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GUIDELINE

Diagnosis and treatment of osteoporotic fractures

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1. Overview

Osteoporosis is a systemic, metabolic skeletal disease, characterized by reduced bone quality and decreased bone mass with destruction and deterioration of bone microstructure. This in turn induces a predisposition to bone fragility and overall decrease in bone strength, consequently leading to increased risk of fracture. Often referred to as a silent disease, osteoporosis is categorized into two main categories: primary and secondary osteoporosis.

The term osteoporotic fracture (fragility fracture) used in this guideline indicates fracture induced by further reduction in bone density and bone strength in primary osteoporosis, as a result of a small or non-traumatic force. Osteoporotic fragility fractures are severity endpoints of osteoporosis related complications, bones commonly affected by these fractures include the spine, hip, distal radius and proximal humerus.

Osteoporotic fragility fractures pose extreme treatment difficulties with specific characteristics: (i) due to prolonged bed rest and immobilization, following osteoporotic fracture accelerated bone loss occurs, further aggravating the severity of the underlying disease; (ii) because of the pre-existing low bone mass and poor bone quality, osteoporotic fractures are usually comminuted fractures, posing difficulty in reduction of the fracture, which leads to unsatisfactory results; (iii) when surgically treated, poor bone quality contributes to decreased stability of internal fixation, often resulting in the complications of loosening, a need to extract of internal fixation implants, and failure of bone grafts to fuse due to graft absorption; (iv) deferred fracture healing eventuating in delayed union or nonunion lengthens recovery time, predisposing patient to further complications; (v) there is a significantly increased risk of secondary fracture within the same or other, mostly adjacent, sites; (vi) because osteoporosis is a disease of the elderly, meaning that concomitant systemic diseases aside from degenerating pathophysiological conditions are often present, management of osteoporotic fractures is inherently complex and difficult and inevitably accompanied by an increase in complication rates; and (vii) osteoporotic fragility fractures, with their relatively high disability and fatality rate, endanger patients' mental and physical health, interfere with their quality of life and reduce overall life expectancy in the elderly. Thus osteoporotic fracture treatment and management is clearly different from that of general traumatic fractures, requiring both a complete consideration of orthopaedic fracture treatment and active anti-osteoporosis therapy.

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2. Diagnosis and differential diagnosis

Osteoporotic fractures are particularly prevalent in elderly females, often resulting from low-energy microtrauma (meaning that these injuries are induced by minor falls on ordinary surfaces or simply by the force of gravity), or occur with no apparent trauma history, but merely through the impact of normal daily activities.

Clinical manifestations

1. General manifestations include localized pain, tenderness, swelling, functional impairment and dysfunction of the fractured limb. However, patients with osteoporotic fractures may be asymptomatic, presenting either no pain or only non-specific mild discomfort, possibly with aggravation of some pre-existing tenderness. Limb function may be relatively normal, and any dysfunction can be so slight as to be unapparent to an observer.
2. Specific manifestations particular to fractures include visible deformity and bony crepitus, along with abnormal function and movement. However, such fracture specific presentations may also be lacking in osteoporotic fracture patients.
3. Clinical manifestations of osteoporosis include an obvious decrease in body height, scoliosis, kyphosis, and complications related to spinal deformity, such as neuropathy.

Radiological imaging

X-ray examination provides visualization of the fracture site and type, allowing assessment of the fracture direction and extent of displacement, all of which is valuable information with respect to diagnosis and treatment. Aside from providing radiological evidence of the presence of fracture, X-ray films also offer clues towards osteoporosis diagnosis, including reduced bone density, thinning of trabecular and cortical bone, and expansion of the bone marrow cavity. Radiographic films should also be taken of the joints immediately superior and inferior to the fracture site, or, in the case of hip fractures, the entire pelvis including both hip joints. In order to avoid misdiagnosis, possible spinal fractures should be assessed by thorough, detailed physical examination to determine which segments should be X-rayed. Computed tomography (CT) and magnetic resonance (MR) examinations should be ordered where there are positive indications. CT imaging of the spine accurately depicts and locates the extent of fracture comminution and spinal cord compression. Three-dimensional CT allows for clear anatomical identification of intra-articular or peri-articular fractures. MRI provides valuable assistance in the detection of occult fractures, as well as in identifying both recent and old fractures.

Bone mineral density

There is uniform consensus that the diagnosis of osteoporosis should be established by bone mineral density (BMD) measurements. A clinical diagnosis of osteoporosis is often presumed in at-risk patients with low-energy or low-trauma fractures. Various methods of examination have been developed to measure and analyze BMD, including dual-energy X-ray absorptiometry (DXA), peripheral dual-energy X-ray absorptiometry (pDXA), quantitative computed tomography (QCT), peripheral quantitative computed tomography (pQCT), and quantitative ultrasound (QUS). However DXA is now internationally recognized as the gold standard for confirming the diagnosis of osteoporosis and predicting fracture risks. Areas of BMD are assessed in terms of grams of mineral per square centimeter scanned (g/cm^2). Using the figure thus obtained, which is referred to as the Z-score, the patient's BMD is compared to values of BMD for normal, healthy adults of the patient's race, age and gender, and this is termed the T-score. The difference between the patient's BMD score and the normal to which it is compared is expressed as the number of standard deviations (SD) greater or smaller than the mean. A normal BMD is within one SD of that of a healthy adult of the same gender, age and race (T score ≥ -1.0 SD). A BMD result ranging between 1 and 2.5 SD below that of a healthy adult is considered to confirm osteopenia, which is defined as a low or reduced bone mass (-2.5 SD $<$ T score < -1.0 SD). Results greater than or equal to 2.5 SD (T score ≤ -2.5 SD) are diagnostic of osteoporosis. When the BMD is even less, as is often the case in patients with one or more simultaneous fractures, severe osteoporosis is definite. Common clinical BMD testing sites include L1–L4 and the femoral neck (hip).

Laboratory examinations

1. Routine blood and urine tests may be ordered according to the requirements of individual cases: these may include an array of tests of hepatic and renal function, serum alkaline phosphatase (ALP), blood glucose (BG), serum electrolytes such as calcium and phosphorus and so on. Other endocrine and biochemical parameters such as sex hormones, thyroid and/or parathyroid hormone, calcitonin and 25-hydroxy-vitamin D may be assessed when required.
2. Measurement in serum and urine of biochemical markers of bone remodeling, (both bone resorption and formation), is a useful quantitative means of monitoring the condition of the osteoporotic patient. Bone remodeling is an ongoing cyclic metabolic phenomenon in the life cycle of bone, and includes repair and replacement of old, fatigued, damaged, and even fractured bone. Biochemical markers are useful in initial assessment of patients with respect to predicting fracture risk, as well as in determining and affecting selection of drug therapies. They allow determination of metabolic status, monitoring of drug efficacy, and establishment of differential diagnoses, as well as the prediction of fractures and assessment of any reduction in fracture risk. Biochemical indicators of bone formation include serum ALP, osteocalcin, bone-derived ALP, and type I pre-collagen C-terminal and N-terminal peptides. Bone resorption markers include plasma tartrate-resistant acid phosphatase and type I collagen C-terminal peptide, fasting urine calcium-creatinine ratio, and urine pyridinoline and deoxypyridinoline, type I collagen C-terminal and N-terminal peptides. A low BMD paired with a high bone turnover rate denotes a marked increase in fracture risk.
3. A combination diagnostic approach using radiography, DXA and biochemical marker assessment is superior to using single options of either BMD or biochemical measurements.

Differential diagnosis

Identification of osteoporotic fractures secondary to concomitant conditions is crucial in selecting appropriate therapy. Secondary osteoporosis and osteoporotic frac-

tures may be caused by bone tumors, including metastatic tumors and multiple myeloma, as well as other metabolic diseases such as hyperparathyroidism, calcium-phosphorus imbalance, renal osteodystrophy and other related diseases which affect bone metabolism and mineralization.

Principles of diagnosis

Osteoporotic fracture diagnosis is based on considerations of the patient's age, gender, menopausal state, history of fragility fractures, and individual clinical manifestations, as well as a comprehensive analysis of radiographic imaging and/or BMD results.

3. Treatment

Therapeutic principles of osteoporotic fracture include fracture reduction, surgical or non-surgical immobilization, rehabilitative exercise, and anti-osteoporosis therapy; ideally treatment involves an organic combination of all four principles. Reduction of the fracture must include taking precautions to prevent any further trauma or compromise of the local blood supply, and to implement early mobilization and rehabilitation once solid, stable immobilization of the fracture has been achieved. Such precautionary measures facilitate early healing of the fracture and reduce risks of complications to a minimum, allowing for satisfactory results. Consideration of treatment with anti-osteoporosis agents is important as this can help to prevent worsening of the osteoporosis which preceded the fragility fracture and to prevent fracture related complications.

Design of osteoporosis fracture treatment, whether surgical or non-surgical, is based on the characteristics of individual patients. Specific treatment is determined according to the fracture site and type, degree of osteoporosis, and overall patient condition, judiciously balancing the advantages and disadvantages of surgery or medical treatment.

The majority of osteoporotic fractures occur in elderly patients, and therefore require simple, safe and effective reconstructive fixation techniques to expedite restoration of the patient's quality of life to 'pre-fracture' levels. The primary consideration is to select procedures involving minimal trauma and impact upon joint function, focusing on tissue repair and functional rehabilitation rather than simple anatomical reduction. For patients requiring surgery, orthopedic surgeons should fully understand the difference between osteoporotic and common traumatic fractures; osteoporotic fractures have initial poor bone quality which adversely affects their healing. The following measures may prevent unnecessary complications:

1. Thoughtful selection of special internal fixation instrumentation using locking compression plates, coarse spiral-thread screws, and special coated material.
2. Consideration of internal fixation instrumentation with reduced stress-shields to decrease further bone loss.
3. An emphasis on delicate surgical manipulation during internal fixation, such as using gentle controlled force when implanting the fixation screw through bilateral cortical bone.
4. Use of surgical techniques to strengthen and increase the stability of internal fixation, such as using bone cement around screws, expandable screws and biological materials.
5. With severe bone defects, autologous or allogenic bone graft and biological fillings (e.g. bone cement, calcium sulfate) should be considered.
6. External fixation devices are selected according to fracture severity and location, and the overall general condition of the patient. Integrity of external fixation should guarantee an adequate healing period, and provide solid stability by sufficiently immobilizing the joints adjacent to the fracture.

Osteoporotic fracture rehabilitation and recovery management share the same basic principles as general fracture rehabilitation, but in addition take into account the characteristics specific to fragility fractures, for example poor bone quality, instability of internal fixation and retarded fracture healing. Emphasis should be on active muscle and joint rehabilitation, with immediate active exercising of all joints not affected by surgery in order to minimize the duration of bed rest, and thus minimize complications associated with prolonged bed rest and inactivity.

Apart from prevention of local fracture related complications in osteoporotic patients, measures should be taken to improve the patient's general condition and prevent systemic complications, especially those peri-surgical complications such as deep vein thrombosis, hypostatic pneumonia, urinary tract infections and bed sores which can cumulatively increase the rates of disability and fatality.

4. Common sites, features and surgical treatment of osteoporotic fracture

Spinal fractures

Most osteoporotic fractures occur in the spinal column, 85% of these patients experience various degrees of pain, with the remaining 15% being asymptomatic. The thoracolumbar spine accounts for approximately 90% of

osteoporotic spinal fractures; these typically present as vertebral compression fractures and/or vertebral burst fractures. The latter may be caused by an incident of minor trauma, but mostly there is no obvious trauma history, making these fractures susceptible to being completely missed or misdiagnosed.

Diagnosis involves combining an evaluation of the patients' age and medical history with radiological examination. Post-traumatic back pain, reduction in height, scoliosis or kyphosis, diffusely sparse bone trabeculae, cortical bone thinning, and wedge-shaped or bi-concave deformation of the vertebral body on the X-ray films are all basic diagnostic parameters. DXA measurement is useful for determining the extent of osteoporosis and evaluating bone density to allow for prediction of future fractures. CT scans can define the type of fracture, and extent of vertebral destruction and spinal compression. MRI allows an assessment of spinal cord and nerve root compression, as well as aids in the identification of both new and old fractures.

Non-surgical treatment is recommended in cases with mild pain and vertebral compression (vertebral height loss less than 1/3), while minimal invasive surgery is preferred for cases with obvious vertebral compression (vertebral height loss greater than 1/3), damage to the posterior wall of the vertebral body and significant pain responding poorly to conservative treatment. Percutaneous vertebroplasty and kyphoplasty are recommended for effective analgesia, stabilization of the vertebral column, restoration of the physical curvature of the spine and, most importantly, early mobilization. This surgery should be conducted with intra-operative radiological assistance (such as X-ray, CT, and navigation), and it is recommended that surgeons gain accreditation through formal training programs, with resultant standardization of surgical techniques. Such measures reduce the risk of complications such as bone cement leakage and nerve root or vascular injury. Vertebral burst fractures are often caused by vertical compression or a vertical flexing compression force, and are characterized by bursting of the anterior and interior columns, causing fracture of the posterior aspect of the vertebral body. Within recent years, there has been a positive trend in the surgical treatment of vertebral burst fractures towards active reconstruction and maintenance of the mechanical stability of the vertebral column, and as much restoration and maintenance of neural function as possible.

Because spinal osteoporotic fracture is associated with a marked increase in new fracture risk (spinal or non-spinal), positive identification and diagnosis is a crucial step in active enhancement of osteoporotic treatment and prevention of falls.

Hip fracture

Hip osteoporotic fractures occur mainly in the femoral neck and intertrochanteric region and are characterized by high deformity and disability rates, deferred recovery and increased fatality.

With regard to femoral neck fractures, non-surgical or surgical treatment is chosen according to specific patient characteristics. A non-surgical approach is considered a priority in cases of inconspicuous displacement, or with impact fractures in patients whose poor general health would make them intolerant of surgery. Non-surgical approaches include absolute bed rest with weighted traction (either skeletal or skin traction), brace immobilization and nutritional support. Femoral neck fractures often require surgical treatment using either external or internal fixation, prosthetic femoral head replacement or total hip replacement (total hip arthroplasty, THA).

THA or prosthetic femoral head replacement are chosen according to the patient's age, overall general health, life expectancy and condition of the acetabulum. In elderly patients in poor overall condition and with concomitant diseases, a short life expectancy is assumed with a degenerative or pathogenic acetabulum; therefore femoral head replacement is selected considering its overall decreased surgical time, as complete removal simplifies manipulation and replacement, as well as better control and reduction of intra-operative bleeding. Elderly patients are prone to sedentary lifestyles especially when affected by disabling pain; surgical treatment therefore allows an improvement in overall quality of life. For some patients, THA may also be considered to be a positive treatment choice.

For intertrochanteric fractures complicated by fracture displacement, open reduction and internal fixation are considered, with optional intramedullary or extramedullary nail implantation. The intramedullary nail implantation system includes the Gamma nail, proximal femoral nail, and reconstruction nail. Extramedullary nail systems include the dynamic hip screw, locking compression plate, and hip anatomic plate. The best internal fixation technique to choose depends on specific patient characteristics, as well as on the individual surgeon's experience in regards to these related procedures.

Fracture of the distal radius

Because osteoporotic fractures of the distal radius are often comminuted, these fractures can extend into, and involve, the articular surface. Fracture healing can then be complicated by deformity, resulting in chronic residual pain and crippling dysfunction of the wrist and hand.

Treatment considerations should therefore focus initially on closed manual reduction, with application of

external gypsum-splint fixation. With manual reduction, careful restoration and alignment of a smooth articular surface, normal volar tilting angle and ulnar inclination is crucial. For comminuted fractures of the distal radius involving articular surfaces, unstable distal radius fracture, and unsatisfactory manual reductions, surgical treatment is recommended. Either external fixation, or open reduction and internal fixation implantation, may be selected according to the specific characteristics of the fracture.

Proximal humeral fracture

Non-surgical treatment is the principle option to be considered for nondisplaced fractures of the proximal humerus. Fracture reduction manipulation includes using a simple suspending neck-wrist sling, chest bandage immobilization and shoulder brace fixation. Surgery is considered without hesitation for displaced fractures of the proximal humerus, choosing between closed or open reduction and internal fixation, or prosthetic femoral head replacement.

For the open reduction and internal fixation of osteoporotic fractures, a proximal humerus plate, or locking compression plate is used, as these result in less loosening and disturbance of surrounding soft tissue than other techniques. Another commonly used, minimally invasive procedure involving the use of a Kirschner wire, screw and tensile wires facilitates surgical manipulation, fixes the greater tubercle firmly onto the humeral neck, and also reduces peripheral tissue damage. However it is less efficient for severe comminuted fractures. Prosthetic femoral head replacement is recommended for elderly patients with multiple fractures (more than three fractures) or comminuted fractures of the distal humerus.

5. Anti-osteoporosis treatment

Aside from surgery, active treatment of osteoporosis is advocated in patients with fragility fractures.

Basic preventive measures

The basic principles of general prevention depend upon maintenance of a healthy lifestyle, including a balanced nutritious diet enriched with Vitamin D and calcium, reduced salt consumption and adequate protein intake. For patients with certain addictive tendencies, quitting smoking and reducing consumption of alcohol provides a general foundation for a healthy lifestyle. Various concomitant drug therapies can negatively influence bone metabolism, hence should be monitored closely by a physician. Regular physical exercise and rehabilitation to increase muscular strength and overall coordination are also recommended.

Judicious and sufficient calcium supplements can slow bone loss, and have been reported to result in improvement in bone mineralization. Calcium supplements should always be administered as an adjunct and in combination with other anti-osteoporosis agents in osteoporosis treatment. Vitamin D deficiency progresses into secondary hyperparathyroidism, with increased bone resorption, and consequent worsening of osteoporosis. Managed Vitamin D supplements may promote bone mineralization, through improving gastrointestinal absorption of calcium, reducing overall calcium excretion, enhancing muscle strength and hence improving neuromuscular coordination and balance.

Drug therapy

Because osteoporotic fracture is a complication of osteoporosis; administration of effective anti-osteoporosis drugs lays the foundation for its treatment. Drug therapy slows bone loss, improves bone quality and strength, alleviates pain, treats established osteoporosis without compromising fracture healing, and finally reduces the incidence of secondary fractures.

Currently approved anti-osteoporosis agents include the following (listed in alphabetical order):

Bisphosphonates are anti-resorption drugs which inhibit osteoclast-mediated bone resorption, reducing bone turnover. Strong inhibition of osteoclast absorption results in an increase in bone mass. Evidence-based medical studies indicate an increase in BMD of the lumbar spine and hip, with decreased fracture risks.

Calcitonin causes moderate inhibition of osteoclast biological activity, indirectly reducing the active osteoclast population. Evidence-based medicine confirms that calcitonin can inhibit bone resorption, improve the BMD of the lumbar spine and hip, and provide a rapid, centrally mediated analgesic effect in acute osteoporotic bone pain.

The mechanism of estrogen in osteoporosis treatment includes its effects on the hormone calmodulin and skeletal bone tissue, as well as inhibition of osteoclast activation. It is indicated only in postmenopausal patients.

Parathyroid hormone ($PTH_{1–34}$) provides a new approach, as it promotes bone formation by increasing collagen secretion by osteoblasts and promoting the formation and mineralization of bone matrix, a mode of action rather different to the anti-resorption effects of previously utilized drugs.

Selective estrogen receptor modulators (SERM) have estrogen-like actions in regards to the skeletal and cardiovascular system. However in female specific organs such as the breasts and uterus, SERM act as estrogen inhibitors, blocking necessary hormone function with resulting carcinogenic complications. SERM act on skeletal estrogen

receptors which in turn inhibit osteoclast activity. However, the use of SERM is confined strictly to postmenopausal osteoporosis.

The newest anti-osteoporosis agent that has been introduced clinically is strontium ranelate. Its mode of action is of a new category and it has been uniformly accepted by clinicians. In contrast to the original anti-resorption and bone formation promoting drugs, strontium ranelate is an uncoupling agent which promotes ossification with simultaneous inhibition of bone resorption. It has been reported to restore dynamic bone turnover balance and reduce the risk of vertebral and hip fractures. However current indications are limited to postmenopausal osteoporosis.

Various clinical studies have reported possible efficacy of traditional Chinese herbal remedies, with symptom relief, and reduction in bone loss and incidence of osteoporotic fractures. However further investigations are required to fully understand the mechanism and pharmacological dynamics of herbal treatments.

Recommendations for post fracture anti-osteoporosis medication

1. Moderate calcium supplements are the basis for all anti-osteoporosis therapy. Calcium is absorbed mainly in the intestines, hence oral administration of calcium agents ensures maximum efficacy. The recommended daily calcium dose for an adult ranges from 800 to 1200 mg. Insufficient daily calcium intake should be countered with oral calcium supplements, in accordance with recommended dosage and frequency. Considering the rapid bone loss in cases of osteoporotic fracture, an increase in calcium dosage is suggested. However in order to minimize unwanted side effects, when increasing dosage judicious attention should be paid to the prevention and avoidance of complications of calcium overdose, such as renal lithiasis or cardiovascular diseases induced by calcification and stenosis of vessels.
2. Active supplementation with Vitamin D_3 not only enhances intestinal calcium absorption and promotes bone formation and mineralization, but also strengthens muscle, improves neuromuscular coordination, and reduces the risk of falling. Active vitamin D_3 is recommended for elderly patients with osteoporotic fracture; the recommended adult dosage is 0.25–0.5 μg/day., Serum or urinary calcium should be regularly monitored during active vitamin D_3 treatment, and careful attention paid to individual patient differences and clinical safety.
3. Calcitonin enhances the overall biomechanical properties of bone through an increase in BMD and bone quality. It is effective in reducing the incidence of osteoporotic vertebral fractures. Early calcitonin treatment offers an outstanding analgesic effect for acute osteoporotic vertebral fracture, with simultaneous control and decrease of bone loss. Studies of calcitonin have shown safety and tolerance with no adverse reactions or disturbance of the healing of osteoporotic fractures. Recommended treatment is salmon calcitonin 50 IU/day by subcutaneous or intramuscular injection, or 200 IU/day as a nasal spray. Common transient adverse reactions following initial administration include flushing, nausea and mild dizziness, with spontaneous relief within a few hours. However calcitonin treatment is contraindicated in patients with an obvious history of drug allergy or calcitonin allergy.
4. Mineral bisphosphonates can increase the BMD of the lumbar spine and hips, with consequent reduction of fracture or re-fracture risks. Recommended bisphosphonates include alendronate, risedronate sodium, and zoledronic acid. Today, two therapeutic regimes are in use for alendronate: 70 mg orally/week and 10 mg orally/day. We recommend once daily administration, 30 min before breakfast, followed by at least 250 ml of water. In order to reduce gastrointestinal complications, the patient should remain standing and avoid bed rest for at least 30 min after taking alendronate orally. Drug compliance should be closely monitored, especially in patients who are bed-ridden. The major adverse reactions to bisphosphonates are gastrointestinal, such as nausea, vomiting, abdominal pain and diarrhea.
5. SERM are effective ein improving the BMD and reducing postmenopausal osteoporotic fractures. The dosage generally recommended is raloxifene 60 mg/day; its absorption is not affected by food. Some patients experience recurrent fever and spasms of the lower extremities while taking this medication. For peri-menopausal patients with severe recurrent fever and flushing, the medication should be terminated and reconsidered. SERM treatment is contraindicated in patients with a positive history of venous thrombosis and thrombotic risk factors, such as being bed ridden, sedentary, or having concomitant cardiovascular disease.
6. Strontium ranelate has a double mechanism of action. It can increase bone strength and decrease the risk of vertebral fracture due to its effect on both bone resorption and formation. The recommended dosage is strontium ranelate 2 g/day, 2 h after dinner or at bedtime. Common adverse reactions include headache, nausea, diarrhea, loose stools, dermatitis, and eczema. Strontium ranelate should be used only after

careful consideration and with appropriate precautions when treating patients with a positive history of thrombosis or embolism.
7. Chinese herbs may be effective in pain relief and in reducing swelling with some improvement in the BMD. However further studies are required to update and provide information regarding their true clinical efficacy.
8. Osteoporosis is a chronic systemic metabolic bone disease. Osteoporotic fracture patients should adhere to long-term anti-osteoporosis therapy under the close guidance of responsible physicians to prevent the occurrence of further fractures. Patients with secondary osteoporosis should receive treatment for predisposing diseases and conditions.

6. Prevention of osteoporotic fractures

Risk factors

1. Major risk factors: Falling, low BMD, positive history of osteoporotic fractures, age >65 years, and positive family history of fracture.
2. Secondary risk factors: excessive smoking and alcohol consumption, low body mass index (kg/m^2), hypogonadism, premature menopause (<45 years old), malnutrition, history of concomitant diseases, drug therapy with substances which affect bone metabolism (e.g. glucocorticoids, heparin), rheumatoid arthritis, hyperthyroidism, and hyperparathyroidism.

Prophylactic treatment

1. Quit smoking, limit alcohol consumption, ensure a balanced diet and adequate nutrition.
2. Maintain a stable healthy body weight, refraining from sudden or massive weight fluctuation or loss.
3. Adopt a moderate, individually designed exercise regimen to increase muscle strength and improve sense of balance and coordination.
4. Ensure adequate sun exposure through selected appropriate outdoor activities.
5. Adopt precautionary measures to prevent falls and trauma.
6. Judicious preventive drug therapy.

This guideline serves only as an academic reference for clinical practice. With future developments and improved discoveries in the field of medicine, this information is clearly subject to change. This guideline should be read and applied in accordance with a thorough understanding of individual patient characteristics and specific medical needs. The summarized product information provided is not to be regarded as definitive administration guidelines. It is recommended that clinicians refer to and read product specific literature or product information before prescribing anti-osteoporosis preventive and/ or therapeutic measures.

Disclosure

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