Prevent the next fracture

GP Guide

osteoporosis australia
2nd edition, 2008
General practitioners play a central role in identifying people at high risk of osteoporotic fractures. Many of their patients may already unknowingly be suffering from the ‘silent disease’ osteoporosis, which can progress for many years without any signs or symptoms. The disease, characterised by low bone mass and poor bone quality, leads to an increased risk of fracture, and can cause significant disability.

Population ageing has increased the incidence of osteoporotic fractures worldwide. 2.2 million Australians are affected by osteoporosis with between 70,000 - 100,000 osteoporotic fractures per year. On current trends, by 2021 these rates will more than double.

Vertebral fractures are the most common osteoporotic or fragility fracture. However, more than half of all vertebral fractures do not come to medical attention (although nearly all will be associated with disability and pain) and about half of patients with a fracture due to osteoporosis will have another – the so called ‘cascade effect’. Women who have suffered a vertebral fracture are 4 times more likely to sustain a new fracture within the next year. They are at increased risk of hip fracture with all of its associated costs, and increased risk of premature death.

Yet, more than 75% of people with osteoporotic fractures who come to medical attention are NOT treated to prevent further bone loss and stop the ‘cascade’ effect of further fractures. (International Osteoporosis Foundation)

This booklet aims to promote optimal management of osteoporosis through identification and treatment, with the goal of minimising first fractures and preventing the cascade effect of further fragility fractures.

This guide is based on a review of current evidence and research. A bibliography and reference list for this guide is available at www.osteoporosis.org.au.

## CONTENTS

1 BONE LOSS AND FRAGILITY 4
2 FRACTURE PATTERNS 5
3 THE FRACTURE CASCADE 6
4 GOALS OF PATIENT CARE 6
   A. IDENTIFYING OSTEOPOROSIS 6
      Risk Factors for Osteoporosis and Fractures 7
      Patient Interview Notes 8
      Assessment and Diagnosis 10
      Bone Densitometry 11
      Radiography 12
      Other Investigations 12
   B. MANAGEMENT OF OSTEOPOROSIS TO PREVENT THE FIRST FRACTURE 14
      Who Should be Treated? 14
      Treatment Options: 16
         1. Drug Therapy 16
            A. First Line Medications 16
               Other Agents 18
            B. Hormone Replacement Therapy for Women (HRT) 20
            C. Vitamin D 21
            D. Calcium 23
         2. Lifestyle Management 26
            A. Diet 26
            B. Sunlight Exposure 26
            C. Physical Activity and Exercise 26
               Principles of Exercise that Maximise Bone Adaptation 28
               If Your Patient has Osteoporosis and Spinal and/or Lower Limb Fractures 29
               Falls Prevention Strategies 29
      C. MANAGEMENT OF FRACTURES TO MINIMISE THE FRACTURE CASCADE 31
         Vertebral Fractures 31
         Hip Fractures 32
         A Fracture Prevention Guide 33
5 ACKNOWLEDGEMENTS 34
6 RESOURCES 35
1. BONE LOSS AND FRAGILITY

- Bone is divided into cancellous (or trabecular) bone and cortical bone. Cancellous bone is more metabolically active and formed by an interconnecting latticework surrounded by the less delicate cortical bone. Bone is remodelled (bone turnover) throughout adult life by discrete remodelling units of osteoclasts (cells that resorb a volume of bone) and osteoblasts (cells that lay down new bone matrix).

- After about 50 years of age, the volume of bone resorbed is greater than the volume formed in each bone remodelling unit. This process continues into old age ie. over 70 years of age and is accelerated during: altered sex hormonal states such as menopause and androgen deficiency; excess activity in the adrenal and thyroid glands; or with alcohol excess and malabsorptive states.

- During menopause, decreasing oestrogen enhances the rate of bone dissolution, and most women begin a period of accelerated bone loss, averaging 2-5% per year over the next 10 years.

- After menopause, the remodelling rate increases, leading to trabecular thinning, eventual loss of trabecular connectivity, accelerated thinning and porosity of cortical bone. The increased rate of bone removal decreases mass, causing more architectural disruption. This trabeculae decrease increases bone fragility exponentially. Loads on bone become relatively greater as they are distributed over a smaller area.

- Accelerated bone loss is greatest in the three to six years after menopause gradually resuming the level of premenopausal bone loss. Oestrogen replacement therapy is therefore at its most effective and is likely to cause the least morbidity when used at this stage. After the age of 70, bone loss begins to accelerate again, reaching 1-2% per year in women older than 80 years, contributed to by both reduced intestinal calcium absorption and secondary hyperparathyroidism. Thus, calcium and adequate vitamin D nutrition are particularly important in the elderly.

- A 10% loss of bone mass in the vertebrae can double the risk of vertebral fractures and 10% loss of bone mass in the hip can result in a 2.5 times greater risk of hip fracture.

- Men do not have a midlife increase in remodelling, so that structural integrity of trabecular bone is maintained longer. Also, the rate of new bone deposition on the outside of bone is about three times more in men than in women, which increases bone size and maintains the strength of the wider bone, so offsetting inner bone loss.

- Fracture risk increases exponentially for men and women, so the imperative to intervene pharmacologically increases with age, particularly for those aged over 70.

1 in 2 women and 1 in 3 men over 60 years in Australia will suffer an osteoporotic fracture
2. FRACTURE PATTERNS

- Approximately every 5-6 minutes someone is admitted to an Australian hospital with an osteoporotic fracture (averaging 262 hospitalisations per day in 2007).
- 30-50% of Australian women and 15-30% of men will develop osteoporotic fractures.
- Osteoporotic fractures commonly occur in the spine, humerus, ribs, forearm or wrist and importantly, in the hip of older people, especially over the age of 75, often with little or no trauma (although almost any bone can fracture from osteoporosis).
- Wrist fractures are the most common fracture in perimenopausal women and increase rapidly after menopause.
- Fragility or minimal trauma fractures are the result of trauma equal to or less than a fall from standing height. Fragility fractures of upper limbs are typically due to falls.
- The risk of falling increases from 1 in 5 in women aged 45-49 years to almost 1 in 2 in women aged 85 years and older and 1 in 3 in older men, per annum.
- Vertebral fractures tend to occur when the person is lifting a weight, being lifted, during everyday activities like sneezing, turning around quickly or doing up shoes. (Vertebral fractures range from mild wedge compressions to complete crush fractures).
- Osteoporosis prevalence increases with age, but health surveys underestimate osteoporosis because most people are unaware of the condition until a symptomatic fracture occurs.
- A fragility fracture in late middle-aged or elderly patients suggests a clinical diagnosis of osteoporosis.
- Available therapies can reduce the risk of osteoporotic fractures by approximately 50% within a year of beginning treatment.

**FIGURE 2 AGE-SPECIFIC PREVALENCE OF OSTEOPOROSIS**

![Graph showing age-specific prevalence of osteoporosis](image-url)
3. THE FRACTURE CASCADE

- Of all reported osteoporotic fractures, 46% are vertebral, 16% are hip and 16% are wrist fractures.
- Approximately two thirds of all vertebral fractures are asymptomatic but the risk of further fractures is increased 4 times following the first fracture.
- Women who have had 2 or more osteoporotic fractures have up to a 9 times greater risk of a future fracture compared to those who have not had a fracture. This rises to an 11 times greater risk if 3 or more fractures are present. This fracture cascade can eventually result in pain, deformity, disability and even early death.
- However, medical records, X-ray reports and discharge summaries often fail to note osteoporosis in elderly women despite spinal X-rays showing severe vertebral deformities.
- Hip fractures are associated with reduced life expectancy. More than 20% of people who suffer a hip fracture (which tend to occur in older populations) die within 12 months, 50% need long-term help with activities of daily living, and 15-25% require full-time nursing-home care.
- About one in every 4-5 hip fractures in the over 50s occurs in men.
- Men have higher disability and death rates after a hip fracture than women. Men with hip fractures are likely to be more frail than women.

*Life time fracture risk of people at 50 years of age*

One in three women and one in eight men over 50 years of age will experience osteoporotic fractures:

- **Wrist fracture**: men 1 in 40 (2.5%) ; women 1 in 6 (16%)
- **Vertebral fracture**: men 1 in 20 (5%) ; women 1 in 6 (16%)
- **Hip fracture**: men 1 in 17 (6%) ; women 1 in 6 (17.5%)  
  (Melton L.J., 1992)

4. GOALS OF PATIENT CARE

A. IDENTIFYING OSTEOPOROSIS

B. THE MANAGEMENT OF OSTEOPOROSIS TO PREVENT THE FIRST FRACTURE

C. THE MANAGEMENT OF FRACTURES TO PREVENT THE FRACTURE CASCADE

A. IDENTIFYING OSTEOPOROSIS

“Knowledge of an individual's absolute risk of fracture is central to making treatment decisions.”  
(MJA supplement)
RISK FACTORS FOR OSTEOPOROSIS AND FRACTURES

Genetics
- Maternal family history of osteoporotic fracture
- Caucasian or Asian race

Increasing Age
Previous low trauma fracture (fragility fracture) particularly of the hip, spine or wrist.

Loss of height, thoracic kyphosis (Dowager’s hump)

Hormonal and metabolic factors
- Early menopause, late menarche (women)
- Low testosterone levels (men)
- Hypogonadism including orchidectomy
- Anorexia nervosa
- Low body mass index
- Hyperthyroidism
- Absence or suppression of menstrual periods (amenorrhoea > 1 year)

Comorbidity and medical treatments
- Corticosteroid therapy (prednisolone, or equivalent, 7.5mg or more daily with an expected use of 3 months or more) is the most common cause of secondary osteoporosis
- Malabsorption syndromes (including chronic liver disease, Coeliac disease and inflammatory bowel disease)
- Chronic renal failure
- Rheumatoid arthritis
- Prolonged bed rest and immobilisation
- Hormonal therapy for prostate carcinoma
- Anticonvulsant therapy

Lifestyle Factors
- Inadequate dietary calcium intake
- Vitamin D deficiency – much more common than previously recognised
- Physical inactivity/sedentary lifestyle over many years
- Smoking
- Regular, excessive alcohol use – especially in men

Increased risk of falls
- Poor muscle strength
- Poor balance
- Obesity/Sarcopenia
- Poor eyesight
- Cognitive impairment
- Polypharmacy
- Malnutrition
- Disability
- Use of sedatives/psychotropics
TABLE 1  COMMON CAUSES OF SECONDARY OSTEOPOROSIS

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<thead>
<tr>
<th>ENDOCRINE</th>
<th>CHRONIC DRUG THERAPY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypogonadism</td>
<td>Corticosteroids</td>
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<tr>
<td>Hyperthyroidism</td>
<td>Thyroxine</td>
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<td>Anorexia nervosa</td>
<td>Anticonvulsants</td>
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<tr>
<td>Type 1 diabetes mellitus</td>
<td>Loop diuretics</td>
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<tr>
<td>Hyperadrenocorticism</td>
<td>GnRH agonists, Aromatase inhibitors, Chronic heparin therapy, Immunosuppressants</td>
</tr>
</tbody>
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<tr>
<th>NUTRITIONAL</th>
<th>OTHER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malabsorption syndrome</td>
<td>Rheumatoid arthritis</td>
</tr>
<tr>
<td>Vitamin D deficiency/resistance</td>
<td>Hypercalciuria</td>
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<tr>
<td>Calcium deficiency</td>
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<td>Alcoholism</td>
<td>Organ transplantation</td>
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PATIENT INTERVIEW NOTES

Medical/Fracture History

- Always attempt to document fracture history upon new presentations or at health check opportunities.
- Every patient over 50 with a fracture should be investigated to exclude osteoporosis and consider how the risk of future fractures may be reduced. Ask how the injury occurred.
- Suspect osteoporosis in late middle-aged or elderly patients with a bone fracture. Ask how the injury occurred.
- A fragility fracture signals osteoporosis in this age group.
- Assess diet, in particular energy, protein, calcium and vitamin D intake.
- Assess vitamin D status.
- Assess alcohol and smoking patterns especially in males.
- Forearm fracture is an early and sensitive marker of male skeletal fragility. In ageing men, wrist fractures carry a higher absolute risk for hip fracture than spinal fractures in comparison to women.
- Take menstrual history in women. Prolonged amenorrhoea and early menopause are important factors to note.
- Back pain, especially sudden and severe, may be due to vertebral fractures. Only a third of vertebral fractures come to medical attention as many people believe back pain is a normal part of ageing and will not mention it unless prompted.
- Ask about their level of physical activity.
- Ask about all risk factors for falls.
Height Loss

- Is the person losing height ie shrinking? A loss of more than 3cm in height is a surrogate marker for the presence of vertebral fractures.
- Ask patients to recall their height in young adulthood and measure height as part of every check-up in older patients.

Physical Examination

- In patients with risk factors for osteoporosis look for: kyphosis, decreased height, spinal bone tenderness, signs of chronic renal failure, hyperthyroidism or primary hyperparathyroidism, proximal muscle weakness (may indicate vitamin D deficiency), and any neurological signs or visual impairment that might increase the risk of falling.

X-Ray Examination

- The incidental finding of vertebral fractures commonly goes unreported for radiographs that are taken for purposes other than to assess osteoporosis.
- Less than 20% of people who are operated on after fracture are assessed by a bone mineral density scan, or referred for treatment.
- By routinely viewing radiographs in older patients, GPs can identify osteoporosis that may otherwise remain untreated until significant deformity has occurred (see Figure 3).

FIGURE 3 VERTEBRAL FRACTURE AS AN INCIDENTAL FINDING

This radiograph was ordered in a 55-year-old woman to assess suspected rib fracture. The radiologist’s report did not mention the wedge fracture visible at T7 (outlines enhanced in image on right).
Medication Use

- Corticosteroid-induced osteoporosis is the most common cause of secondary osteoporosis. Preventative treatment with a bisphosphonate should be considered for all patients who require long-term corticosteroid treatment (more than 3 months).

- Other medications that may decrease BMD and/or increase falls risk should also be reviewed. An increased risk of falls is clearest for psychotrophic agents, such as long-acting benzodiazepines, but also for neuroleptics, antidepressants, anticonvulsants and class 1A antiarrythmics.

- Polypharmacy can be a risk factor. Use of 4 or more medications has been strongly associated with increased risk of falls. Improving the drug regimen is one effective means of reducing fall risk, especially in the frail elderly. Consider a Home Medicines Review (HMR) and assess the ongoing need for every repeat prescription. A comprehensive GP Management Plan may assist in patient education and self management of lifestyle change. The addition of Team Care Arrangements may allow the patient to be referred for allied health services for guidance in better nutrition and balance training.

ASSESSMENT AND DIAGNOSIS

“Based on WHO definitions, about 11% of Australian men and 27% of Australian women aged 60 and over have osteoporosis, and another 42% of men and 51% of women have osteopenia.”

(International Osteoporosis Foundation)

WHO DEFINITIONS BASED ON BONE DENSITY LEVELS*

Normal:
BMD is within +1 or -1 SD of the young adult mean

Osteopenia (low bone mass):
BMD is between -1 and -2.5 standard deviations below young adult mean.

Osteoporosis:
BMD is -2.5 SD or more from the young adult mean.

Severe (established osteoporosis):
BMD is more than -2.5 SD and one or more osteoporotic fractures have occurred.

* based on DXA measurement at hip or spine

NOTE: For every standard deviation (SD) below peak bone mineral density, fracture risk increases by 50-100%. The same BMD values are provisionally used for men because currently there is little data on BMD and fracture in men.
BONE DENSITOMETRY

- Bone densitometry by dual-energy X-ray absorptiometry (DXA) of hip and spine is the ‘gold standard’ test for diagnosing osteoporosis and monitoring response to treatment. *NB: Be aware that different imaging service providers may use different machines and the results may not be comparable.*

- The hip (femoral neck, trochanteric, inter-trochanteric sites) and lumbar vertebrae (L1-L4 or L2-L4) are used unless there are abnormalities in these regions that may affect bone density.

- Proximal femur BMD appears to be the best overall predictor of fracture risk, particularly as it is unaffected by osteoarthritis. The presence of spinal osteophytes can lead to discrepancies between hip and spine BMD values.

- Suspected degenerative changes in the spine should be confirmed by plain radiograph. In younger patients, a disparity between spinal and proximal hip bone density can suggest secondary osteoporosis, e.g. hyperparathyroidism.

- Peripheral DXA and spinal quantitative computed tomography are sometimes used as alternatives for diagnosis.

- Quantitative ultrasound of the heel (calcaneus) is not currently recommended as an appropriate standard test for BMD and is not reimbursed by Medicare.

Measurement of BMD should be used as part of patient care for high risk individuals rather than for screening healthy patients, i.e. if the decision to treat a patient will be influenced by the result of the test.

BMD TESTING – REBATE

Medicare rebates are available for BMD testing using DXA in the following situations:

- For diagnosis and monitoring of bone loss in people in certain high risk categories:
  - prolonged glucocorticoid therapy; conditions associated with excess glucocorticoid secretion; male hypogonadism; female hypogonadism lasting more than 6 months before the age of 45; primary hyperparathyroidism; chronic liver disease; chronic renal disease; proven malabsorptive disorders (including coeliac disease); rheumatoid arthritis; or conditions associated with thyroxine excess.
  - all people over the age of 70 years.

- For confirmation of a presumptive diagnosis of osteoporosis in a patient with one or more minimal trauma fractures.

- For monitoring of low BMD (more than 2.5 SDs below the young normal mean) proven by bone densitometry at least 12 months previously.

- For measurement of BMD 12 months after a significant change in therapy.

In postmenopausal women the rate of bone loss is generally 1-2% per annum; hence an interval of 2 years between scans is satisfactory, unless there is an accelerated rate of bone loss, in which case yearly measurements may be required.
**RADIOGRAPHY**

- Plain X-rays should be ordered to check for asymptomatic spinal fractures in patients with high risk factors or a known loss of height or osteoporosis documented on bone densitometry.
- X-rays should also be considered to check for sudden, severe unexplained back pain, which may indicate a new vertebral fracture.
- Plain X-rays are also useful in investigating a BMD that is higher than expected or where there is a discrepancy between hip and spinal BMD.

**OTHER INVESTIGATIONS**

- **Blood test** results are usually normal in a patient with osteoporosis. A Z-score below minus 1.5 on BMD testing is worth investigating for causes of secondary osteoporosis. Tests may be indicated to exclude other causes of bone mineral loss such as primary hyperparathyroidism, malabsorption, thyroid disease or vitamin D deficiency. Typical investigations include:
  - Full blood count
  - Erythrocyte sedimentation rate (ESR)
  - Serum calcium
  - Serum creatinine
  - Total alkaline phosphatase and albumin
  - Thyroid stimulating hormone (TSH)
  - Protein electrophoresis (EPP)
  - Anti-tissue transglutaminase antibody (TTG) or anti-endomysial antibody
  - Parathyroid hormone (PTH)
  - Serum 25-hydroxy-vitamin D

- **Bone markers**
  Several biochemical markers of bone turnover can be measured in serum and urine. These include serial measurement of urinary or serum cross-links/telopeptides (NTx) or serum bone Gla protein (osteocalcin).
  These measurements may provide additional independent information in assessing fracture risk, but cannot quantify total skeletal bone mass and are not routinely indicated for osteoporosis assessment in general practice. They may have a role in assessing compliance with therapy.
FLOWCHART 1  DIAGNOSTIC EVALUATION OF OSTEOPOROSIS

Assessment of Risk factors and previous fracture history on a regular periodic basis or upon presentation of acute minimal trauma fracture

Measure Bone Density

Identify any fracture

Radiograph of the spine

Search for causative factors

Biochemical Evaluation

Clinical Examination

Initiate treatment plan – if criteria are met

Identify diseases that modify choice of treatment

Identify diseases that require treatment

Treat

Monitor effect
B. MANAGEMENT OF OSTEOPOROSIS TO PREVENT THE FIRST FRACTURE

“Treatment of established osteoporosis is cost-effective irrespective of age. Therapies with proven rapid efficacy may offer important value to healthcare payers, providers and patients.” (International Osteoporosis Foundation)

WHO SHOULD BE TREATED?

- **People with normal BMD:** osteoporosis treatment has not been shown to reduce fracture rates in women with normal BMD or women with osteopenia. A fracture in people with normal BMD may be due to trauma or local pathology rather than bone fragility.

- **Women with osteopenia but no fracture:** unless on long-term corticosteroids, the patient should be monitored, ensuring adequate calcium and vitamin D intake as well as encouraging regular exercise (weight-bearing/high impact and weight training). Consider possible predisposing conditions and follow-up at 1-3 years, depending on risk factors. Consider hormone replacement if within 2-3 years of the onset of menopause. Repeat DXA in 1-2 years.

- **Men with osteopenia:** fracture rates are quite low in these men and, to date, clinical studies have not shown a therapeutic effect with treatment.

- **Women with osteopenia where a spinal fracture is present:** treatment should be considered.

- **Women diagnosed with osteoporosis, with or without fractures:** treatment to prevent further bone loss and fractures is recommended.

- **All women and men with a fragility fracture:** drug treatment to reduce the risk of future fractures should be considered, as the risk of further fractures is increased by 30-40% within three years. Treatment is particularly effective for those people who have already had a fracture.

- **All people on corticosteroid therapy for longer than 3 months:** should be given preventative treatment, as it is estimated that 30-50% will experience fractures. Fracture risk is related to the severity of reduction in bone density and the duration of exposure to corticosteroids.

- **Osteoporosis in men:** risk factors such as smoking, excessive alcohol intake, glucocorticoid therapy, malabsorption and underlying bone marrow malignancies need to be identified. Testosterone replacement therapy is indicated in men with proven hypogonadism, but not in eugonadal men, due to an increased risk of developing prostate cancer. There is reasonable evidence for the efficacy of bisphosphonates and parathyroid hormone (PTH teriparatide) in men with osteoporosis.

- **Treatment of frail older people:** older people are more likely to have several risk factors for fracture, including previous fractures, but are also often under treated.
  - Osteoporosis treatment must take account of the likelihood of co-morbidity and multiple therapies.
  - For those in residential care, vitamin D deficiency is very common (45% of women in high level care have frank deficiency with the remainder in the lower half of the reference range). Adjunctive therapy with calcium and vitamin D is particularly important in this group. Dark skin colour, cultural dress and Southern winters may all contribute to Vitamin D deficiency.
  - Consider fall prevention strategies. There is evidence for the efficacy of hip protectors in institutionalised elderly, however compliance with hip protectors is poor.
  - Consider encouragement of activities which are a combination of strength and balance training.
FLOWCHART 2  MANAGEMENT OF OSTEOPOROSIS

Assess baseline bone mineral density by DXA (T-score hip and/or total spine)

- T-score ≥ -1.0 SD
- T-score > -2.5 and < -1.0 SD
- T-score ≤ -2.5 SD

- Exclude/treat secondary causes
- Initiate specific anti-osteoporosis therapy

- Review:
  - 6 monthly for compliance (and possible medication side effects)
  - 1-2 yearly DXA scan

- Reassess and follow-up in 2-5 years

- Ensure adequate daily calcium intake (>1200mg/day) and ensure supplement vitamin D status (>50nmol/L)
- Encourage strength, balance and weight-bearing aerobic activity and implement falls reduction strategies
- Oral bisphosphonates (alendronate, risedronate)
- SERM (raloxifene) (women only)
- Teriparatide
- Strontium ranelate (women only)
- Hormone therapy in presence of hypogonadal symptoms

PATIENTS OVER 70 YEARS OF AGE
- Family history
- Low body weight
- Hypogonadism
- Smoking
- Hyperparathyroidism
- Hyperthyroidism
- Corticosteroid use (longer than 3 months)
- Inflammatory conditions (e.g. RA)
- Malabsorption disorders (e.g. celiac disease)

PART 2

PATIENTS WITH MAJOR RISK FACTORS
- Flattening or kyphotic deformity
- Osteopenia/osteoporosis
- Falls: 
  - Associated with a slip, trip or fall from standing height or less
  - Hip
  - Spine

MANAGEMENT

Investigation and Assessment

Spine X-ray to confirm fracture

Dr. Matthew Low developed by

Prevent the next fracture – a guide for GPs
Calcium and vitamin D assessment/replacement, with supplementation if necessary, plus appropriate lifestyle measures should be considered as first line therapy (see pages 21-25 for more information).

1. DRUG THERAPY

A. FIRST LINE MEDICATIONS

- Bisphosphonates, such as risedronate and alendronate, and the SERM, raloxifene, have each been shown to inhibit excessive bone resorption, increase BMD and reduce fracture risk by between 30% and 60%. However, they cannot reverse structural damage. A newer agent, strontium ranelate is effective in increasing BMD and reducing fracture risk (see page 17).

Bisphosphonates

- Bisphosphonates are bone specific. They inhibit osteoclast mediated bone resorption and allow bone mass to increase, which reduces the risk of fracture. Three bisphosphonates are currently available for treatment of osteoporosis – risedronate, alendronate and etidronate.
- The potent bisphosphonates: risedronate (Actonel and Actonel Combi) and alendronate (Fosamax, Fosamax Plus and Alendro) are effective first-line options for vertebral, hip and non-vertebral fracture prevention. They demonstrate approximately 50% reduction in vertebral fractures in studies of women with one or more baseline spinal fractures. The reduction in fracture rate is seen within 12-18 months and they have been demonstrated to reduce bed day use and healthcare costs.
- Fosamax Plus is Fosamax with vitamin D. Actonel Combi is Actonel plus calcium. Actonel Combi D is Actonel plus both calcium and vitamin D.
- The bisphosphonates, alendronate and risedronate, are currently subsidised by the PBS for treatment of osteoporosis once a minimal-trauma fracture has occurred for people of any age. They are also available on the PBS for treatment of osteoporosis in people aged 70 years and over with a BMD T-score of ≤ -3.0, without a prevalent fracture (see page 18).

"The purpose of treatment is to reduce morbidity and mortality associated with the first fracture and all subsequent fractures."  (from MJA supplement)
• As all the bisphosphonates have poor bioavailability (between 1-3% of dose ingested) and bind calcium avidly, they have to be taken on an empty stomach, at least half an hour before food with a full glass of plain water only. After that, the patient should stay upright for at least 30 minutes.
• The most common side-effect of bisphosphonates is mild-moderate gastrointestinal discomfort.
• Rare instances of oesophagitis have been reported with alendronate. To minimise the risk of oesophagitis, alendronate should be avoided in people with oesophageal abnormalities, such as stricture or achalasia.
• If commencing bisphosphonates, it is recommended that supplementation with oral vitamin D (400 - 800IU daily) and oral calcium (500 -1200mg elemental calcium daily) be started. Combination preparations are also available.

Generally, bisphosphonates should be taken first thing in the morning on an empty stomach with a glass of plain water. The patient should remain upright for half an hour after taking them and not eat or drink anything else in that half hour. As well, calcium supplements and oral bisphosphonates should be taken at least two hours apart. Otherwise the absorption of one can interfere with the other.

Jaw Osteonecrosis with Bisphosphonates
The adverse event of jaw osteonecrosis has been most commonly reported with the use of intravenous bisphosphonates (zoledronate and pamidronate), in cancer patients. Several cases have been reported in people taking oral bisphosphonates for osteoporosis, but it has mainly been the result of high IV doses, 4 -10 times higher than oral bisphosphonate doses. This problem can be precipitated by dental extractions. It remains a rare problem, however GPs should be aware of this potential side-effect and be able to discuss it with their patients.

Strontium ranelate (Protos)
• Strontium ranelate is a new agent for the prevention of fractures in post-menopausal women with osteoporosis.
• It has a dual action – increasing bone formation markers and decreasing bone resorption markers.
• Strontium ranelate reduces vertebral fractures by 50%; non-vertebral fractures by 16%; and it reduces hip fractures by 19%.
• It is a once daily dose, taken as a powder mixed with water. It is best taken at bed-time, at least 2 hours after food, calcium-containing products or antacids.
• Possible side-effects include nausea, diarrhoea, headache and skin irritation. Venous thrombosis is an uncommon side effect.
• A very rare side effect of strontium ranelate is drug hypersensitivity syndrome or drug rash with eosinophilia and systemic symptoms (DRESS). It is characterised by fever, rash, eosinophilia, and internal organ involvement that may include hepatitis, interstitial nephropathy and interstitial lung disease. It occurs around 3-6 weeks after initiation of strontium ranelate and most cases resolve after discontinuation of the drug and treatment with corticosteroid therapy. It would be prudent to stop strontium ranelate if a skin rash occurs soon after starting the drug.
Selective oestrogen receptor modulators (SERMs)

- SERMs interact with oestrogen receptors, but in a different way from oestrogen, resulting in mixed agonist and antagonist effects in different body tissue.
- Raloxifene (Evista) increases BMD in the spine and hip, reducing the risk of vertebral fracture for women with osteopenia and osteoporosis, but has not been demonstrated to reduce non-vertebral/hip fractures.
- Unlike HRT, raloxifene does not stimulate the endometrium and therefore is not associated with increased frequency of vaginal bleeding or increased risk of endometrial cancer. However, it may exacerbate vasomotor menopausal symptoms eg hot flushes and leg cramps.
- Raloxifene has also been demonstrated to reduce the risk of invasive breast cancer in post-menopausal women on long-term therapy (greater than 5 years), without increasing the risk of endometrial cancer. However, this may be balanced by an increased risk of VTE and fatal stroke.
- An increased risk of venous thrombosis has been reported with raloxifene, similar to that seen with HRT, so it should be stopped if people are immobilised for a prolonged period.

MEDICATIONS FOR PREVENTION OF FRACTURES AVAILABLE ON THE PBS

- Men and women aged 70 years and over with a BMD T-score of ≤-3.0 can receive treatment for osteoporosis on the PBS, without having sustained a fracture ie for primary prevention. The treatments listed by the PBS for this group include alendronate (Fosamax, Fosamax Plus, Alendro and Alendrobell) and risedronate (Actonel and Actonel Combi). Strontium ranelate is also available on the PBS for primary prevention in women aged 70 and older.
- The PBS also subsidises treatment for osteoporosis in patients of any age who have had a minimal-trauma fracture. Available treatments include alendronate, risedronate and etidronate (Didrocal).
- Raloxifene (Evista) and strontium ranelate are subsidised for the treatment of osteoporosis in post-menopausal women who have had a minimal-trauma fracture.

OTHER AGENTS

Teriparatide (Forteo)

- The anabolic agent parathyroid hormone, teriparatide, (Forteo) which stimulates bone formation and hence, bone density and strength, has been shown to reduce the incidence of spinal (65%) and non-spinal (55%) fractures in studies of postmenopausal women with prior spinal fractures. It is available in Australia for people with established osteoporosis, who have had fractures, for whom other agents are considered unsuitable. It does not have PBS listing. It is given by daily sc injection and maximum treatment duration is 2 years.

Zoledronic Acid (Aclasta)

- It is a potent bisphosphonate administered as a once-yearly intravenous infusion. It is not PBS listed.
EVIDENCE ACCORDING TO SEX AND FRACTURE TYPE

Prevention of vertebral fractures in women
- There is strong evidence of efficacy for risedronate, alendronate, raloxifene, parathyroid hormone (teriparatide) and strontium ranelate.

Prevention of hip fractures in women
- There is strong evidence of efficacy for risedronate, alendronate and HRT (however, the role of HRT solely as an osteoporosis treatment is not recommended). There is evidence for strontium ranelate in high-risk women.
- There is evidence for the efficacy of combination calcium plus vitamin D, and hip protectors, in institutionalised elderly.

Prevention of fractures in men
- There is reasonable evidence for the efficacy of bisphosphonate and parathyroid hormone (teriparatide) in men with osteoporosis.
- Androgen therapy is indicated in osteoporotic men with hypogonadism.

WHICH FIRST-LINE TREATMENT SHOULD BE GIVEN?
- The choice of drug may be influenced by the mode of administration (eg weekly for some bisphosphonates as opposed to daily) or by the need for extra skeletal effects, such as treatment of postmenopausal symptoms using HRT.
- If the aim is to reduce vertebral fractures, then any one of the first-line agents: alendronate, risedronate, raloxifene or strontium ranelate are suitable.
- If the aim is to reduce non-vertebral fractures, for example in women over 70-75 years with low femoral neck BMD, where the risk of hip-fracture is high, then a potent bisphosphonate or strontium ranelate should be used. The SERM: raloxifene has been demonstrated to prevent spinal fractures, but not non-spinal fractures.
- For corticosteroid-induced osteoporosis, bisphosphonates have been demonstrated to provide effective prophylaxis.
- In men with osteoporosis there is reasonable evidence for the efficacy of bisphosphonates and PTH.
- The efficacy of combination therapies has been investigated, but data are scarce and study sizes too small to determine whether fracture risk would be significantly reduced compared with monotherapy, although combined therapy may produce greater increases in BMD.
LENGTH OF TREATMENT

- Currently clinical trials of anti-fracture efficacy only extend as far as five years. However, treatment should be continued beyond five years for those at high fracture risk.
- Adherence with osteoporosis medications is often poor, as it is with many long term medications. A recent study showed that postmenopausal women were more adherant with weekly than daily bisphosphonates, but long-term adherence remains low. (After 12 months only 44% of people on weekly medication and 32% on daily medication were still persisting with treatment).
- Because many people are non-adherant and stop treatment within 2 years, bone loss and increased remodelling and further structural damage can recur (particularly with HRT).
- People being treated with prednisolone or equivalent at a daily dose of 7.5 mg or greater for more than 3 months should have treatment with bisphosphonates maintained for the same period, particularly if they have low BMD.

B. HORMONE REPLACEMENT THERAPY FOR WOMEN (HRT)

*Hormone replacement therapy is not listed by the TGA as an indication for the treatment and prevention of osteoporosis.*

- Oestrogen therapy (alone or in combination with progestogen) can prevent bone loss in menopausal women and is especially indicated in the first 3-5 years of menopause, during which time HRT is associated with very little morbidity. Therapy allows increases in bone density averaging 5% over 3 years. DXA screening may determine those women in which this approach

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TABLE 3  EFFICACY OF DRUG TREATMENTS IN REDUCING FRACTURE RISK AMONG WOMEN WITH OSTEOPOROSIS

<table>
<thead>
<tr>
<th>AGENT</th>
<th>FRACTURE TYPE</th>
<th>Vertebral</th>
<th>Hip</th>
<th>Other non-vertebral</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bisphosphonates -</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alendronate (Fosamax)</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Risedronate (Actonel)</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Parathyroid Hormone</td>
<td>✓</td>
<td>–</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>HRT</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>SERMs (Raloxifene)</td>
<td>✓</td>
<td>–</td>
<td>–</td>
<td></td>
</tr>
<tr>
<td>Calcium + vitamin D³ preparations</td>
<td>–</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Strontium Ranelate</td>
<td>✓</td>
<td>✓**</td>
<td>✓</td>
<td></td>
</tr>
</tbody>
</table>

✓ Convincing evidence of anti-fracture efficacy from randomised, placebo-controlled clinical trials of women with prior vertebral fractures or with osteoporosis (as defined by low BMD). * Selective group of people in residential care – Ineffective or insufficient evidence of efficacy. ** T-score < 3.0
is appropriate, if there are risk factors detected in the history or physical examination.

- Oestrogen-only therapy confers an increased risk of endometrial hyperplasia and cancer, so women with a uterus should take oestrogen in combination with progestogens to protect against endometrial cancer. Progestogens may be given cyclically for 10-14 days each month in perimenopausal women.
- HRT is indicated for the short term relief of menopausal symptoms (up to 5 years) and may have a role in preventing bone mineral density loss in these women. Its use is most appropriate in women under the age of 60 years.

Changing from HRT to First Line Agents

- Because HRT has also been associated with a small increase in absolute risk of cardio-vascular disease and breast cancer (in the case of combined HRT), it is **not** recommended for management of fracture risk alone, as this would require long-term use. For women at high risk of fractures and with no menopausal symptoms, HRT should be replaced by one of the **first line options** for treating postmenopausal osteoporosis: bisphosphonates, strontium ranelate or a selective oestrogen-receptor modulator (SERM).
-Raloxifene, which is a SERM, should be avoided during the early menopause transition as it may exacerbate vasomotor symptoms. It does however confer a degree of protection from breast cancer, a matter which should be discussed with individual women at risk.
- Although the TGA does not approve HRT as a first line treatment for osteopenia or osteoporosis, in the absence of menopausal symptoms, it is the only treatment available on the PBS for women with low BMD and no fracture (**under 70 years**). For women who have osteopenia or osteoporosis and no fracture, doctors are faced with the following options:
  1) Use HRT with appropriate counselling about risk, especially in women under 60 years of age. (It is particularly an option in women who are within a few years of their menopause and have low risk factors for cardiovascular disease).
  2) Use First Line agents (bisphosphonates, raloxifene, strontium ranelate) and pay for these privately.

C. VITAMIN D

- The NRV (Nutrient Reference Value) for adults is 400-800 IU (10-20 micrograms) of vitamin D per day but is of limited relevance since most vitamin D comes from sunlight exposure.
- For most Australians the main source of vitamin D is through sunlight exposure. Cholecalciferol (vitamin D₃) is formed in the skin through the action of UV light on 7-dehydrocholesterol. Vitamin D is also obtained from the diet as ergocalciferol (vitamin D₂), however food sources of vitamin D are limited.
- Vitamin D primarily increases intestinal calcium absorption and ensures the correct renewal and mineralisation of bone tissue
- Vitamin D deficiency increases the risk of osteoporosis, falls and fractures in the elderly.
- For people who do not get adequate sun exposure for a variety of reasons, then a supplement of at least 800IU (20 micrograms) per day is recommended.
Vitamin D and Diet

- For most Australians, adequate vitamin D is unlikely to be achieved through diet alone.
- Vitamin D is found in small quantities in a few foods, such as: fatty fish (salmon, herring, mackerel), liver, eggs and fortified foods.
‘Optimum calcium and vitamin D nutrition are key modifiable risk factors for developing osteoporosis, are important in the maintenance of musculoskeletal health, and can have broader effects on health in general’.

### TABLE 4  RECOMMENDED SUN EXPOSURE FOR PEOPLE WITH MODERATELY FAIR SKIN*

<table>
<thead>
<tr>
<th>Region</th>
<th>December - January</th>
<th>July - August</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>At 10am or 2pm†</td>
<td>At 10am or 2pm</td>
</tr>
<tr>
<td>NORTHERN AUSTRALIA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cairns</td>
<td>6 to 7 minutes</td>
<td>9 to 12 minutes</td>
</tr>
<tr>
<td>Townsville</td>
<td>5 to 7 minutes</td>
<td>9 to 13 minutes</td>
</tr>
<tr>
<td>CENTRAL AUSTRALIA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brisbane</td>
<td>6 to 7 minutes</td>
<td>15 to 19 minutes</td>
</tr>
<tr>
<td>Perth</td>
<td>5 to 6 minutes</td>
<td>20 to 28 minutes</td>
</tr>
<tr>
<td>SOUTHERN AUSTRALIA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sydney</td>
<td>6 to 8 minutes</td>
<td>26 to 28 minutes</td>
</tr>
<tr>
<td>Adelaide</td>
<td>5 to 7 minutes</td>
<td>25 to 38 minutes</td>
</tr>
<tr>
<td>Melbourne</td>
<td>6 to 8 minutes</td>
<td>32 to 52 minutes</td>
</tr>
<tr>
<td>Hobart</td>
<td>7 to 9 minutes</td>
<td>40 to 47 minutes</td>
</tr>
<tr>
<td>NEW ZEALAND</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Auckland</td>
<td>6 to 8 minutes</td>
<td>30 to 47 minutes</td>
</tr>
<tr>
<td>Christchurch</td>
<td>6 to 9 minutes</td>
<td>49 to 97 minutes</td>
</tr>
</tbody>
</table>

* Recommended sun exposure times resulting in 1/3 minimal erythematic dose. Exposure times for people with highly pigmented skin would be three to four times greater.
† 11am or 3pm daylight saving time, respectively.


### D. CALCIUM

**WHO NEEDS TO HAVE WHAT?**

- Children 5 to 9 years should aim for 2 to 3 serves of calcium-rich foods each day to reach a total intake of 800 - 1000 mg/day.
- Children and adolescents aged 9 to 18 years should aim for at least 3 serves of calcium-rich foods a day to reach a total intake of 1000 - 1300 mg/day.
- Adults need at least 1000 mg of calcium per day; women aged over 50 and men aged over 70 require at least 1300 mg of calcium per day.
More than half of Australian adults do not get their recommended intakes of calcium.

Including calcium in the treatment regime minimises the risk of dietary calcium deficiency.

The nutrient reference value (NRV – previously known as the Recommended Daily Intake) is 1000mg calcium per day for most adults. 1300mg calcium per day is recommended for postmenopausal women and men aged over 70 years.

Dairy products are a rich source of calcium. The simplest way to ensure sufficient daily calcium is to include 3 serves per day of high-calcium foods like milk, cheese or yoghurt. Many calcium-enriched products are now available for those who cannot tolerate dairy products.

Prescribe calcium supplements in people over 65 years, for those with insufficient dietary calcium intake, for the treatment of postmenopausal osteoporosis and for those on corticosteroids for more than 3 months.

The effect of calcium supplementation on bone health is modest, as shown by increases in bone density and reduction in excessive bone turnover. The relative risk reduction for osteoporotic fracture is likely not to be more than 10 -20% and thus difficult to detect.

Calcium supplementation of between 500-1500mg/day is generally safe although constipation may occur. Calcium supplementation is associated with renal calculus disease in patients with high baseline dietary calcium intakes.

Supplements containing calcium carbonate require gastric acidity for optimal absorption and should therefore be taken with meals. Supplements containing calcium in other forms, such as citrate, do not require gastric acidity.

There is no significant difference in the absorption of calcium from supplements compared with different dietary sources (excluding foods rich in phytate or oxalate), provided stomach acidification is normal.

Proton pump inhibitors may reduce calcium absorption, particularly calcium carbonate. However, they do not affect calcium absorption from dairy products.

**Special Considerations for calcium and vitamin D in the elderly**

*International Osteoporosis Foundation*

Elderly persons are at increased risk for calcium and vitamin D insufficiency. There are also several alterations in body functions that can contribute to calcium loss from bone, and hence increase the risk of osteoporosis.

Ageing is associated with:

- Reduced intake of dietary calcium, usually as a result of decreased overall dietary energy intake (e.g. poorer appetite, inter-current illnesses, social and economic factors)
- Decreased intestinal absorption of calcium (exacerbated if vitamin D status is low)
- Decreased capacity of the intestinal cells to adapt to a low calcium intake, and increase their absorptive capacity
- Less frequent exposure to sunlight (e.g. elderly who are housebound, institutionalised, or have reduced mobility), hence poorer vitamin D status
- Decreased capacity of the skin to synthesise vitamin D
- Decreased efficiency with which the kidneys can retain calcium, leading to increased calcium loss in the urine
- Decreased capacity of the kidneys to convert vitamin D into the most active form, 1,25-dihydroxyvitamin D.

**TIPS FOR ENHANCING ADHERANCE WITH MEDICATION**

- Refer patients to an education or self-management programme (see OA State Offices – 1800 242 141).
- Refer to a Fracture Clinic if appropriate.
- Give patient initial education to include:
  - Treatment options – patients given informed choice
  - Possible side effects of treatment
  - Clear Instructions, verbal and written
  - Emphasis on long-term nature of treatment
  - Aim of treatment
- Go through the DXA printout with your patients. The visual impact of seeing the results can often aid adherance.
- Patient Follow-up to include:
  - Adherence check
  - Recording of further falls or fractures
  - Assessing adequacy of calcium and vitamin D therapy
  - Assessing adequacy of pain relief
  - Reinforcement of initial education
  - Assessment of lifestyle measures, including diet and exercise
- Internal Practice Audit of patients with osteoporosis to assess adherance and to provide GP Management Plans where possible.
- Recall systems to plan 2 yearly BMD evaluation.
- Consideration of periodic radiographic re-evaluation.
- Consider urine /serum Ntx to assess adherance in ‘at risk’ patients.
2. LIFESTYLE MANAGEMENT
A. DIET
See pages 21-24 for information on calcium and vitamin D nutrition.

B. SUNLIGHT EXPOSURE
See pages 22 and 23 for information on sun exposure.

C. PHYSICAL ACTIVITY AND EXERCISE

Exercise helps to build and maintain strong bones and prevent falls and fractures.

Exercise can also play a crucial role in rehabilitation. Muscle strengthening exercises can help to rebuild bone in people who have developed osteoporosis, provide pain relief and speed the rehabilitation process.

- Exercise and bone maintenance are inextricably linked.
- Regular weight-bearing exercise, high impact exercise and strength training can increase bone density and prevent bone loss associated with ageing and menopause.
- By improving balance, co-ordination, strength and agility, exercise helps to prevent falls that lead to fractures.
- Exercise helps to speed the rehabilitation process after fracture.

ROLE OF EXERCISE AND OSTEOPOROTIC PREVENTION

- Osteoporotic fracture is a multifactorial problem requiring a holistic approach to prevention for optimal efficacy and safety.
- Targeted exercise addresses many of the risk factors for osteoporotic fracture, including osteopenia, muscle wasting and weakness, falls, poor balance, depression, use of medications for depression and insomnia, sedentariness, fear of falling, mobility impairment and disability.
- Concurrent management of fracture risk with a physical activity prescription, adequate nutrition and pharmacotherapy for osteoporosis when required offers the best approach to optimal bone health.
- The important elements of the exercise prescription for bone health include high-intensity progressive resistance exercise (weight lifting), progressive balance training, moderate to high intensity weight-bearing aerobic exercise and, when feasible, high impact exercise.

• Regular weight-bearing and resistance exercises are best for people with osteoporosis. **High-impact activities are only recommended for people with osteoporosis who don’t have lower limb arthritis or recent fractures.**

• Spinal extension strength training during middle-age has been shown to reduce vertebral fracture rates over 10 years.

• People with osteoporotic fractures have been shown to benefit from strength and balance training to improve rehabilitation outcomes and prevent recurrent falls. Such exercise should be incorporated into routine care and performed in consultation with the orthopaedic surgeon.

• Exercise can help to relieve the pain and some of the symptoms of increased kyphosis and other postural changes.

**Exercise and the prevention of osteoporosis**

• Bones need nourishment and the mechanical stress of physical activity to remain strong and healthy. Daily exercise helps to keep bones and muscles strong, maintains flexibility and reduces the chances of injury.

• People who exercise regularly have greater bone density than inactive people of the same age.

• To have an effect on bone, exercise needs to be REGULAR, PROGRESSIVE, FAIRLY VIGOROUS, HAVE VARIETY (put different loads on it), and performed in SHORT INTENSE BURSTS.

• **Types of exercise** required for bone health: **weight-bearing** and **strength-training**. High impact exercises (eg jumping, hopping, skipping) should also be included when arthritis or other limitations do not preclude them.

• Good weight-bearing exercises for bones include brisk walking, jogging, dancing, tennis and volleyball.

• Strength training should involve progressive resistance training using moderate to heavy weights.

• Two short exercise sessions separated by 8 hours are better than one long one.

• If exercise time needs to be reduced, it is better to reduce the length of each session rather than the number of sessions per week.

Advise patients to:

- Start slowly and progress gradually
- Do activities that they enjoy, and make it fun
- Set short-term goals for what they want to achieve
- Exercise with a friend or in a group
- Keep an exercise diary
- Be aware of pain: report any pain to a healthcare professional
- Tai Chi and other regimens that promote muscle strength, balance and co-ordination are good for falls prevention
- Go for a short brisk walk or jog (20 minutes) or run up stairs for 10 minutes: this may be more beneficial to bone than a long slow walk of about an hour
- Perform just 10 jumps a day – this significantly improves bone density for pre-menopausal women.
PREScribing Exercise for osteoporotic prevention

• The most important elements of the exercise prescription for bone health are high intensity progressive weight lifting exercise and progressively more difficult balance training, with the addition of high impact exercise (such as jumping) when feasible.
• The most economical prescription with the broadest benefits for body composition and bone health as well as neuromuscular function is progressive resistance training as the primary exercise modality.
• Continuous progression of weight moved, balance exercise difficulty and jump height is the most critical element of the exercise prescription for bone health; if progression stops, so does adaptation in the bone and muscle.
• Given the short time (several minutes per day) that is necessary for effective high impact exercise or balance training, incorporating such episodes into daily activities may be more successful than planning structured exercise classes away from home.


PRINCIPLES OF EXERCISE THAT MAXIMISE BONE ADAPTATION

• Rapid, short bursts of high intensity and/or high impact activities such as jogging, jumping and rope skipping are more stimulating to bone cells than sustained, low impact activity such as walking.
• Effective activity does not have to be weight-bearing. Seated resistance training is an effective nonweight-bearing activity.
• Aerobic activity that is nonweight-bearing (such as swimming or cycling) does not enhance bone density.
• Lifting heavy weights is more effective than lifting light weights.
• Lifting heavy weights rapidly (power training) seems to be more effective than lifting heavy weights slowly (traditional resistance training).
• Exercising in short bouts with rest periods between has been shown in animal models to be more effective than continuous, long periods of exercise.
• Rapid movements are more stimulating than slow movements.
• Novel forces, such as changing directions and different heights of jumps, are more stimulating than repetitive force patterns.
• As the response of the bone to muscle contraction is a local phenomenon, muscles connected to clinically important bones susceptible to osteoporotic fracture (hip, wrist, thoracic spine) need to be targeted specifically to achieve protection at those skeletal sites.

IF YOUR PATIENT HAS OSTEOPOROSIS AND SPINAL AND/OR LOWER LIMB FRACTURES

Supervision by a physiotherapist, an exercise physiologist or other qualified health care professional can help to:
- Reduce the risk of further injury through falling
- Ensure that the program is suited to the patient’s needs
- Relieve acute pain.

Advise patients to:
- Practice balance-enhancing exercise
- Avoid high impact activities during acute recovery from fractures
- Avoid jarring and twisting movements while recovering
- Strengthen all the muscles of the legs to improve rehabilitation and prevent future falls
- Avoid back flexion movements/exercises, as these have been shown to increase the risk for vertebral compression fractures
- Train upper body (eg triceps) while leg is healing to ease transferring and functional tasks
- Train the fractured leg once the surgical site is healed and clearance is obtained from the orthopaedic surgeon.

Before commencing any exercise program, people who have severe osteoporosis and/or several fractures should see a physiotherapist, exercise physiologist or GP for an individual exercise program.

FALLS PREVENTION STRATEGIES

- Falls are responsible for 90% of hip fractures and 50% of vertebral fractures in older patients, so one of the main aims of exercise programs in this group should be to reduce the number of falls.
- Risk factors for falls include: impairment of vision, sensation, strength and balance, depression, cognitive impairment, neurological disease, inadequate nutrition and sarcopenia, polypharmacy and frailty.
- Quadriceps strength and postural sway have been found to be as important as BMD in predicting male and female fractures.
- Exercise that increases muscle strength and improves balance may reduce the risk of falls.
- The risk of falls can be reduced by:
  - Vitamin D replacement in deficient individuals
  - Nutritional supplementation for malnourished individuals
  - Falls prevention programs, including muscle strengthening
  - Balance training: eg home based physiotherapy or Tai Chi
    (47% decrease in falls and 25% less hip fracture rate in practising individuals)
  - Regular exercise
- Environmental modifications (eg removing mats, improving lighting)
- Correct footwear: recommend firm fitting, flat shoes
- Optimising patient vision
- Appropriate use of walking aids
- Optimising treatment of medical conditions associated with falls eg hypotension
- Reduction in psychotropic medication use and polypharmacy

TIPS FOR PATIENTS ABOUT FALLS PREVENTION

- **It’s never too late to start exercising!**
  Balance, muscle strength and muscle mass can be improved at any age.

- **Exercise regularly**
  Exercise regularly – at least 3 days a week. This keeps the balance ‘tuned up’ and bones and muscles strong.

- **Chronic diseases**
  Diseases such as diabetes, arthritis or asthma should not stop you exercising. Chronic disease is an indication for, not a reason to avoid exercise. Your physiotherapist, physician or exercise physiologist can tailor a specific exercise program for you.

- **Maintain good posture**
  Good spinal care throughout your life will assist your balance.

- **Walking aids such as sticks and frames should be correctly prescribed and fitted**
  Not borrowed from other people.

- **Choose proper footwear**
  Firm fitting, flat shoes improve your stability.

- **Take extra care on uneven ground**
  Surfaces such as gravel and grass are more challenging to the balance.

- **Good vision helps your balance**
  Be careful if lighting is poor and avoid walking in the dark. Be careful when using bifocal / multifocal lenses.

- **Be aware of home hazards**
  Slippery mats, dangling electrical cords & clutter can turn your home into an obstacle course.

- **Have a ‘Falls Emergency Plan’**
  Know how to summon help if you do have a fall. Ask your physiotherapist to show you the easiest way to get up off the floor.

- **Eat well**
  Weight loss and muscle wasting from inadequate energy and protein intake increases the risks of falls and fractures.

*These tips are provided by the Australian Physiotherapy Association and used with permission.*
Hip Protectors

- Hip protectors have been reported to reduce hip fractures in some, but not all, clinical trials in high-risk populations (residential care).
- Compliance with wearing hip protectors is a major problem.

Individually tailored exercise programs include balance training to reduce the likelihood of having a fall.

C. MANAGEMENT OF FRACTURES TO MINIMISE THE FRACTURE CASCADE

“Rehabilitation to independent living is the primary goal after any fracture.” (MJA supplement)

Optimal care of fragility fracture patients includes not only management of the presenting fracture but also investigation, diagnosis and treatment of underlying causes of the fracture, including osteoporosis or other medical conditions.

VERTEBRAL FRACTURES

- A first vertebral fracture often goes unrecognised – patients often attribute back pain to ageing, while healthcare professionals may diagnose a non-specific musculoskeletal condition and treat symptomatically. This means significant spinal remodelling may have occurred before treatment can be started. Additionally, a woman’s first vertebral fracture makes her 4 times more likely to have another fracture within the next year.
- Vertebral fractures are recognised through physical examination: examine for loss of height, kyphosis and spinal bone tenderness. X-rays may also reveal evidence of osteoporosis and incidental fracture.
- The pain from vertebral crush fractures is usually short-term (6-8 weeks) and should resolve as the fracture heals.

Management of vertebral fractures

- For minor vertebral fractures, conservative treatment is appropriate and consists of:
  - pain relief with non-steroidal anti inflammatory drugs (NSAIDs)
  - abdominal exercises and bracing
  - physiotherapy, particularly hydrotherapy
- For patients suffering from multiple crush fractures specific management programs should include:
  - medications, in combination with pain relieving strategies, e.g. TENS (transcutaneous electrical nerve stimulation) and relaxation techniques.
  - opiate therapy may be indicated and pain management consultation may be required.
Where pain persists, several surgical techniques have proven effective for some people. These include:
- vertebroplasty: ‘cement’ is injected percutaneously (through the skin) into the vertebrae.
- kyphoplasty: an expandable balloon is put into a vertebrae and inflated. The cavity created in the bone is then filled with cement.

HIP FRACTURES

More than 95% of patients require surgery to repair their hip fracture, and of these, fewer than one-third will regain normal functioning; a further one-third have to give up independent living and need constant care.

After a hip fracture, 1 in 5 people will die within 6-12 months, up to 1 in 4 will require full-time nursing-home care and 1 in 2 will need long-term help with activities of daily living.

Recognised risk factors for poor functional recovery following a hip fracture include older age, post-fracture depression, lack of social support and low ability to function properly prior to the fracture.

Management of hip fractures

High intensity progressive resistance training can lead to improvements in strength and function in elderly patients who have had hip replacement surgery. Patients treated with such exercise therapy have been shown to be better at getting up, walking, climbing stairs and maintaining posture compared to patients who haven’t been treated with an intensive exercise program following surgery.

Coordinated geriatric hip-fracture programs and early discharge (with support) for selected patients have been shown to significantly increase the return-home rates, reduce length of stay in hospital and total costs.

Pain management treatments such as medication, hot or cold applications, TENS and acupuncture are more successful when used in combination with self-help techniques such as relaxation, meditation and hypnosis. Courses to learn these techniques are generally conducted by local hospitals and community centres.

Patients should continue rehabilitation at home or as an outpatient at the hospital.

Home-based rehabilitation after any fracture typically includes various combinations of muscle strength conditioning, ambulation, transfer and balance training supervised by a physiotherapist or exercise physiologist.

Walking aids, such as frames, may be recommended and supplied by a physiotherapist. Patients should be encouraged to maintain these exercises and advised to avoid extremes of movement following total hip replacements.

A personalised exercise program is an important aspect of rehabilitation after fracture. This image shows exercises used in a specialised rehabilitation program under professional supervision.
• Practical equipment should be arranged by the occupational therapist prior to discharge, following a home visit and assessment. These include raised toilet seats and shower chairs, ramps and handrails. Positioning the telephone and other items that are used regularly within easy reach should also be recommended.

A FRACTURE PREVENTION GUIDE

*GP*s can promote healthy lifestyles and self-management to optimise health outcomes for their patients. Prevention of first and subsequent fractures is the goal of treatment for patients with osteoporosis.

**TREATMENT RECOMMENDATIONS:**

**General**

• Discuss the risk of osteoporosis and related problems with all patients aged over the age of 50, especially those at high risk.

• Conduct BMD testing of postmenopausal women who exhibit one or more risk factors for osteoporosis, and men who may be at risk.

• Confirm the diagnosis of osteoporosis in patients who present with a fragility fracture.

• Review medications to avoid drugs that cause bone loss and to minimise the risk of sedation or balance impairment.

• Counsel patients who may have become non-adherant with their osteoporosis therapy and identify why, with a view to recommencing or changing medication.

• Check for postural hypotension.

• Always treat patients on long-term corticosteroid therapy (greater than 3 months) prophylactically with a bisphosphonate where possible.

• Discuss the importance of stopping smoking and consuming excess alcohol with patients. Discuss options for achieving these goals.

• Advise elderly patients to have their eyesight checked regularly.

• Check for conditions that may cause secondary osteoporosis.

**Nutrition**

• Emphasise the importance of maintaining adequate calcium (1300mg/day for all post-menopausal women and men aged over 70 years) and vitamin D (at least 400-800IU daily [10-20 micrograms]) intake.

• Make appropriate recommendations regarding vitamin D and ways to safely enhance levels.

• Review patient nutrition and recommend supplements as appropriate.
Physical activity

- Encourage participation in regular moderate to high intensity muscle strengthening, weight-bearing aerobic, and balance-enhancing exercise.
- Include balance training in the physical activity program.
- Consider ways to prevent falls (see Falls Prevention Strategies, page 29).

5. ACKNOWLEDGEMENTS

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References and bibliography are available on the OA website www.osteoporosis.org.au
6. RESOURCES

HEALTH PROFESSIONAL GUIDES

CONSUMER GUIDES

5 FACT SHEETS IN 5 LANGUAGES (PLUS ENGLISH): CHINESE, VIETNAMESE, ARABIC, GREEK AND ITALIAN
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