Clinical Practice Guidelines on Management of Osteoporosis 2006

Malaysian Osteoporosis Society

Academy of Medicine
# Clinical Practice Guidelines on Management of Osteoporosis

## Committee Working Group

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## Expert Panel

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<tr>
<td>A. Professor Basri Johan Abdullah</td>
<td>Consultant Radiologist</td>
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<td>College of Radiology</td>
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<tr>
<td>Dr Emily Goh</td>
<td>Consultant Rheumatologist</td>
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<tr>
<td>Dr Hew Fen Lee</td>
<td>Consultant Endocrinologist</td>
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<td>Dr Lee Tong Weng</td>
<td>Family Physician</td>
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<td>A. Professor Malik Mumtaz</td>
<td>Consultant Endocrinologist /</td>
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<td>Consultant Nuclear Medicine Physician</td>
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<td>Dr P. Srinivas</td>
<td>Consultant Geriatrician</td>
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<td>Dr Yeap Swan Sim</td>
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<td>Family Physician</td>
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<td>Dr Faridah Bte Ismail</td>
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<td>Dr Mohd Daud Che Yusof</td>
<td>Family Medicine Specialist</td>
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<td>Dr K. Parameshwaran</td>
<td>Consultant Orthopaedic Surgeon</td>
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<td>Dr Winnie Chee</td>
<td>Dietitian</td>
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<tr>
<td>Dr Zainudin bin Mohd Ali</td>
<td>Medical Officer of Health</td>
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Levels of evidence and grades of recommendation

Level of evidence

<table>
<thead>
<tr>
<th>Levels</th>
<th>Type of evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ia</td>
<td>Evidence obtained from meta-analysis of randomised controlled trials (RCTs)</td>
</tr>
<tr>
<td>Ib</td>
<td>Evidence obtained from at least one RCT</td>
</tr>
<tr>
<td>IIa</td>
<td>Evidence obtained from at least one well designed controlled study without randomisation</td>
</tr>
<tr>
<td>IIb</td>
<td>Evidence obtained from at least one other type of well-designed quasi-experimental study</td>
</tr>
<tr>
<td>III</td>
<td>Evidence obtained from well-designed non-experimental descriptive studies e.g. comparative studies, correlation studies, case-control studies</td>
</tr>
<tr>
<td>IV</td>
<td>Evidence obtained from expert committee reports or opinions and/or clinical</td>
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Grades of recommendation

<table>
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<tr>
<th>Grade</th>
<th>Recommendation</th>
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<tr>
<td>A (evidence levels Ia and Ib)</td>
<td>Requires at least one randomized controlled trial as part of the body of literature of overall good quality and consistency addressing the specific recommendation.</td>
</tr>
<tr>
<td>B (evidence levels IIa, IIb and III)</td>
<td>Requires availability of well conducted clinical studies but no randomized clinical trials on the topic of recommendation.</td>
</tr>
<tr>
<td>C (evidence level IV)</td>
<td>Required evidence obtained from expert committee reports or opinions and/or clinical experiences of respected authorities. Indicates absence of directly applicable clinical studies of good quality.</td>
</tr>
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</table>
These guidelines are not intended to serve as a standard of medical care. Standards of medical care are determined on the basis of all clinical data available for an individual case and are subject to change as scientific knowledge advances and patterns of care evolve.

The contents of this publication are guidelines to clinical practice, based on the best available evidence at the time of development. Adherence to these guidelines may not ensure a successful outcome in every case, nor should they be construed as including all proper methods of care or excluding other acceptable methods of care. Each physician is ultimately responsible for the management of his/her unique patient in the light of clinical data presented by the patient and the diagnostic and treatment options available.
Osteoporosis is an important threat to the health of a significant number of our population confirming what many epidemiological studies predicted. The awareness of osteoporosis and more importantly its related fracture risk among the medical and general public has certainly increased and I am glad to say that the Malaysian Osteoporosis Society played a spearheading role in this.

Knowledge does not stagnate and therefore practice needs to keep pace. It has therefore become necessary to update the Clinical Practice Guidelines (CPG) on Management of Osteoporosis. There has been a greater usage of the DXA scanner to measure bone mineral density and thus proper interpretation becomes an important issue. This allows the early detection of the problem but it remains important to put the place of DXA scanning in perspective. We want to treat fracture risk and not mere numbers so the overall assessment of risk is essential. There are new anti-resorptive agents available and there is the exciting prospect of reliably increasing bone by stimulating bone formation. There is now a paradigm shift towards improving bone quality rather than just increasing BMD indices. With the prospect of better measurement of bone turnover markers becoming available, their place in monitoring needs to be addressed.

Once again a multi-disciplinary panel of experts have come together to plough through a burgeoning literature on osteoporosis and related topics to produce this update of the CPG. It is important to accept that we cannot be comprehensive in all aspects. Subtle aspects of related topics such as menopause are addressed elsewhere. I must congratulate the panel for their tireless effort in the realisation of the update CPG. The role of Professor SP Chan as co-chairman must be highlighted and I appreciate her help in the many meetings that someone for the provinces cannot always attend. The role of the Secretariat cannot be understated and they have to help pull together the many busy clinicians so that the product can come out in good time.

I hope the CPG will be of use to all practicing medical practitioners.

Prof Amir S Khir
Chairperson of the CPG Working Group
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<td>9. Osteoporosis in Men</td>
<td>40-48</td>
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1. BACKGROUND

1.1 Guidelines Development
In 2001, the Malaysian Osteoporosis Society, in collaboration with Ministry of Health and Academy of Medicine produced practice guidelines for the management of osteoporosis. These guidelines were developed by a multi-disciplinary workgroup involving local experts. Since the launch of these guidelines, the field of osteoporosis has progressed rapidly, and there has been a need to review and update information based on the available current evidence.

The current guidelines were developed by a multi-disciplinary workgroup under the auspices of the Malaysian Osteoporosis Society, Ministry of Health Malaysia and Academy of Medicine Malaysia. The workgroup conducted a systematic review of current medical literature, obtained inputs from local experts in the area of osteoporosis and prepared the guidelines. These guidelines were reviewed at a consensus workshop meeting, finalised and published.

1.2 Objectives
The guidelines are not to be viewed as a protocol, but provide a framework to:
• assist doctors in the diagnosis and management of osteoporosis without restricting the physician’s individual judgement.
• provide a review of the therapeutic agents available for the treatment of osteoporosis, with the aim of reducing fracture rates.
• aid primary care physicians in deciding when to refer patients with difficult problems to the relevant specialists.
• highlight some areas where further research may be pursued.

1.3 Target Group
These guidelines would be useful for all health care professionals particularly clinicians who have a role in managing patients with osteoporosis, such as primary care doctors, family physicians, gynaecologists, orthopaedic surgeons, rheumatologists, endocrinologists, and general physicians, as well as paraclinical personnel such as nurse practitioners, nurse specialists and dietitians.
Osteoporosis is defined as a skeletal disorder characterized by compromised bone strength predisposing a person to an increased risk of fracture. Bone strength is determined by bone density and bone quality. Bone density (g/cm² or g/cm³) is determined by peak bone mass and amount of bone loss. Bone quality refers to architecture, turnover, damage accumulation, and mineralization.

The WHO working group defines osteoporosis in women on the basis of the criteria shown in Table 1. Bone mineral density (BMD) peaks during the third decade of life and declines with advancing age. In women, this decline accelerates with menopause (Figure 1). Values of –2.5 SD below the mean for the young adult (T score) would identify 95% of women at highest risk of fracture.

Table 1: The World Health Organisation (WHO) working group classification of osteoporosis

<table>
<thead>
<tr>
<th>Category</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>Bone mineral density (BMD) within 1 SD of young adult reference range (T score ≥ –1)</td>
</tr>
<tr>
<td>Osteopenia</td>
<td>BMD more than 1 SD but less than 2.5 SD below the young adult mean (T score between –1 and –2.5)</td>
</tr>
<tr>
<td>Osteoporosis</td>
<td>BMD value of 2.5 SD or more below the young adult mean (T score ≤ –2.5)</td>
</tr>
<tr>
<td>Severe/ Established Osteoporosis</td>
<td>BMD value of 2.5 SD or more below the young adult mean with the presence of 1 or more fragility fractures</td>
</tr>
</tbody>
</table>

* T score: comparison with young adult mean
Osteoporosis related fractures have been recognised as a major health problem, particularly in the elderly. The common sites of fracture are the spine, wrist and hip. Hip fractures are associated with high morbidity and a mortality rate of up to 20% in the first year. Majority of those who survive are disabled and only 25% will resume normal activities.

(Grade B, Level III)

In 1997, the incidence of hip fracture in Malaysia among individuals above 50 years of age was 90 per 100,000. There was a marked increase in the incidence among the older age group. The incidence of hip fracture is consistently higher in women (Table 2).
Table 2: Incidence of Hip Fracture in Malaysia by Age Group 1997

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Male</th>
<th>Female</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td>50-54</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>55-59</td>
<td>20</td>
<td>30</td>
<td>20</td>
</tr>
<tr>
<td>60-64</td>
<td>40</td>
<td>50</td>
<td>40</td>
</tr>
<tr>
<td>65-69</td>
<td>60</td>
<td>100</td>
<td>80</td>
</tr>
<tr>
<td>70-74</td>
<td>100</td>
<td>230</td>
<td>170</td>
</tr>
<tr>
<td>≥75</td>
<td>320</td>
<td>640</td>
<td>510</td>
</tr>
</tbody>
</table>

In our community, the Chinese had the highest incidence of hip fractures compared to the Malays and Indians. Chinese women accounted for 44.8% of hip fractures.

The direct hospitalisation cost for hip fractures in 1997 is estimated at RM 22 million. This is a gross underestimate of the total economic burden, as it does not take into account the costs incurred in rehabilitation and long term nursing care. Therefore, in an ageing population this cost will escalate without appropriate intervention.

(Grade B, Level III)
3. CLASSIFICATION AND RISK FACTORS

3.1 Primary Osteoporosis
2. Age-related osteoporosis. This occurs in both men and women.
3. Idiopathic (rare).

3.2 Secondary Osteoporosis

Table 3: Secondary Osteoporosis

1. Endocrine
   • Cushing’s syndrome
   • Hypogonadism
   • Thyrotoxicosis
   • Hyperparathyroidism

2. Drugs
   • Glucocorticoids
   • Heparin
   • Anticonvulsants (phenytoin)
   • Immunosuppressants

3. Chronic Diseases
   • Renal impairment
   • Liver cirrhosis
   • Malabsorption/ post-gastrectomy
   • Chronic inflammatory polyarthropathies (e.g. rheumatoid arthritis)

4. Others
   • Nutritional
   • Multiple myeloma and malignancy
   • Osteogenesis imperfecta
### 3.3 Risk factors for Osteoporosis:
Osteoporosis is a silent disease without any symptoms in most patients until fractures have occurred. While population screening is not cost effective, identification of risk factors will help in case finding\(^8\).

*(Grade C, Level IV)*

The major factors associated with an increased risk of osteoporotic fracture in postmenopausal women are shown in Table 4.\(^9\)

**Table 4: Risk Factors\(^9\)**

<table>
<thead>
<tr>
<th>Non-modifiable</th>
<th>Modifiable</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Advancing age</td>
<td>1. Low calcium intake</td>
</tr>
<tr>
<td>2. Ethnic group (Oriental &amp; Caucasian)</td>
<td>2. Sedentary lifestyle</td>
</tr>
<tr>
<td>3. Female gender</td>
<td>3. Cigarette smoking</td>
</tr>
<tr>
<td>4. Premature menopause (&lt; 45 years) including surgical menopause</td>
<td>4. Excessive alcohol intake</td>
</tr>
<tr>
<td>5. Slender build</td>
<td>5. Excessive caffeine intake</td>
</tr>
<tr>
<td>7. Personal history of fracture as an adult</td>
<td>7. Estrogen deficiency</td>
</tr>
<tr>
<td></td>
<td>8. Impaired vision</td>
</tr>
<tr>
<td></td>
<td>9. Recurrent falls</td>
</tr>
</tbody>
</table>
4. DIAGNOSIS

4.1 Clinical Presentation
Most patients are asymptomatic and diagnosis is made only after a fracture. Common clinical presentations include:
1. Increasing dorsal kyphosis (Dowager’s hump)
2. Low trauma fracture
3. Loss of height
4. Back pain

4.2 Diagnosis
The diagnosis of primary osteoporosis is made after excluding secondary causes of bone loss. A clinical evaluation, which includes a careful history, physical examination and appropriate laboratory investigations, is mandatory.

Although multiple risk factor assessment does not predict bone mass with sufficient precision\textsuperscript{10}, (Grade B, Level IIa) it remains the mainstay in decision making to identify the ‘at-risk’ patient requiring further investigation. \textit{(Grade C, Level IV)}

When a patient presents with a low trauma fracture, osteoporosis is a presumptive diagnosis. BMD measurement with dual energy x-ray absorptiometry (DXA) is advised. However, in the absence of this facility, treatment should still be initiated. In the absence of fracture, the gold standard for diagnosis of osteoporosis remains measurement of BMD using DXA. \textit{(Grade C, Level IV)}

If a BMD measurement is not available, women over 65 years of age with multiple risk factors who are at sufficiently high risk for osteoporosis, can be started on treatment\textsuperscript{11}. \textit{(Grade C, Level IV)}
4.3 Investigations
The main aims of investigation are:
1. to confirm the diagnosis of osteoporosis
2. to assess fracture risk
3. to exclude secondary causes

Initial investigations include:
1. full blood count and ESR
2. serum calcium, phosphate, albumin
3. alkaline phosphatase
4. renal function
5. plain X-rays* - lateral thoraco-lumbar spine or hip (as indicated)

*Osteoporosis is apparent in plain X-rays only after more than 30% of bone loss has occurred. Other investigations may be done as indicated (FT4, TSH, testosterone, FSH, LH, urine Bence Jones protein, serum protein electrophoresis).

4.4 Specific Investigations
4.4.1 Densitometry
BMD measurement gives an accurate reflection of bone mass (Table 1). It is important to use race-specific reference ranges when available. BMD results are reported as T-scores (comparison with the young adult mean) and Z-scores (comparison with the mean of individuals of the same age) (Figure 2). The risk of fracture is increased 2 fold for each SD reduction in BMD\textsuperscript{12}.

*(Grade A, Level Ia)*

Currently available methods in Malaysia for measuring BMD include:
\begin{itemize}
  \item a) Dual energy X-ray absorptiometry (DXA)
  \item b) Quantitative computed tomography (QCT)
  \item c) Single energy X-ray absorptiometry (SXА)
\end{itemize}
a) DXA
The gold standard for diagnosis is DXA, which is measured at the hip and lumbar spine. The procedural standard for performing DXA should be followed to ensure quality and consistency. Prediction of fracture risk is site-specific. When site-specific measurements are not available, other skeletal sites can be used to provide an adequate estimation of fracture risk.

Peripheral DXA (phalanges/ distal radius/ calcaneum) is useful for site-specific fracture risk prediction. Calcaneus and forearm BMD measurement can be used to predict fracture risk. However, their predictive capacity for hip fracture appears to be less than that of DXA of the spine and hip.

The decision to measure BMD should be based on an individual's risk profile and is indicated if the results will influence management. (See Table 5)

(Grade C, Level IV)
Table 5: Indications for BMD Measurement*

1. All women aged 65 and above and men aged 70 and above\(^{13}\)

2. Presence of strong risk factors
   - Oestrogen deficiency
     - Premature menopause (< 45 years of age) including surgical menopause
     - Prolonged secondary amenorrhoea
     - Hypogonadism
   - Glucocorticoid therapy (equivalent to $\geq 5.0 \text{ mg prednisolone daily for } \geq 3 \text{ months}$)\(^{14}\)
   - Maternal family history of hip fracture
   - Low body mass index (<19 kg/m\(^2\))

   Other conditions associated with osteoporosis
   - Anorexia nervosa
   - Malabsorption
   - Hyperparathyroidism
   - Hyperthyroidism
   - Prolonged immobilisation
   - Cushing’s syndrome

3. Radiological osteopenia and/or vertebral deformity

4. Previous low trauma fractures of hip, spine and/or wrist

5. Loss of height, thoracic kyphosis

6. Low weight for age (OSTA**) for postmenopausal women (Appendix 1)

* BMD should only be measured in postmenopausal women who are willing to consider available interventions.

** OSTA = Osteoporosis Self-assessment Tool for Asians
b) QCT
Quantitative computed tomography (QCT) is an alternative technique for measuring bone density in the axial skeleton\textsuperscript{15}. It is able to measure vertebral volumetric bone density. The main limitations are the lack of availability in Malaysia and a higher radiation dose compared to DXA\textsuperscript{16,17}.

c) SXA
SXA is a technique for measuring bone mineral density of the peripheral skeleton (distal radius and calcaneum). Its predictive capacity for vertebral and hip fracture is less than that of DXA\textsuperscript{18}.

4.4.2 Quantitative Ultrasound (QUS)
Presently, the role of QUS in the diagnosis and monitoring of treatment is not clearly defined and awaits further evaluation. Problems with this modality include the diversity of techniques, the lack of standardisation and comparable local normal ranges.

\textit{(Grade C, Level IV)}

QUS can be used for future osteoporotic fracture prediction in the elderly, perimenopausal and immediate postmenopausal women\textsuperscript{19,20,21}. These QUS parameters are stronger predictors of low bone mass than currently recognised clinical risk factors\textsuperscript{19}. Those who are found to have low QUS measurements should be referred for axial BMD measurement.

\textit{(Grade C, Level IV)}

4.4.3 Biochemical Markers
Biochemical markers of bone formation and resorption should not be used in the diagnosis of osteoporosis. Resorption markers can be used in addition to a BMD assessment to identify high risk patients for future fractures\textsuperscript{22,23,24}.

\textit{(Grade B, Level Ila)}

Biochemical markers are useful in the monitoring of response to treatment\textsuperscript{24}.

\textit{(Grade B, Level Ila)}
### Table 6: Currently available biochemical markers

<table>
<thead>
<tr>
<th>Resorption</th>
<th>Formation</th>
</tr>
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<tbody>
<tr>
<td>Urinary deoxypyridinoline (DPD)</td>
<td>Bone specific alkaline phosphatase</td>
</tr>
<tr>
<td>Urinary N-telopeptide (NTx)</td>
<td>Osteocalcin</td>
</tr>
<tr>
<td>Serum C-telopeptide (CTx)</td>
<td>N-terminal propeptide of type 1 procollagen (P1NP)</td>
</tr>
</tbody>
</table>

#### 4.5 Monitoring of Therapy

The aim of monitoring is to assess the response to treatment.

1. Patients should have regular clinical assessments
2. DXA (spine/hip) should be performed at 1-2 year intervals, preferably with the same machine
3. Currently, monitoring of treatment using QUS and peripheral DXA is not recommended
4. If biochemical markers are available, two separate baseline measurements need to be carried out followed by one repeat measurement 2-3 months after initiating therapy and yearly thereafter, if indicated. These measurements should be taken at the same time of the day to minimise the effect of diurnal variation.

*Grade C, Level IV*

#### 4.6 Screening

Population-based screening is not recommended given the constraints of current methods of measurement and lack of cost effectiveness.

*Grade C, Level IV*

Recently, a simple tool, based on age and weight, Osteoporosis Self-Assessment Tool for Asians (OSTA), was developed for postmenopausal Asian women. Women in the high risk category should be recommended for DXA (See Appendix 1).
5. PREVENTION OF OSTEOPOROSIS AND FALLS

5.1 Nutrition
A balanced diet is important to provide adequate nutrients that are required for skeletal health\(^\text{25}\).

\textit{(Grade B, Level IIa)}

5.1.1 Calcium
Calcium intake is positively correlated to bone mass at all ages. A sustained high calcium intake in children and adolescents is associated with higher peak bone mass. Increased calcium intake potentiates the effect of other treatment modalities such as vitamin D and hormone replacement therapy (HRT)\(^\text{26}\).

\textit{(Grade A, Level Ia)}

The current calcium intake in the Malaysian diet is between 300-500 mg daily\(^\text{27}\). The recommended total daily calcium intake is shown in Table 7\(^\text{28,29}\). Attempts should be made to achieve these levels for maximum benefit for bone health.

\textit{(Grade C, Level IV)}
<table>
<thead>
<tr>
<th>Age</th>
<th>Recommended Intake</th>
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<tbody>
<tr>
<td>Infants&lt;sup&gt;a&lt;/sup&gt;</td>
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<tr>
<td>0 - 6 months</td>
<td>300 mg (breast-fed)</td>
</tr>
<tr>
<td></td>
<td>400 mg (non-breast-fed)</td>
</tr>
<tr>
<td>6 - 12 months</td>
<td>400 mg</td>
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<tr>
<td>Children</td>
<td></td>
</tr>
<tr>
<td>1 - 3</td>
<td>500 mg</td>
</tr>
<tr>
<td>4 - 6</td>
<td>600 mg</td>
</tr>
<tr>
<td>7 - 9</td>
<td>700 mg</td>
</tr>
<tr>
<td>Adolescents (boys &amp; girls)&lt;sup&gt;b&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>10 - 18</td>
<td>1000mg</td>
</tr>
<tr>
<td>Men</td>
<td></td>
</tr>
<tr>
<td>19 - 49</td>
<td>800 mg</td>
</tr>
<tr>
<td>&gt; 50 years</td>
<td>1000 mg</td>
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<tr>
<td>Women</td>
<td></td>
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<tr>
<td>19 - 49</td>
<td>800 mg</td>
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<tr>
<td>&gt; 50 years</td>
<td>1000 mg</td>
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<td>Pregnant&lt;sup&gt;c&lt;/sup&gt;</td>
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<td>Lactating</td>
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<td>1000 mg</td>
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</tbody>
</table>


<sup>a</sup> The absorption of calcium from human breast milk is higher than from baby formula, therefore the calcium requirement for non breast-fed babies is higher.

<sup>b</sup> The calcium recommendation of Malaysian adolescents is 1000 mg/day based on a moderate animal protein intake of 20-40 g/day<sup>29</sup>.

<sup>c</sup> During pregnancy and lactation, calcium absorption is increased and fetal bone mineralization can be obtained with no detectable mobilization of maternal bone for this purpose<sup>30</sup>. However, in Malaysia where habitual calcium intake is low, a high calcium intake may possibly benefit the fetus. The recommendation for calcium during pregnancy and lactation is 1000 mg/day.

The calcium content of some common foods is given in Appendix 2.
When the diet is calcium deficient, calcium may be given in the form of supplements. The absorption of calcium supplements is highly variable ranging from 20-40% depending on the formulation as shown in Table 8. It is postulated that calcium supplements should be ingested in small divided doses and taken after meals (except calcium carbonate which should be taken with meals).

(Grade B, Level IIa)

Table 8: Studies investigating calcium absorption from different sources

<table>
<thead>
<tr>
<th>Type</th>
<th>Elemental Calcium (%)</th>
<th>Average calcium absorption (%) (range)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium carbonate</td>
<td>40</td>
<td>26 (13.8-64)</td>
</tr>
<tr>
<td>Calcium citrate</td>
<td>21</td>
<td>22 (12.3-31.4)</td>
</tr>
<tr>
<td>Calcium lactate</td>
<td>13</td>
<td>32</td>
</tr>
<tr>
<td>Calcium gluconate</td>
<td>9</td>
<td>34 (21.8-67.5)</td>
</tr>
<tr>
<td>Milk (non calcium enriched)</td>
<td>33</td>
<td>33 (21.4-37.7)</td>
</tr>
</tbody>
</table>

5.1.2 Vitamin D
Individuals exposed to sufficient sunlight (> 15 minutes a day) should have adequate vitamin D levels. Elderly who are institutionalised, immobile, lack outdoor activities and have a poor diet will benefit from 800 IU vitamin D supplementation daily.

(Grade A, Level Ia)

5.1.3 Body Weight
Low body weight and excessive dieting is associated with low bone mineral status and increased fracture risk (Grade B, Level IIa). Maintenance of a body mass index of not less than 19 kg/m² is recommended for prevention of osteoporosis.

(Grade C, Level IV)

5.1.4 Nutritional Status
Maintenance of an adequate protein and energy intake is important especially in children and the elderly.

(Grade B, Level III)
5.2 Exercise
Regular physical activity, in particular weight-bearing exercise (eg: brisk walking, line-dancing) is encouraged in all age groups in order to maximise peak bone mass, decrease age-related bone loss, maintain muscle strength and balance\(^{39}\) (Grade C, Level IV). The individual’s health status should be taken into consideration when recommending an exercise programme.

5.3 Prevention of falls
Most osteoporosis-related fractures, especially in the elderly, are a consequence of decreased BMD and falls.

Table 9: Factors increasing risk of falls

<table>
<thead>
<tr>
<th>Poor balance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduced muscle strength</td>
</tr>
<tr>
<td>Poor vision</td>
</tr>
<tr>
<td>Diseases of nervous &amp; musculoskeletal systems</td>
</tr>
<tr>
<td>Excessive alcohol consumption</td>
</tr>
<tr>
<td>Certain medications (e.g. sedatives, anti-hypertensives)</td>
</tr>
<tr>
<td>Hazards in the home (e.g. steps, inadequate lighting, slippery floors)</td>
</tr>
</tbody>
</table>

5.3.1 Evaluation of Falls
Family physicians caring for older patients should integrate fall assessment into the history and physical examination\(^{40}\).

(Grade C, Level IV)

Older persons who present for medical attention because of a fall, report recurrent falls in the past year, or demonstrate abnormalities of gait and/or balance should have a fall evaluation performed\(^{40}\).

(Grade C, Level IV)
A fall evaluation is defined as an assessment that includes the following: history of fall circumstances, medications, acute or chronic medical problems, and mobility levels; an examination of vision, gait and balance, and lower extremity joint function; an examination of basic neurological function, including mental status, muscle strength, lower extremity peripheral nerves, proprioception, reflexes, tests of cortical, extrapyramidal, and cerebellar function; assessment of basic cardiovascular status including heart, rhythm, and postural blood pressure\(^40\).

### 5.3.2 Recommendations for Prevention of Falls

<table>
<thead>
<tr>
<th>RECOMMENDATIONS(^41,42)</th>
<th>STRENGTH AND LEVEL OF EVIDENCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patients should receive a multifactorial risk assessment and intervention because it is the most consistently effective strategy to prevent falls.</td>
<td>Grade A, Level Ia</td>
</tr>
<tr>
<td>Home hazard assessment and modification is recommended for patients with a history of falls</td>
<td>Grade A, Level Ia</td>
</tr>
<tr>
<td>Exercise and physical therapy are recommended to prevent falls and injuries from falls</td>
<td>Grade A, Level Ia</td>
</tr>
<tr>
<td>Evaluation of medications and withdrawal of medications that increase the risk of falling is recommended</td>
<td>Grade B, Level IIa</td>
</tr>
</tbody>
</table>

In long-term care and assisted living settings, multifactorial interventions should include: staff education programs (Grade B); gait training and advice on the appropriate use of assistive devices (Grade B); and review and modification of medications, especially psychotropic medications (Grade B)\(^40\).

### 4.3.3 Strategies for the Prevention of Falls in Older People

See Appendix 3.
5.4 Hip Protectors
Ninety percent (90%) of hip fractures result from falls. Hip protectors reduce the impact on the hip during falls. The use of hip protectors in nursing home residents reduce the risk of hip fractures by up to 39%. 

(Grade A, Level Ib)

5.5 Pharmacological agents
HRT, selective oestrogen receptor modulators (SERMs) and bisphosphonates have been shown to be effective in prevention of osteoporosis. For further details, please refer to Chapter 6.
6. MANAGEMENT

6.1 Hormone Replacement Therapy (HRT)
- Combination HRT (Oestrogen + progestin in women with intact uterus)
- ERT (Oestrogen only in women without uterus)

Oestrogen therapy is beneficial in the prevention and treatment of postmenopausal osteoporosis. It increases lumbar spine BMD up to 7.6% and femoral neck BMD up to 4.5% over 3 years. It reduces the risk of spine, hip and other osteoporotic fractures by 33-40%.\(^47,48\)

However, if HRT is prescribed solely for prevention of osteoporosis, other treatments should be considered first and the severity of risk should be significant.

\((\text{Grade A, Level Ib})\)

Effective bone protective doses of oestrogen are as shown in Table 10.

**Table 10. Effective Bone Protective Doses of Oestrogen** \(^{49,50}\)

<table>
<thead>
<tr>
<th>Type of oestrogen</th>
<th>Dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conjugated Equine Oestrogen (CEE)</td>
<td>0.3, 0.625 mg</td>
</tr>
<tr>
<td>Oestradiol Valerate</td>
<td>1.0, 2.0 mg</td>
</tr>
<tr>
<td>Transdermal oestradiol</td>
<td>25 -100 ug</td>
</tr>
<tr>
<td>Micronised oestradiol</td>
<td>0.5, 1.0 mg</td>
</tr>
<tr>
<td>Tibolone*</td>
<td>2.5 mg</td>
</tr>
</tbody>
</table>

*STEAR (Selective Tissue Estrogenic Activity Regulator)
Women initiating therapy for menopausal symptom relief will receive simultaneous protection against early bone loss. The beneficial effects in fracture reduction are seen throughout the duration of HRT use.

While ERT alone has not shown to increase the risk of breast cancer and coronary heart disease, combination HRT (cHRT) has been found to increase the risk of breast cancer and coronary heart disease. Both cHRT / ERT show a similar increase towards the risk of stroke.

Oestrogen therapy has also been shown to be beneficial in the treatment of urogenital symptoms associated with the menopause51 and in reduction of colorectal cancer 52,53. However the long term use of cHRT / ERT has to be assessed on an individual basis.

(Grade A, Level Ia)

A full gynaecological assessment is mandatory prior to starting HRT/ERT and at regular intervals thereafter. A breast examination should be conducted at least annually and mammography at 1-3 yearly intervals. Women should be advised to perform monthly self-breast examination.

Absolute contraindications for oestrogen use are undiagnosed vaginal bleeding, severe liver disease and a history of venous thromboembolism.

However, HRT is not currently recommended as first-line treatment for the prevention and treatment of osteoporosis, as there are other alternatives available.

Based on current evidence:
1. In women considering HRT solely to prevent osteoporosis, alternatives should be considered.
2. When used for vasomotor symptoms at the early menopausal age group and for premature menopause, HRT will decrease bone loss and prevent osteoporosis.
3. HRT/ERT is not advised in women with coronary heart disease or stroke.
4. HRT is recommended in women with premature menopause with no excess risk of breast cancer if used until the normal age menopause ie, the age of 50 years.
6.2 Selective Estrogen Receptor Modulators (SERMs)

Selective estrogen receptor modulators (SERMs, e.g. raloxifene at 60 mg daily) improve and preserve bone density at both the spine (2.6%) and hip (2.1%) after 4 years\textsuperscript{54} with a simultaneous reduction by 76% in the risk of invasive breast cancer\textsuperscript{55,56}.

Raloxifene has been shown to be beneficial in reducing vertebral fracture risk in both osteopenic and osteoporotic post menopausal women\textsuperscript{57}. Raloxifene can be used as therapy for the prevention and treatment of osteoporosis especially for women with an increased risk of breast cancer\textsuperscript{56}.

Raloxifene and oestrogen are associated with a similar increased risk of venous thromboembolism (VTE). However, no cases of VTE were reported amongst healthy post menopausal Asian women whilst on raloxifene\textsuperscript{58}.

Other side effects include hot flushes, which are more likely in the peri-menopausal period, and leg cramps.

\textit{(Grade A, Level Ib)}
6.3 Bisphosphonates

Bisphosphonates are potent inhibitors of bone resorption.

6.3.1 Alendronate

Alendronate at 10 mg daily for 3 years increases lumbar spine BMD by up to 8.8% and femoral neck BMD by 5.9% compared to placebo\(^59\). The rate of new vertebral and hip fractures is reduced by 50% in women with\(^60\) or without\(^61\) prior fractures. Wrist fractures are reduced by 50% in patients with prior vertebral fractures\(^62\). Fracture reduction is seen after 1 year of treatment\(^63\).

Alendronate 70 mg weekly has similar efficacy to alendronate 10 mg daily in the treatment of postmenopausal osteoporosis\(^64\).

Alendronate at 5 mg daily has been shown to prevent postmenopausal bone loss with similar efficacy to HRT\(^65\). It is a useful alternative for women unable or unwilling to take HRT. However, in established osteoporosis, the recommended daily dose of alendronate is 10 mg.

Continuous use of alendronate, for up to 10 years, if clinically indicated, produces a sustained increase in BMD with a good safety profile\(^66\).

*(Grade A, Level Ia)*

6.3.2 Etidronate

Cyclical etidronate 400 mg daily for 2 weeks out of every 3 months over 3 years increases lumbar spine BMD between 5-8\(^%\)\(^67\),\(^68\) with a smaller increase at the femoral neck. Vertebral fractures are reduced especially in patients at high risk. *(Grade A, Level Ib)* An observational study has shown a small reduction in hip fracture\(^69\). *(Grade B, Level III)*

Currently, the use of cyclical etidronate for up to 7 years, has been shown to be effective and safe\(^70\). *(Grade A, Level Ib)*

Continuous daily use of etidronate will result in demineralisation. *(Grade C, Level IV)*
6.3.3 **Risedronate**

Treatment with risedronate 5 mg daily for 3 years increases lumbar spine BMD by 6.4%\(^\text{71}\) and femoral neck BMD up to 3.4%\(^\text{72}\) compared to placebo. This is associated with up to a 49% reduction in new vertebral fractures in women with prior vertebral fractures\(^\text{71,73}\) and a 39% reduction in non-vertebral fractures\(^\text{72}\). Vertebral fracture risk reduction is seen after 6 months of therapy.\(^\text{74}\) Reduction of hip fracture risk after 3 years of therapy was 40% in women with confirmed osteoporosis and by 60% in women with at least one co-existing vertebral fracture\(^\text{72}\). Currently, the use of risedronate for up to 5 years, is safe and efficacious\(^\text{75}\). Risedronate 35 mg once weekly has similar efficacy to the 5 mg daily dosing\(^\text{76}\).

*(Grade A, Level la)*

The common side effects of the oral bisphosphonates are gastro-intestinal, most commonly nausea, although the actual incidence is low. Proper administration of bisphosphonates will reduce the small risk of oesophagitis or oesophageal ulceration. For patients with upper gastrointestinal disease, risedronate may be better tolerated\(^\text{77}\).

6.4 **Calcitonin**

A daily intranasal dose of 200 IU of calcitonin, will increase lumbar spine BMD by 1% - 1.5% over 5 years and reduce vertebral fracture rates by 36%\(^\text{78}\). Calcitonin has also been shown to have an analgesic effect for acute pain relief in osteoporosis related fractures\(^\text{79}\).

*(Grade A, Level Ib)*

Side effects of calcitonin include nausea, flushing, vomiting and nasal irritation.

6.5 **Calcium**

In established osteoporosis, calcium supplementation alone is not adequate. However, calcium supplementation potentiates other treatment modalities.
6.6 Vitamin D
Vitamin D supplementation at 800 IU/day in combination with calcium has been shown to reduce fracture in elderly populations with vitamin D deficiency\textsuperscript{35,80}.

\textit{(Grade A, Level Ib)}

In most of the recent osteoporosis trials, active therapies have demonstrated significantly increased bone density and greater fracture reduction, despite calcium and vitamin D in the placebo arm. Therefore, calcium with vitamin D alone is generally considered inadequate for the treatment of osteoporosis, and should usually be prescribed together with other active osteoporosis therapies.

6.7 Activated Vitamin D
Activated Vitamin D (calcitriol 0.25\textmu g bd, alfacalcidol 1\textmu g od) has been demonstrated to increase BMD in those with established osteoporosis\textsuperscript{81} and reduce vertebral fractures\textsuperscript{82,83}. The reduction in fracture risk is in the spine and in those with mild to moderate osteoporosis\textsuperscript{84}.

\textit{(Grade A, Level Ib)}

All patients on activated Vitamin D should avoid taking more than 800mg of calcium supplements to reduce the risk of hypercalcemia and renal stone disease. Serum and urinary calcium should be monitored periodically, 6 weeks after initiation of therapy and at 3 to 6 monthly intervals thereafter\textsuperscript{11}.

\textit{(Grade C, Level IV)}

Patients on activated Vitamin D should ensure adequate but not excessive calcium intake due to improved calcium absorption in the body.
6.8 Recombinant human PTH 1-34 (rPTH)
Recombinant human PTH 1-34 (rPTH), teriparatide is a potent anabolic agent. rPTH is indicated for individuals with severe osteoporosis.

Subcutaneously administered rPTH at 20 microgram daily for 21 months increases lumbar spine BMD by up to 8.6% and femoral neck BMD by 3.5% compared to placebo. The rate of new vertebral and non-vertebral fractures is reduced by 65% and 53% respectively\(^{86}\).

(Grade A, Level Ib)

The drug is contraindicated in patients with open epiphyses (children and adolescents), Paget’s disease of the bone, prior radiation therapy involving the skeleton, bone malignancies, metabolic bone diseases other than osteoporosis or preexisting hypercalcaemia.

(Grade C, Level IV)
**Clinical assessment**

- General measures:
  - Calcium intake (B)
  - Physical activity (B)

- In the elderly:
  - Vitamin D + calcium (A)
  - Prevention of falls (B)

- Patients with prior incidental low trauma fracture
- Patients with risk factors but no fracture

**BMD measurement**

- T score: \( \geq -1 \)
  - NORMAL
    - Monitor
    - Reassess with BMD after 2 years (A)
  - If multiple risk factors present (C)
    - Reassess with BMD after 2 years (A)

- T score: \(< -1 \) to \( > -2.5 \)
  - OSTEOPENIA
    - If multiple risk factors present (C)
    - Reassess with BMD after 2 years (A)

- T score: \( \leq -2.5 \)
  - OSTEOPOROSIS
    - Treatment options:
      - SERMs / Bisphosphonates (A)
      - Activated Vitamin D (A)
      - Calcitonin (A)
      - rPTH (A)

- Follow-up with BMD if available

**Treatment options:**

- SERMs / Bisphosphonates (A)
- Activated Vitamin D (A)
- Calcitonin (A)
- rPTH (A)
The treatment options found in the algorithm for the management of postmenopausal osteoporosis reflects the order of preference according to current medical evidence. The level of evidence is not a yardstick for comparing relative efficacy. There are few comparative studies between therapeutic agents but the therapeutic aim is for clinical fracture reduction rather than an increase in BMD. Therefore, agents with clinical fracture reduction are ranked higher in the hierarchy of therapeutic choice than agents with only BMD data.
The goals of treatment are early mobilisation and a return to normal activities. Conservative management of hip fractures is discouraged because it places the patient at risk of respiratory problems, thromboembolic disease, pressure ulcers and further bone loss. These patients are best treated by early surgical intervention.\textsuperscript{86}

Vertebral compression fractures are associated with increased morbidity and mortality.\textsuperscript{87} The majority of osteoporotic vertebral fractures are stable. Operative intervention is indicated for those fractures complicated by spinal cord or nerve root compression. Surgery may be required for those with chronic backache and progressive spinal deformities.

\textit{(Grade C, Level IV)}

Symptomatic relief of spinal pain is often difficult to achieve. Morphine and other potent analgesics may be required. Calcitonin is a useful adjunctive analgesic agent.\textsuperscript{79} \textit{(Grade A, Level Ib)} Significant relief may be achieved through physiotherapy, activity modification and bracing (e.g. lumbar corset). \textit{(Grade A, Level Ib)}

Vertebroplasty, a percutaneous injection of cement augmentation of the vertebra has produced quick and significant relief of backache in selected cases.\textsuperscript{88,89} \textit{(Grade B, Level III)}

Adequate calcium\textsuperscript{90}, vitamin D\textsuperscript{6} \textit{(Grade A, Level I)} and protein intake aids fracture healing\textsuperscript{38}. \textit{(Grade B, Level III)} All patients with osteoporotic fractures are at high risk for the development of further fractures. They should receive active management for osteoporosis and advised regarding prevention of falls. \textit{(Grade A, Level Ia)}
8. SECONDARY OSTEOPOROSIS

8.1 Glucocorticoid-Induced Osteoporosis (GIOP)
Osteoporosis is a major complication of glucocorticoid therapy. Patients on glucocorticoid therapy are at increased risk of sustaining fractures over and above that of the underlying disorder. *(Grade A, Level Ia)*

Bone loss occurs most rapidly in the first 6-12 months of oral glucocorticoid therapy. *(Grade B, Level III)* Fractures may occur in patients with GIOP at a higher BMD compared to post-menopausal osteoporosis. *(Grade A, Level Ia)* Prednisolone ≥ 5 mg daily or its equivalent, for more than 3 months is associated with osteoporosis. *(Grade B, Level III)* However, higher doses of glucocorticoid for a shorter duration may also carry the same risk. *(Grade C, Level IV)*

Standard doses of inhaled or topical glucocorticoid use have not been shown to adversely affect BMD. Inhaled high potency glucocorticoid over an extended period of 7 years have been associated with significant bone loss. *(Grade B, Level IIa)*

8.2 Diagnosis
The use of BMD measurement for the diagnosis of GIOP is not crucial, but may be useful in the monitoring of therapy. DXA measurement at the hip provides the best assessment of fracture risk as degenerative changes at the spine may cause falsely high BMD result. *(Grade B, Level IIa)* Diagnostic thresholds in GIOP have not been established for peripheral densitometry using either DXA or ultrasound, which therefore should not be used for assessment or monitoring.

8.3 Management
8.3.1 General measures include: *(Grade C, Level 4)*
- Prescribing the lowest effective dose of glucocorticoid for disease control.
- The use of alternative route of administration (e.g. inhaled steroids in asthma).
- Consider the use of steroid-sparing agents.
- Modification of lifestyle- adequate calcium intake, adequate mobilisation, regular exercise and prevention of falls.
8.3.2 Specific measures:
In hypogonadal states, replacement therapy with sex steroids should be considered. *(Grade A, Level Ib)* All patients on glucocorticoid should be supplemented with calcium and vitamin D. *(Grade A, Level Ia)*

Drugs found to be effective in management of GIOP are shown in Table 11.

**Table 11: Grades of Recommendation for Preventive and Therapeutic Interventions in Corticosteroid-induced Osteoporosis**

<table>
<thead>
<tr>
<th>Drug</th>
<th>Primary Prevention</th>
<th>Secondary Prevention / Treatment</th>
<th>Vertebral fracture reduction</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alendronate</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>99,100</td>
</tr>
<tr>
<td>Alfacalcidol</td>
<td>A</td>
<td>A</td>
<td>ND</td>
<td>101,102</td>
</tr>
<tr>
<td>Calcitonin</td>
<td>ND</td>
<td>A</td>
<td>ND</td>
<td>103</td>
</tr>
<tr>
<td>Calcitriol</td>
<td>A</td>
<td>ND</td>
<td>ND</td>
<td>104</td>
</tr>
<tr>
<td>Calcium &amp; Vitamin D</td>
<td>ND</td>
<td>A</td>
<td>ND</td>
<td>105</td>
</tr>
<tr>
<td>Etidronate</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>106,107</td>
</tr>
<tr>
<td>HRT (in females)</td>
<td>ND</td>
<td>A</td>
<td>ND</td>
<td>108</td>
</tr>
<tr>
<td>Pamidronate</td>
<td>A</td>
<td>A</td>
<td>ND</td>
<td>109,110</td>
</tr>
<tr>
<td>Parathyroid Hormone</td>
<td>ND</td>
<td>A</td>
<td>ND</td>
<td>111</td>
</tr>
<tr>
<td>Risedronate</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>112,113</td>
</tr>
<tr>
<td>Testosterone (in males)</td>
<td>ND</td>
<td>A</td>
<td>ND</td>
<td>114</td>
</tr>
</tbody>
</table>

Primary Prevention : Given within 3 months of initiation of glucocorticoid therapy
Secondary Prevention : Treatment following an osteoporotic fracture or use of glucocorticoid for longer than 1 year include
ND : No benefit demonstrated / no data
In a study comparing alendronate, vitamin D and calcitriol, alendronate increased lumbar spine BMD by 5.9% over 2 years, compared to 0.5% and 0.7% loss on vitamin D and calcitriol respectively. There was no difference at the femoral neck\textsuperscript{115}. Alendronate and risedronate reduces vertebral fractures in patients on glucocorticoid therapy\textsuperscript{100,113}. In patients on glucocorticoids with osteoporotic fractures or confirmed osteoporosis on DXA, bisphosphonates are the first-line treatment.

\textit{(Grade A, Level Ib)}

Treatment should be continued as long as the patients are on glucocorticoids\textsuperscript{14}. Upon discontinuation of glucocorticoids, treatment should be continued as in non-glucocorticoid osteoporosis for those with established or high risk of osteoporosis.

\textit{(Grade C, Level IV)}
Osteoporotic Fracture

Treatment options:
• Bisphosphonates (A)
• Activated Vitamin D (A)

Consider risk factors*
AND/OR measure lumbar spine and hip BMD (C)

Risk factors present OR T score < -1.5 (C)
Risk factors absent OR T score > -1.5 (C)

Remeasure BMD at 1 year

If bone loss is >4% at spine or >7% at hip after 1 year consider starting or changing therapy (C)

* Risk factors: (A)
• premature menopause (<45 years) including surgical menopause
• family history of low trauma fractures
• history of prolonged amenorrhoea
• slender build (BMI < 19 kg/m²)
• Immobility

General measures:
• Calcium and vitamin D intake (Grade A)
• Physical activity (Grade C)
• Minimize glucocorticoid dose (Grade C)
• HRT, if appropriate, in postmenopausal women (Grade A)
• Testosterone replacement in hypogonadal men (Grade A)
8.4 Renal Osteodystrophy
Renal osteodystrophy is a common complication of renal disease particularly those on dialysis. The severity increases with duration of dialysis. The mainstay of treatment is to address the metabolic abnormalities associated with renal impairment, namely correction of acidosis, hyperphosphataemia and hypocalcaemia.

(Grade C, Level IV)

8.5 Amenorrhoea
Extreme physical activity, anorexia nervosa and hypogonadal disorders in young women may be associated with a low BMD. Bone loss in amenorrhoeic women show the same pattern as in postmenopausal women.\textsuperscript{116} Treatment is with hormone replacement.

(Grade B, Level III)

8.6 Drugs
Drugs that can cause alteration in bone metabolism include anti-convulsants, cyclosporin, tacrolimus, exchange resins and long-term heparin. All patients should be encouraged to remain physically active and consume 800 IU vitamin D and 1500 mg calcium daily. If BMD is markedly low, anti-resorptive agents should be considered.

(Grade C, Level IV)
9. OSTEOPOROSIS IN MEN

Osteoporosis is increasingly recognised in older men, accounting for up to 30% of hip fractures and 20% of vertebral fractures\(^{117}\). *(Grade C, Level IV)* Fifty to sixty percent of the cases are due to secondary causes such as hypogonadism, hyperparathyroidism, intestinal disorders, malignancies, glucocorticoid therapy and immobilisation. For every 1 SD reduction in age-matched mean BMD (Z score), fracture risk increases by 2 fold\(^{118}\).

*(Grade B, Level III)*

9.1 Treatment

The management consists of identifying and treating underlying causes. Androgen treatment is beneficial in hypogonadal men\(^{119}\). It may be of some benefit in eugonadal osteoporotic men\(^{120,121}\).

Bisphosphonates\(^{122}\) and teriparatide (human parathyroid hormone)\(^{123}\) have been shown to be effective in the treatment of osteoporosis in men. All other treatment modalities have not been adequately assessed.

*(Grade A, Level Ib)*
ALGORITHM FOR THE MANAGEMENT OF
MALE OSTEOPOROSIS

Low trauma fracture

General measures:
- Calcium intake
- Physical activity

BMD of lumbar spine and femoral neck
Exclude secondary causes:
- check serum testosterone
- bone profile
- full blood count
- protein electrophoresis
- TSH
- ESR

Suspect Osteoporosis

General measures:
- Calcium intake
- Physical activity

BMD of lumbar spine and femoral neck
Exclude secondary causes:
- check serum testosterone
- bone profile
- full blood count
- protein electrophoresis
- TSH
- ESR

Normal
Z > 0

Monitor BMD
1 - 2 years

Osteopenia
Borderline
Z 0 to -1
or T < -2.5

Monitor

Osteoporosis
Low
Z < -1
or T < -2.5

• Treat underlying secondary cause
  • Bisphosphonates
  • rPTH
KEY STATEMENTS AND RECOMMENDATIONS:

Osteoporosis is defined as a skeletal disorder characterized by compromised bone strength predisposing a person to an increased risk of fracture. Bone strength is determined by bone density and bone quality. Bone density (g/cm² or g/cm³) is determined by peak bone mass and amount of bone loss. Bone quality refers to architecture, turnover, damage accumulation, and mineralization. 

(Grade C, Level IV)

Classification is based on bone mineral density (BMD) – osteoporosis defined by BMD of less than –2.5 SD and osteopenia when T score is between –1 and –2.5. Observational studies suggest that a similar cut-off point to that used in women can be taken for diagnosis in men.

(Grade C, Level IV)

Clinical significance of osteoporosis lies in the resulting fracture. The exact magnitude in Malaysia is not known but hip fracture incidence in 1996/97 in the over 50 years of age is 90/100,000 and is likely to increase with our ageing population. (JK Lee, personal communication)

The risk of fractures increases progressively with decreasing BMD. Risk of fractures increases approximately two fold for each SD decrease in BMD (meta-analysis of cohort studies).

(Grade A, Level Ia)

In those with low trauma fracture, a BMD measurement, though advisable is not necessary before starting therapy.

(Grade C, Level IV)

The aim of diagnosis is to confirm osteoporosis, assess fracture risk and exclude secondary causes.

(Grade C, Level IV)
BMD measurement is recommended especially when assessment would influence management (Table 5) and may save more resources than undirected use of treatment in all patients.

(Grade C, Level IV)

In the absence of fracture, the gold standard for measuring BMD is the DXA. DXA still remains the recommended method in monitoring the effect of therapy. Other methods for measuring BMD such as QCT and QUS are not recommended for diagnosing osteoporosis but QUS may help in case-finding.

(Grade C, Level IV)

Biochemical indices of skeletal turnover have the potential for aiding risk assessment and monitoring but utility in diagnosis is not established.

(Grade C, Level III)

Strategies for prevention include population-based strategies – nutrition including calcium and vitamin D intake, exercise and reducing the level of smoking, etc. Strategies should be targeted at those at risk.

(Grade C, Level IV)
Recommendations concerning **prevention** is summarised in the following table:

<table>
<thead>
<tr>
<th>Intervention</th>
<th>BMD</th>
<th>Vertebral Fracture</th>
<th>Hip Fracture</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exercise</td>
<td>A</td>
<td>B</td>
<td>B</td>
</tr>
<tr>
<td>Calcium and vit D supplements</td>
<td>A</td>
<td>B</td>
<td>B</td>
</tr>
<tr>
<td>Dietary calcium intake</td>
<td>A</td>
<td>B</td>
<td>B</td>
</tr>
<tr>
<td>Smoking cessation</td>
<td>B</td>
<td>B</td>
<td>B</td>
</tr>
<tr>
<td>Reduced alcohol consumption</td>
<td>C</td>
<td>C</td>
<td>B</td>
</tr>
<tr>
<td>Oestrogen</td>
<td>A</td>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td>Raloxifene</td>
<td>A</td>
<td>A</td>
<td>-</td>
</tr>
<tr>
<td>Alendronate</td>
<td>A</td>
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</tr>
<tr>
<td>Etidronate</td>
<td>A</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Recommendations concerning interventions in the **treatment** of osteoporosis are shown in the following table:

<table>
<thead>
<tr>
<th>Intervention</th>
<th>BMD</th>
<th>Vertebral Fracture</th>
<th>Hip Fracture</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alendronate</td>
<td>A</td>
<td>A</td>
<td>A</td>
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<tr>
<td>Risedronate</td>
<td>A</td>
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<td>A</td>
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<tr>
<td>Etidronate</td>
<td>A</td>
<td>A</td>
<td>B</td>
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<tr>
<td>Oestrogen</td>
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<tr>
<td>Raloxifene</td>
<td>A</td>
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<tr>
<td>Calcitomin</td>
<td>A</td>
<td>A</td>
<td>-</td>
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<tr>
<td>Calcitriol/ Alfacalcidol</td>
<td>A</td>
<td>A</td>
<td>C</td>
</tr>
<tr>
<td>Calcium (±vit D)</td>
<td>A</td>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>Anabolic steroids</td>
<td>A</td>
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<td>B</td>
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<tr>
<td>r-PTH</td>
<td>A</td>
<td>A</td>
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</tbody>
</table>
The choice of drug for established osteoporosis especially those with previous fracture must be an agent shown not only to increase BMD but also shown to reduce fracture both at the spine and hip.  

(Grade A, Level Ia)

Hip fractures should be surgically managed early. Spinal fractures rarely need operative intervention.  

(Grade C, Level IV)

Glucocorticoid-induced osteoporosis (GIOP) occurs rapidly in the initial period and when glucocorticoids are taken for more than 3 months. Fractures can occur at a higher BMD.  

(Grade C, Level IV)

Osteoporosis in older men is underdiagnosed. Secondary causes must be excluded. Bisphosphonates have been shown to be effective, and androgen is useful in hypogonadal men.  

(Grade A, Level Ib)
Appendix 1

Osteoporosis Self-Assessment Tool for Asians

<table>
<thead>
<tr>
<th>Weight (kg)</th>
<th>40-44</th>
<th>45-49</th>
<th>50-54</th>
<th>55-59</th>
<th>60-64</th>
<th>65-69</th>
<th>70-74</th>
<th>75-79</th>
<th>80-84</th>
<th>85-89</th>
<th>90-94</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>40-44</td>
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<td>55-59</td>
<td>60-64</td>
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</tr>
</tbody>
</table>

- If your patient is in the yellow or red region of the chart above, her risk of osteoporosis is increased.

Note: Patients who have already had a non-violent fracture after menopause have approximately twice the risk of future fractures regardless of their age, weight, or BMD, and should be considered for treatment\textsuperscript{125}. The risk of future fractures is further increased if the patient also has low BMD\textsuperscript{125}.

- Other factors may increase risk regardless of her current age and weight.

* Important risk factors for accelerated bone loss include corticosteroid use (losses increase with dose and duration), hypogonadism (including menopause), and immobilization (bedridden, casted fractures, wheelchair-bound, etc.)\textsuperscript{126}.

# BMD = Bone Mineral Density
## Appendix 2

### Calcium Content of Some Common Foods

<table>
<thead>
<tr>
<th>Food</th>
<th>Calcium content (mg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 glass of high calcium milk (200 ml)</td>
<td>500</td>
</tr>
<tr>
<td>1 glass of skimmed milk (200 ml)</td>
<td>250</td>
</tr>
<tr>
<td>1 glass of full cream milk (200 ml)</td>
<td>220</td>
</tr>
<tr>
<td>1 cup of yoghurt (150 g)</td>
<td>200</td>
</tr>
<tr>
<td>1 piece tofu (150 g)</td>
<td>200</td>
</tr>
<tr>
<td>1/2 cup of yellow dhal (100 g)</td>
<td>170</td>
</tr>
<tr>
<td>1 cup of spinach (56 g)</td>
<td>160</td>
</tr>
<tr>
<td>1 cup of ice-cream (156 g)</td>
<td>150</td>
</tr>
<tr>
<td>1 cup watercress (sai-yong choy) (50 g)</td>
<td>100</td>
</tr>
<tr>
<td>1 piece of cheddar cheese (20 g)</td>
<td>100</td>
</tr>
<tr>
<td>1 cup of mussels (160 g)</td>
<td>100</td>
</tr>
<tr>
<td>1/2 cup of ikan bilis (dried without head &amp; entrails) (20 g)</td>
<td>100</td>
</tr>
<tr>
<td>1 piece of canned sardine (40g)</td>
<td>100</td>
</tr>
<tr>
<td>1 cup of baked bean (240 g)</td>
<td>100</td>
</tr>
<tr>
<td>1 cup of mustard green (sawi), cekur manis, kai lan or pucuk ubi kayu (50 - 80 g)</td>
<td>100</td>
</tr>
<tr>
<td>1 piece of tempeh (70 g)</td>
<td>50</td>
</tr>
<tr>
<td>1 cup of soyabean milk (200 ml)</td>
<td>40</td>
</tr>
<tr>
<td>1 cup of broccoli (95 g)</td>
<td>40</td>
</tr>
<tr>
<td>10 almonds (15 g)</td>
<td>30</td>
</tr>
</tbody>
</table>

* 1 cup = 200 ml
## Appendix 3

### Evidence for the prevention of falls in older people

<table>
<thead>
<tr>
<th>Statement</th>
<th>Falls fracture reduction</th>
<th>Strength of evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individually tailored exercise programmes administered by qualified pros. in selected community-living high risk group</td>
<td>Reduce falls</td>
<td>2</td>
</tr>
<tr>
<td>Exercise programmes in a selected community living group with mild deficits in strength and balance</td>
<td>Reduce falls</td>
<td>3</td>
</tr>
<tr>
<td>Exercise classes, where the exercise is based on Tai Chi forms, with individual tuition with older people</td>
<td>Reduce falls</td>
<td>2</td>
</tr>
<tr>
<td>Programmes based on multiple risk factor assessment and tailored intervention (most of which include some form of exercise)</td>
<td>Reduce falls</td>
<td>1</td>
</tr>
<tr>
<td>Attention to postural hypotension, number of medications, balance, transfers and gait is</td>
<td>Reduce falls</td>
<td>2</td>
</tr>
<tr>
<td>Identification of patients who attend A&amp;E because they have fallen with subsequent medical and OT assessment, with referral and follow-up</td>
<td>Reduce falls</td>
<td>2</td>
</tr>
<tr>
<td>Assessment of residents after falling with recommendations for specific preventive measures</td>
<td>Reduce falls</td>
<td>1</td>
</tr>
<tr>
<td>Hip protectors in nursing home residents</td>
<td>Prevent hip fractures</td>
<td>2</td>
</tr>
</tbody>
</table>

*Adapted from:*
C. Cryer, S. Patel. Falls, Fragility, and Fractures – The case for and strategies to implement joint health improvement and modernization plan for falls and osteoporosis.

**Evidence grading:**
1 – Consistent findings in multiple randomized controlled trials (RCTs) or meta-analysis
2 – Single RCT or weak inconsistent findings in multiple RCTs
3 – Limited scientific evidence, cohort studies, flawed RCTs, panel consensus.
REFERENCE


