



Title	Clinical management guidelines for osteoporosis in Hong Kong
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Clinical management guidelines for osteoporosis in Hong Kong

The Working Group for Formulating Clinical Management Guidelines for Osteoporosis in Hong Kong

The following guidelines provide a basis for the management of osteoporosis for the practising physician in Hong Kong. The guidelines have been compiled by a working group that represents the specialties concerned with osteoporosis and summarise the current management of osteoporosis based on available published evidence and relevant local experience.

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Introduction

Osteoporosis is characterised by low bone mineral density and the microarchitectural deterioration of bony tissue with a consequent increase in fracture risk.

The public health impact of osteoporosis stems from its association with fractures of the hip, spine, and forearm. Between 10% and 20% of hip fracture patients die within 1 year of the event, and of those who survive, almost two thirds remain disabled. The medical cost of

osteoporosis and its attendant fractures have been placed at US\$5.2 billion (HK\$40 billion) each year in the United States and £615 million (HK\$8.0 billion) each year in the United Kingdom. The total cost for the treatment of hip fracture in Hong Kong was HK\$150 million in 1995.

Epidemiology

Hip fracture incidence from the 1960s to the 1980s

In the 1960s, there was a pronounced geographical variation in hip fracture incidence, with rates being much higher in Caucasians living in Northern Europe and North America than they were in the Hong Kong Chinese population (Table 1). At that time, the age-adjusted incidence of hip fracture in the Hong Kong Chinese population was approximately 13% to 30% of that observed in Caucasians. With the recent socio-economic developments, however, the incidence of hip fracture among Hong Kong Chinese people has increased by more than two-fold in the past two decades (Table 2).

Currently, the incidence of hip fracture in mainland China is one of the lowest in the world, being 10 per 10000 in both men and women. However, there is some evidence of an increase from 1988 to 1992. The experience in Hong Kong suggests that with the current socio-economic development in China, the incidence of hip fracture is likely to rise rapidly in the future.

Recent hip fracture incidence: from the 1980s to the 1990s

Recent studies indicate that the age-specific incidence of hip fracture in the Hong Kong population levelled

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Table 1. Age-adjusted rate* of hip fracture per 100 000 population for females and males, by ethnic group and year of study†

Ethnic group	Study site	Study period	No. of females	No. of males	Female:male ratio
Black	California, US	1983-1984	241	153	1.6
Hispanic	California, US	1983-1984	219	97	2.3
Asian	Hong Kong	1985	389	196	2.0
	Hong Kong	1965-1967	179	113	1.6
Caucasian	Tottori, Japan	1986-1987	227	79	2.9
	Singapore	1955-1962	83	111	0.7
	Sweden	1972-1981	730	581	1.3
	Oxford, UK	1983	603	114	5.3
	California, US	1983-1984	617	215	2.9

* Rates were age- and gender-adjusted to the 1990 United States non-Hispanic Caucasian population

† Table reproduced from Villa ML, Melson L. Race, ethnicity and osteoporosis. In: Marcus R, Feldman D, Kelsey J, editors. Osteoporosis. Boston: Academic Press, 1996

Table 2. Age-specific hip fracture rates for three different decades in Hong Kong people (per 100000 population)*

Age group (years)	Men			Women		
	1966	1985	1991	1966	1985	1991
40-49	6	13	9	7	11	6
50-59	16	28	27	22	32	26
60-69	67	54	73	54†	135	112
70-79	224	339	321	173†	501	581
≥80	321†	1156	1191	716†	1521	1916†

* Table reproduced from Lau EM. In: Christiansen C, Riis B, editors. Proceedings of the Fourth International Symposium on Osteoporosis and Consensus Development Conference, Hong Kong; 1993 Mar 27-Apr 2; Hong Kong

† 1966 and 1991 rates that are significantly different from the 1985 rates at the P=0.05 probability level

off from 1985 to 1991 in both men and women. The details are shown in Table 2. Between 1995 and 1996, the incidence of hip fracture was 11 per 1000 and 5 per 1000 in women and men aged ≥70 years, respectively.

Future hip fracture figures

The projected number of hip fractures in Hong Kong in the future can be calculated by applying the current age-specific rates to the future population size of Hong Kong. Assuming no increase in age-specific rates, the total numbers for hip fracture in the year 2015 will be 5293 in women and 2349 in men, respectively.

Prevalence of vertebral fracture

Using a definition of vertebral height ratio reduction by three standard deviations or more, prevalence of vertebral fracture has been found to be 30% in Hong Kong women and 17% in Hong Kong men aged 70 to 79 years. These rates are much higher than those found in Taiwan and mainland China, and are comparable to those obtained by American Caucasians.

Diagnosis

Definition

The bone mass can be estimated from the bone mineral density (BMD), which is measured by the degree of absorption of radiant waves. Using dual energy X-ray

absorptiometry (DEXA), the World Health Organization defines osteoporosis according to the criteria shown in Table 3. The criteria use the T-score, which is the difference of a subject's BMD from the young adult mean, normalised to the population standard deviation, with comparison of the data from same sex and ethnic group.

$$T\text{-score} = \frac{\text{Young adult mean BMD} - \text{BMD of the subject}}{\text{Standard deviation for young adult BMD}}$$

The Z-score is a similar concept to the T-score, but comparison is made to a healthy age- and sex-matched population instead of a young normal group.

$$Z\text{-score} = \frac{\text{Age-matched mean BMD} - \text{BMD of the subject}}{\text{Standard deviation for age-matched BMD}}$$

Radiological techniques

Techniques for measuring BMD include radiographic absorptiometry, single/dual photon absorptiometry (SPA/DPA), single energy X-ray absorptiometry, DEXA, quantitative single or dual energy computed tomography (QCT), and quantitative ultrasonography (QUS). Radiographic absorptiometry evaluates bone mass at the metacarpals and phalanges quantitatively

Table 3. World Health Organization criteria for osteoporosis

Diagnostic category	Bone mineral density (BMD) T-score*
Normal	A value for BMD within 1 SD of the young adult mean (T-score >-1.0).
Osteopenia	A value for BMD more than 1 SD below the young adult mean but less than 2.5 SD below this value (T-score <-1.0 and >-2.5).
Osteoporosis	A value for BMD that is 2.5 SD or more below the young adult mean (T-score <-2.5).
Established osteoporosis	A value for BMD that is 2.5 SD or more below the young adult mean (T-score <-2.5) plus the presence of osteoporotic fracture.

* T-score: standard deviation (SD) of the young adult mean

by obtaining a radiograph of the hand. However, this method is seldom employed due to the lack of information confirming its accuracy and precision. The isotope-based DPA technology has been largely replaced by the X-ray-based DEXA owing to the higher precision, better image resolution, shorter scanning time, and reduced radiation dose of the latter system. A plain radiograph of the spine or other part of the body is not a method of choice for diagnosing osteoporosis because it is inaccurate in assessing bone mineral content. But the appearance of osteopenia on a radiograph reported by a radiologist is a common reason for conducting further assessment.

Dual energy X-ray absorptiometry

The current method of choice is DEXA, because it is fast, precise, and has a relatively low absorptive dose (2.6-34 μ Sv depending on the machine, in comparison with 1 day's natural background radiation of 10 μ Sv). With DEXA, BMD is expressed as g/cm². BMD measurements from DEXA machines of different manufacturers are not directly comparable. BMD is usually measured at the spine and hip. To detect early bone loss, the BMD of the spine should be measured. For the spine, the postero-anterior view is used, but if there are degenerative changes with osteophytes, a lateral view is useful.

Quantitative computed tomography

Quantitative computed tomography is useful because it can selectively measure trabecular bone. It is helpful when investigating degenerative diseases and defor-

mities of the spine, and in follow-up studies to assess the response to a treatment. With faster scanners and more accurate phantoms, the precision of QCT has been much improved. However, the radiation dose (60 μ Sv) is higher than that associated with DEXA.

Quantitative ultrasonography

Quantitative ultrasonography is gaining popularity as a portable, simple, and cheap technique that does not involve ionising radiation. The machine measures the broad-band ultrasound attenuation and speed of the sound as the sound wave passes through the bone. Data shows that QUS indices at the heel correlate strongly with BMD at the heel and other sites. At present, there is no consensus on the use of QUS. The machine is currently being evaluated as a primary test for assessing the bone status of a patient. The precision of this technology is much lower when compared with the DEXA machine and the use of QUS in the monitoring of response to treatment remains under evaluation.

Identifying patients at high risk for the development of osteoporosis

Osteoporosis is usually asymptomatic until a fracture occurs and consequently, it is only diagnosed in most patients after a fracture. There is no convincing evidence of the benefit of population-based screening, so we should aim for increased awareness to identify high-risk patients. Case finding is an appropriate exercise for family physicians to undertake, to diagnose

Box 1. Clinical risk factors for osteoporosis

Constitutional factors:
 Caucasian or Asian women
 Family history (maternal history of fractures)
 Small body frame (BMI <19)
 Premature menopause (before age of 40 years) or early menopause (age, 40-45 years)

Lifestyle and nutritional factors:
 Smoking
 Excessive alcohol intake (more than four standard drinks per day)
 Inactivity
 Prolonged sedentary periods (eg prolonged bed rest)
 Low calcium intake

Box 2. Medical conditions associated with an increased risk of osteoporosis

Women with bilateral oophorectomy before normal menopause (age, 45-55 years)
Female hypogonadism lasting more than 6 months before the age of 40 years
Oestrogen-deficient state in premenopausal women (eg anorexia nervosa, excessive exercise leading to amenorrhoea, hyperprolactinaemia)
Cushing's syndrome
Hyperthyroidism
Hyperparathyroidism
Chronic liver disease
Chronic renal disease
Malabsorptive disorder
Gastrectomy
Rheumatoid arthritis
Medications: prolonged treatment with oral glucocorticosteroid (ie >3 months), anticonvulsants (phenytoin), excessive doses of thyroxine
Male hypogonadism

the condition before a fracture occurs. Case finding can begin by identifying patients with clinical risk factors (Box 1), medical conditions associated with osteoporosis (Box 2), an X-ray report of osteopenia, and the occurrence of low-trauma fracture.

The clinical risk factors alone are relatively weak predictors of osteoporosis, as they apply to a large sector of the population. The presence of any of the medical conditions mentioned in Box 2 should be considered a significant potential risk. Clinicians should assess the appropriate weighting of different risk factors in order to efficiently screen patients for osteoporosis.

Preventing osteoporosis and its related complications

The Figure shows an algorithm for use in the management of osteoporosis.

Calcium

Adequate calcium intake has been shown in numerous studies to increase BMD during skeletal growth and to prevent bone loss and osteoporotic fractures in the elderly. The recommended daily calcium intake for an adult is 1000 mg. For people who cannot tolerate milk, calcium can be taken in the form of a calcium supplement. In general, a 500 mg supplemental calcium tablet is adequate to prevent excess bone loss. For adolescents, a higher calcium intake has been shown to improve the peak bone mass and hence, to reduce the chance of osteoporosis occurring after menopause.

Vitamin D

Adequate amounts of vitamin D are necessary for optimal calcium absorption and bone health. Because there is sufficient sunlight in Hong Kong, it is not necessary to recommend vitamin D for everyone. However, for elderly people who are institutionalised

and lack outdoor activities, daily supplementary vitamin D of 400 to 800 U is recommended.

The value of exercise

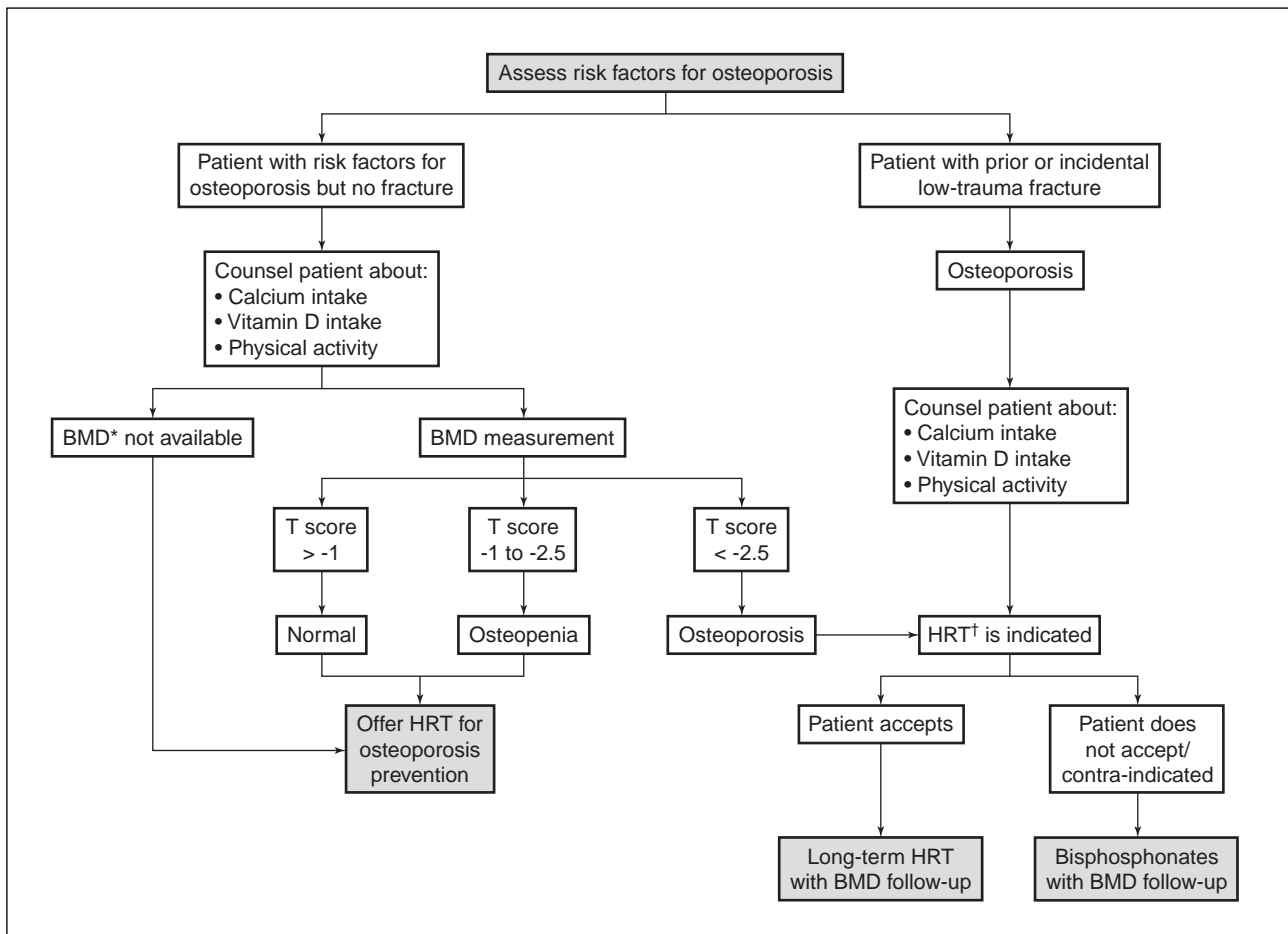
Immobility is associated with an increased risk of osteoporosis and should be avoided in elderly people, if possible. Regular physical activity is recommended for all age groups. Regular exercise is also known to stimulate bone gain and decrease bone loss. The positive effects of exercise are an adjunct to other interventions aimed at preventing osteoporosis. Moderate physical activity in people with osteoporosis can both improve their fitness and overall quality of life.

Fall prevention

The consequence of a fall for an osteoporotic individual would be a fracture. Fall prevention is important for elderly people who have established osteoporosis. Exercise programmes for elderly people help to promote muscle strength and stability.

Any risk factors predisposing the elderly to a fall should be detected and treated early. Visual impairment is an important risk factor for a fall, and cataract is the most common cause of visual impairment in the elderly. Neurological conditions such as Parkinson's disease should be treated promptly to reduce the chances of a fall because of poor mobility. Iatrogenic conditions such as postural hypotension due to the overtreatment of hypertension in the elderly should be avoided. The use of sedative and hypnotic drugs are common causes of a fall, so caution should be taken in prescribing these drugs to the elderly. Housing and public facilities should be designed so that they are safe environments.

Elderly people with risk factors for or a known history of falls should be assessed by physiotherapists and occupational therapists so that proper muscle



* BMD bone mineral density
† HRT hormone replacement therapy

Fig. Algorithm for the management of osteoporosis

training and rehabilitation can occur. Walking aids will be helpful. Hip protectors have been found to be useful overseas, but they have not been shown to be useful in Hong Kong.

Drug treatment for osteoporosis

Hormone replacement therapy

Hormone replacement therapy and osteoporosis prevention

The beneficial effect of oestrogen on bone mass has been clearly demonstrated in prospective, double-blind, controlled studies. Several epidemiological studies have supported a reduction of approximately 50% in the risk of hip fracture or fracture of the distal radius with the long-term use of oestrogen. Fewer data are available to suggest that a reduction in vertebral fracture risk occurs.

The beneficial effects of oestrogen are greatest when treatment begins closest to the time of the meno-pause and with a duration of treatment of at least 5 years. Oestrogen intervention much later in life may

be equally beneficial in preventing osteoporosis, but bone loss begins again when oestrogen therapy is discontinued.

Bone densitometry can identify those women at risk and help with their decision making regarding hormone replacement therapy (HRT).

Hormone replacement therapy and osteoporosis treatment

In addition to the prevention of osteoporosis, oestrogen therapy has been shown in controlled trials to be beneficial even in patients with established osteoporosis. Significant increases in bone mass have been observed over 12 to 18 months of treatment, the effect being greatest in the lumbar spine.

Who should receive hormone replacement therapy?

Hormone replacement therapy should be considered for all postmenopausal women with established osteoporosis or osteopenia, given its proven efficacy in increasing bone density and decreasing fractures, as

well as its additional cardiovascular and quality of life benefits.

Oestrogen offers benefits not supplied by other drugs used in the prevention and treatment of osteoporosis. The administration of oestrogen reduces the risk of coronary artery disease by up to 50%, both by its action on the lipid profile and through a direct effect on blood flow. Oestrogen also protects against stroke and increases peripheral blood flow. Recent evidence suggests that oestrogen protects against Alzheimer's disease and may benefit women already suffering from a mild to moderate degree of this condition. Positive effects have also been demonstrated on memory, mood, quality of life, and genito-urinary tract symptoms.

The dosage of oestrogen prescribed specifically for osteoporosis is critical for its effectiveness. Effective daily doses of Food and Drug Administration-approved preparations include conjugated equine oestrogen 0.625 mg, piperazine oestrone sulphate 0.75 to 1.25 mg, and transdermal oestradiol 50 to 100 µg. Effective daily doses of other preparations include micronised oestradiol 0.5 to 1.0 mg and oestradiol valerate 1 to 2 mg. Oestrogen can be given by any route of administration with similar effects.

For patients with a uterus, progestins are added for at least 10 days per month because cyclic administration of progestins abolishes the risk of endometrial pathologies developing. Continuous combined therapy is aimed at preventing cyclical bleeding and is more appropriate for women with an established menopause who do not wish to have vaginal bleeding. Progestins do not negate the effect of oestrogen in its action on bone and some 19-nortestosterone derivatives may even have an independent beneficial effect.

Contra-indications and precautions regarding the use of hormone replacement therapy

Contra-indications to the prescribing of oestrogen replacement include the following: undiagnosed vaginal bleeding, acute liver disease, chronic impaired liver function, a recent history of thromboembolism or thrombophlebitis, and suspected breast or endometrial carcinoma or a past history of these tumours.

Although able to use oestrogen replacement, caution must be taken in giving it to patients with pre-existing hypertension, benign disease of the breast, uterine fibromyoma, pelvic endometriosis, gall bladder disease, a history of migraine headaches, familial hyperlipidaemia, and chronic thrombophlebitis. The final decision regarding the use of oestrogen therapy,

however, should be an individual one, taking into account the risks/benefits of oestrogen therapy and the concerns of the user.

Complications of hormone replacement therapy

Endometrial hyperplasia and carcinoma

Postmenopausal women receiving unopposed oestrogens have a 3- to 15-fold increased risk of developing endometrial carcinoma. The risk is correlated with both the dose and the duration of oestrogen exposure. The administration of 10 mg medroxyprogesterone acetate or equivalent for 10 days each month has been shown to be protective. Consequently, all postmenopausal women who have not had a hysterectomy should receive HRT as a combination of oestrogen and progestin.

Breast cancer

Although substantial evidence supports the role of oestrogen in the genesis of breast cancer, there is no definite evidence to suggest that the postmenopausal administration of oestrogen increases the risk of breast cancer. Epidemiological studies suggest that oestrogen use does not cause an increased risk of breast cancer in the first 5 years, but this risk may increase when there has been 5 years or more of treatment. The risk is increased in women with a family history of breast cancer. This theoretical slight increase in the risk of breast cancer must be balanced against the benefits of prevention of osteoporosis, cardiovascular disease, and Alzheimer's disease.

Management of hormone replacement therapy

A thorough history should be taken to elicit contraindications to the use of HRT. The physical examination should include a blood pressure reading, breast and pelvic examinations, and a cervical smear. A baseline mammogram should also be performed to exclude subclinical breast cancer. A breast examination should be performed annually and mammography conducted at 2-year intervals.

After the commencement of HRT, a follow-up visit should be arranged for 3 months later to ensure there are no problems. Further visits should be made at 6- to 12-month intervals. Any abnormal uterine bleeding must be appropriately investigated and an endometrial biopsy performed.

Bone antiresorptive agents

Bisphosphonates

Bisphosphonates inhibit bone resorption by binding to mineralised bone surfaces. These compounds may

be considered an alternative to HRT in postmenopausal osteoporotic women who cannot tolerate HRT. Compared with HRT, bisphosphonates are bone specific, of equal or greater efficiency in improving bone density, and have fewer side effects. The bisphosphonates are poorly absorbed and should not be taken with meals or calcium tablets. Currently, etidronate disodium and alendronate sodium are the most commonly used bisphosphonates. Treatment with these drugs should be given for 3 to 5 years. It is uncertain how long the drug should be continued and whether bone loss will resume once the treatment is stopped. There are ongoing trials to evaluate the use of bisphosphonates in treating male osteoporosis and steroid-induced bone loss.

Etidronate

Treatment with etidronate can increase the lumbar spine BMD by 5% to 10% over 2 years and the vertebral fracture risk decreases. The effect of etidronate on hip fracture is not known. To avoid the mineralisation defect, etidronate is given cyclically at a dosage of 400 mg/d for 14 days every 3 months. Calcium supplementation is given during the rest of the 3-month cycle when the patient is not receiving etidronate; side effects of etidronate treatment are uncommon.

Alendronate

Alendronate given at a dosage of 10 mg/d increases the lumbar spine BMD by 8% and the femoral neck BMD by 5% in 3 years. In large randomised controlled trials, alendronate has been found to reduce both vertebral and hip fracture by approximately 50% in postmenopausal osteoporotic women—in those with and without pre-existing vertebral fractures. Alendronate is prescribed at a continuous dosage of 10 mg/d and is not known to cause inhibition of bone mineralisation. The drug must be taken with a full glass of water at least 30 minutes before breakfast. Side effects are those of upper intestinal and oesophageal irritation.

Calcitonin

Calcitonin inhibits bone resorption by inhibiting osteoclast activity. Short-term studies of 1 to 2 years' duration showed significant improvement in BMD in postmenopausal women. However, long-term effects of calcitonin on BMD and fracture prevention are not known. Current evidence does not provide strong support for the use of calcitonin as a first-line treatment of established osteoporosis. Use is also constrained by cost considerations. Calcitonin is given either as an intramuscular or subcutaneous injection (50 to 100 U/d or 100 U three times per week) or as a nasal spray (200 U/d). The available form of calcitonin in Hong Kong is the salmon calcitonin. When given

parenterally, calcitonin may cause nausea, flushing, and gastro-intestinal upset, while nasal calcitonin can result in nasal irritation.

In addition to preventing bone loss, calcitonin also has an analgesic effect and can reduce the acute pain associated with vertebral fractures. Therapy should be adjusted according to response and may be effective for at least 1 month.

Other therapeutic agents

The following drugs have been used for the treatment of osteoporosis and are available in Hong Kong:

- (1) Fluoride salts (enteric-coated sodium fluoride 20-40 mg/d orally)
- (2) Vitamin D derivatives: calcitriol (1,25-dihydroxy-cholecalciferol, 0.25-0.5 mg/d) and alfacalcidol (1 α -hydroxycholecalciferol, 1 mg/d)
- (3) Anabolic steroids (eg stanozolol 5 mg/d orally; nandrolone decanoate 50 mg intramuscularly, every 2-4 weeks)

Each of these agents has been shown in some clinical trials to improve bone mass, but their efficacy in preventing fractures is not established. The use of these agents should be restricted to patients who have failed to respond to conventional therapy and clinicians who are familiar with their toxic effects.

Monitoring treatment progress

Bone density measurements

For follow-up measurements, repeat BMD measurements by DEXA studies at 2-year intervals are advised. Even with the best treatment and response, there will only be 5% to 10% increase in bone density. The BMD measured on different machines cannot be directly compared as there are significant differences in the methods used. Patients should be followed up using calibrated machines from the same manufacturers.

Biochemical markers of bone turnover

Treatment with antiresorptive agents in postmenopausal osteoporosis induces a 30% to 60% decrease in biochemical markers of bone turnover within 3 to 6 months of therapy. These include markers of bone resorption such as urinary pyridinoline and n-telopeptide and markers of bone formation such as serum osteocalcin and bone-specific alkaline phosphatase. The acute response of the biochemical markers to the treatment is predictive of the subsequent response of the bone mass over 2 years. Thus, measurement of biochemical bone markers at baseline and after 3 months of therapy is likely to be

helpful in the management of osteoporotic patients, since treatment effect can be detected before changes in BMD occur. At present, these biochemical tests are not widely available.

Management of osteoporotic fractures

Hip fractures

The standard hemi-arthroplasty for femoral neck fractures and dynamic hip screw system (including gamma nail) for trochanteric fractures should be endorsed. Early intervention, if the patient's general condition allows, is important. Much of the morbidity and mortality is related to the associated complications. Special surgical care must be exercised under the following circumstances: extreme comminution, severe osteoporosis, wide displacement, and concomitant illnesses. Special devices (eg gamma nail) or additional manoeuvres (eg screwing, cementing, osteotomy) might have to be considered.

While early effective surgery should be the rule, overenergetic surgery or a ruthless push for surgery in spite of the patient's poor general condition is a well-known contributing factor towards mortality. The China and Hong Kong experience of conservative traction giving few complications should be borne in mind. If surgery cannot be followed by sitting and standing in 2 to 3 days' time, the decision to operate may not be a wise one. Every patient with a fractured hip should be considered as a 'high-risk' patient and treated conservatively.

Vertebral fractures

Vertebral fractures, either silent or painful, are probably the most common fractures that arise in osteoporotic elderly individuals. Diagnosis is made on clinical grounds and by imaging studies. Fractures can be of various types including squashed, anterior-wedged, or posterior-wedged fractures. Fractures can also occur in clusters. The most troublesome symptom of an osteoporotic vertebral fracture is pain. The pain can be excruciating but controlled by simple analgesics or non-steroidal anti-inflammatory drugs. Morphine and other potent analgesics may be required. Calcitonin is a useful adjunctive analgesic agent. Intercostal blocks should be considered if there is high-level (thoracic) involvement. The use of a soft abdominal corset can also bring relief. A small proportion of vertebral fractures involve the spinal cord or cause root compression and will require surgical decompression.

Distal radial fracture

The management of a distal radial fracture may present

difficulties because of the loose density and shattering. The elderly person's age and low demand prompt for conservative treatment. However, the difficulty of holding the fracture ends together and any subsequent deformities cause real suffering. More frequent assessment and supervision could prevent this problem. Occasionally, a surgically placed bone graft spacer may have to be considered. In cases of severe deformity and pain, corrective measures need to be carried out.

Other treatment

To ensure the comprehensive and efficient rehabilitation of these patients, a multidisciplinary approach in caring for them is crucial. The early involvement of family members, social workers, and other allied health professionals should aid in the establishment of a complete and holistic management scheme for these individuals. All patients with osteoporotic fractures are at high risk for the development of further fractures and should receive active treatment to prevent further bone loss.

The health care cost of osteoporosis in Hong Kong

As in all developed countries, the management of osteoporotic fractures accounts for a significant proportion of the health care cost in our community. With the continuing ageing of the Hong Kong population, the number of osteoporotic fractures and the associated health care cost will most certainly increase. The estimated expenditures in the management of osteoporosis are the following:

- (1) Cost of acute care for hip fracture in 1995 = total number of hip fractures (3783) x estimated acute care cost for one hip fracture patient (HK\$40000) = HK\$151 million
- (2) Estimated cost of acute care for vertebral fracture in 1995 = number in the population with vertebral fracture (94 009) x percentage seeking treatment (1%) x estimated acute care cost for one vertebral

Table 4. Approximate cost of drug treatment in the management of osteoporosis

Drug	Cost per patient per year (HK\$)
Alendronate	4200
Alfacalcidol	1000
Calcitriol	5600
Calcitonin (salmon)	9250
Calcium carbonate	430
Calcium lactate/gluconate	800
Fluoride	1300
Oestrogen-progestin	650

fracture patient (HK\$40 000) = HK\$38 million

- (3) Cost of screening all postmenopausal women in Hong Kong = Cost of one BMD measurement by DEXA (HK\$460) x number of postmenopausal women in Hong Kong (702 000) = HK\$323 million

Table 4 shows the approximate cost of the available drugs for the management of osteoporosis. Current data indicate that mass screening to detect low BMD may not be the most cost-effective approach in the prevention of osteoporosis in Hong Kong.