PROMISE

Recent approval by the United States Food & Drug Administration (FDA) for an important new bone remodeling therapy, parathyroid hormone (PTH), is expected to be followed soon by regulatory sanction in Canada and other countries. The scientific community looks forward to adding this important bone-growth stimulating agent to their list of available treatments. Studies have been conducted on the effects of recombinant human parathyroid hormone, rhPTH(1-34), with respect to vertebral and nonvertebral fracture risk in postmenopausal women, in men and in glucocorticoid-induced osteoporosis. Another parathyroid hormone preparation containing the amino-acid sequence rhPTH(1-84) is currently undergoing clinical trials.

PTH therapy does not appear to cause significant side effects. Observed adverse effects included nausea, headaches, dizziness and leg cramps and were dose-dependent.

Recommendations

- PTH was found to significantly reduce both vertebral and nonvertebral fractures in postmenopausal women with severe osteoporosis and to increase BMD at all skeletal sites with the exception of the radius. Although not yet approved in Canada, it is expected to become a first-line treatment for postmenopausal women with severe osteoporosis [Grade A].
- For men, similar anti-fracture efficacy is anticipated. Studies on the effects of PTH therapy in male osteoporosis

questions and answers

Q “How does PTH work and how will it be used? What are the indications for individual patients? What effect does it have on bone previously exposed to antiresorptive agents?”

A While the exact biologic pathway by which PTH works is not clear, we know that, given by daily injection, it accelerates bone remodelling. The usual sequence of osteoclastic bone resorption is followed by osteoblastic reformation, but the remodelling balance is positive, rather than the usual negative balance seen during the development of osteoporosis.

The OSC believes that PTH will be a first-line therapy for patients with severe or advanced osteoporosis presenting with fragility fractures. It should be considered in patients with T-scores well below -2.5. It will also be a very useful option for men who fail to respond to treatment with bisphosphonates, as well as for patients with severe glucocorticoid-induced osteoporosis, since steroids induce poor osteoblastic function and impaired protein synthesis.

Preclinical data have not resolved the question of what effect PTH has on bone previously exposed to antiresorptive agents. Some very preliminary data exist for postmenopausal women with osteoporosis who had received long-term treatment with alendronate. After six months of PTH therapy, the anabolic effect was blunted using BMD measurement as the primary outcome. Although there are several possible explanations for this, the clinical significance is not known. But research examining this interaction is very important, as many of the patients who will be considered candidates for PTH therapy may also have been on bisphosphonates for a long time.

While vitamin K has shown positive effects in the treatment of postmenopausal women with severe osteoporosis, it has not been proven superior to calcium and vitamin D

showed increases of BMD at the spine comparable to those seen in postmenopausal women. It is anticipated that PTH will be approved as a treatment for men with severe osteoporosis [Grade D].

- In postmenopausal women with glucocorticoid-induced osteoporosis, hPTH(1-34) increases BMD at the spine. It is likely to become a recommended treatment for individuals on long-term glucocorticoid therapy [Grade D].

Nutrition and physical activity: steps to prevention

Talk to your patients about healthy lifestyle choices

Nonpharmacologic interventions are extremely important in the management of this preventable disease affecting so many Canadian women and men. Physicians can help patients identify factors in their lifestyle that put them at risk and encourage some basic steps for maintaining good bone health.

DIET AND SUPPLEMENTS FOR HEALTHY BONES

Basic nutritional strategies for good bone health consist of maximizing dietary bone-building nutrients while minimizing consumption of substances that impede bone health. The nutrition committee reviewed close to 1,000 evidence-based studies that evaluated the role of diet in achieving peak bone mass and preventing bone loss and fractures, and based updated recommendations regarding calcium, vitamin D and other nutritional components on their findings.

Bone is a complex tissue requiring a balance of all essential nutrients for growth and health. Where nutrients showed no effect on bone, no additional intake is needed. Since data for children are not available at present, these guidelines only apply to dietary levels in adults.

Calcium and vitamin D

Ensuring patients get sufficient calcium and vitamin D through diet and/or supplements is an essential part of preventive therapy. These should not be used alone, but rather as an important adjunct to other treatment measures.

Calcium maximizes peak bone mass while vitamin D regulates adequate absorption of calcium. Of the two forms — D2 (ergocalciferol) and D3 (cholecalciferol) — D3 is recommended (see Table 5, page 21).

The new guidelines suggest higher levels for optimal calcium (1500 mg/day) and vitamin D (800 IU/day) intake. These amounts represent dietary goals per person from all sources, including total diet and supplements (Table 5). In Canada, for at least half the year, exposure to sunlight is not considered to be an adequate alternative to ingested forms of vitamin D.

Protein and other nutrients

Protein is an essential nutrient for bone health. Increasing intake in both men and women with low levels of protein



has a positive effect on the risk of hip fracture. To date, researchers have found no substantial evidence that supplementing with nutrients such as essential fatty acids, dietary fibre, magnesium, copper, zinc, iron, phosphorus and manganese will aid in the prevention or treatment of osteoporosis.

Physicians can help patients identify factors in their lifestyle that put them at risk and encourage some basic steps for maintaining good bone health

Caffeine and salt

Heavy caffeine consumption (more than four cups of coffee a day) has been linked to an increased risk of hip fracture in both men and women. Caffeine is also commonly found in tea, cocoa and some soft drinks.

People who consume high levels of salt (NaCl) should be advised to cut back, as evidence points to a significant negative effect on bone health when daily salt intake exceeds 2100 mg Na (5 g salt). Processed foods often contain high levels of salt.

question and answer

Q "If there is a negative effect of coffee intake on bone, is tea drinking also implicated?"

A While some research is showing a positive effect of tea on bone, good studies are still lacking. A cup of tea contains less caffeine than the equivalent amount of coffee, which is why we tend to emphasize the effects of coffee drinking. Photochemicals found in tea — polyphenols — can act as antioxidants and these might be responsible for tea's protective effect on bone.

CAN PHYSICAL ACTIVITY SLOW DOWN OSTEOPOROSIS?

People of all ages can benefit from exercise to cut down their risk of developing osteoporosis and impede further bone loss. Physical activity plays a major role in skeletal health by building stronger bones and increasing peak bone mass, and the detrimental effects of immobilization are well known.

Studies suggest certain types of exercise may produce positive changes in BMD and could consequently reduce fractures. Individuals who remain active also improve their functional ability, coordination and balance, in turn reducing their risk of falls leading to fractures.

While physical activity is important at all ages, the type, intensity, duration and frequency vary according to age, since

Individuals who remain active also improve their functional ability, coordination and balance, in turn reducing their risk of falls leading to fractures

table 5 Recommended calcium and vitamin D3 intake

Recommended daily intake levels for calcium	
Population group	Calcium (mg/day)
Prepubertal children (4-8 years) [Grade B]	800
Adolescents (9-18 years) [Grade B]	1300
Women (19-50 years) [Grade A]	1000
Women (> 50 years) [Grade A]	1500
Pregnant or lactating women (> 18 years) [Grade A]	1000
Men (19-50 years) [Grade C]	1000
Men (> 50 years) [Grade C]	1500
Recommended daily intake levels for vitamin D3	
Population group	Vitamin D3 IU (µg)/day
Women (19-50 years) [Grade D]	400 (10)
Women (> 50 years) [Grade A]	800 (20)
Pregnant or lactating women (> 18 years) [Grade D]	400 (10)
Men (19-50 years) [Grade D]	400 (10)
Men (> 50 years) [Grade A]	800 (20)

question and answer

Q "What role do fruit and vegetables play in reducing the risk of osteoporosis?"

A In researching the Guidelines, we looked for evidence of nutrients' effects on bone, but did not look at individual food groups. In the case of fruit and vegetables, we might have missed their positive contribution to bone health. Researchers studying the Framingham cohort found that increased fruit and vegetable intake reduced bone loss in older men and women, and that the likely explanation was their potassium and magnesium intake. Other studies, however, have shown that alkaline potassium salts such as potassium citrate or potassium bicarbonate decrease calcium excretion and therefore promote calcium retention due to increased alkalinity. In a recent food group analysis of Framingham data, men consuming a rich fruit and vegetable diet had significantly higher bone mineral density at most bone sites; a smaller effect was seen in women.

Advising your patients to follow Canada's *Guide to Healthy Eating* (the rainbow food guide) is a simple way to ensure that they consume enough servings of fruit and vegetables (the current recommendation is five to 10 servings a day).

it affects various parts of the skeleton differently. A complication is that in some cases — especially in premenopausal women — overactivity can be harmful to the skeleton because of its effect on hormonal status and possible associated under-nutrition.

Physical activity and BMD Children

The effects of physical activity can be seen from childhood. Children who get regular exercise through play and/or sports have better bone health than those who do not, and exercising throughout the adolescent years positively affects BMD and skeletal size. Impact-type sports such as baseball, basketball, gymnastics and soccer improve BMD in both boys and girls. At present, there is little research examining whether physical activity in childhood will effectively protect from fractures later in life.

Adults

Since advantages from bone-strengthening activity — especially high impact exercises or sports such as aerobics, running and jump training — are seen in adults as well, both men and women should be encouraged to maintain an active lifestyle. One exception is long-distance running. It may be of little benefit and perhaps even cause harm, although other possible explanations might include undernutrition, low body weight or the effect on hormones. An analysis in premenopausal women reviewed the difference between impact exercise vs

Lifestyle management

Encouraging your patients to make healthy choices regarding nutrition, physical activity and lifestyle can help prevent or halt the progression of osteoporosis

Summary and recommendations

- A higher intake of daily calcium and vitamin D is advisable (see Table 5, page 21).
- Maintaining adequate protein intake is important [Grade C].
- Avoid excess caffeine (> 4 cups coffee/day) [Grade B].
- Keep salt intake low, < 2100 mg Na/day (< 5 g salt/day), as it is associated with a reduced BMD in adults [Grade C].
- Limit alcohol consumption.
- There is no evidence to recommend additional micro- or macronutrients such as magnesium, copper, zinc, phosphorus, manganese, iron, essential fatty acids in the diet [Grade D].
- Men and women should participate in regular physical activity, especially weight-bearing exercises, throughout their lifetime [Grade C, men; Grade B, pre- and menopausal women].
- Children should be encouraged to get involved in impact-type exercise and sports [Grade B].
- Increased activity during middle life is related to a reduced hip fracture risk in old age.
- Staying active increases functional ability and improves coordination and balance — important elements in diminishing the danger of falls and injury.
- Tailored programs should be made available to older adults, including exercise to improve strength and balance and assessment of environmental risk factors [Grade A].

nonimpact exercise on reducing age-related bone loss. Although the studies were limited, both types of exercise were found to be helpful overall in preventing bone loss.

Older adults

Maintaining an exercise program can preserve existing bone health and prevent further bone loss associated with the hormonal changes that go along with menopause. Studies with postmenopausal women demonstrated that physically active women, especially those who did impact exercise, diminished their rate of bone loss at the spine. Some benefit was seen in BMD at the hip as well.

Case-control studies — many of them with adults who have been active since childhood — have shown varying degrees of BMD increase in men who participate in sports.

But more large-scale randomized trials are needed to provide long-term results.

Fracture prevention

An increased activity level during middle life is associated with a decreased risk of hip fracture in old age. Reports suggest that older adults with hip fractures were less active throughout their adult life. Inactive individuals, bed- or chair-bound, were found to have greater loss of BMD from the hip.

Weight-bearing exercise seems to be the most effective for skeletal health. A prospective but not randomized study over seven years concluded that men who participated in more weight-bearing activities had fewer fragility fractures.

Intense activity (beyond walking) was associated with a reduction in hip fracture occurrence in the most active group in a 21-year cohort study.

Avoiding falls

Keeping up physical activity is the best way for older adults to improve their strength and coordination. Studies reported that an active lifestyle in adults over the age of 65 and living independently was a contributing factor in helping them avoid falling. Individually tailored exercise programs — muscle strengthening, balance training, Tai Chi, walking — have proven effective in minimizing injuries related to falls.

Assessing environmental hazards affecting elderly people with a history of falls (perhaps helping to raise their awareness of risks both inside and outside the home) was shown to reduce their danger of falling. Other effective programs include assessing individuals to ensure they are performing exercise to improve strength, balance and health. In elderly people on psychotropic drugs, monitoring and/or withdrawing their medications also helps lower their risk of falling. Hip protector pads have also been shown to reduce the risk of fractures in the elderly.

A WORK IN PROGRESS

The OSC hopes that healthcare professionals will find these clinical practice guidelines accessible and use them to make the best decisions related to their patient care. Basing healthcare decisions on the current best evidence from clinical research, adapted to individual patient needs, should help ensure adherence to therapy and optimal outcomes.

The evidence in the osteoporosis literature is rapidly expanding. And now that an effective review process has been tried and tested, the scientific community can expect to see more frequent updates of the guidelines in the future.

Following the publication of these and subsequent guidelines, the OSC's mandate, according to Joyce Gordon, President and CEO, is "to continue to advocate for improved patient care in Canada and to work with provincial and federal governments to ensure the 2002 recommendations are adhered to and utilized when formulating and implementing new health policies on osteoporosis." 