

# Identification and management of osteoporosis in older adults

Richard Eastell

## Abstract

Fractures resulting from osteoporosis are a major public health problem. Physicians should be aware of the major risk factors for osteoporosis and refer appropriately for bone densitometry. Risk factors include previous fracture, a family history of fracture, slender habitus, early menopause, treatment with drugs known to affect bone (glucocorticoids) and diseases known to affect bone (rheumatoid arthritis). The diagnosis of osteoporosis can be made if the bone density *T*-score is  $-2.5$  or below. This information can be used with other risk factors to estimate the 10-year risk of fractures. Patients at the highest risk of fracture benefit from many licenced treatments. These can be given orally (alendronic acid, risedronate sodium, ibandronic acid, strontium ranelate, calcitriol, raloxifene, hormone replacement therapy), subcutaneously (parathyroid hormone, denosumab) or intravenously (ibandronic acid, zoledronic acid) and usually result in an increase in bone mineral density and a reduction in fracture risk.

**Keywords** Bone mineral density; kyphoplasty; osteoporosis; treatment; vertebroplasty

## Introduction

Osteoporosis is a systemic skeletal disease characterized by low bone mass and microarchitectural deterioration, with a consequent increase in bone fragility and susceptibility to fracture, particularly of the vertebral body, distal forearm and proximal femur in postmenopausal women. A more practical definition of osteoporosis is based on bone mineral density (BMD). The BMD of the older person is compared with the average BMD of a person of the same gender at age 30 and the result expressed in standard deviation units, the so-called '*T*-score'. If the *T*-score is equal to or less than  $-2.5$ , osteoporosis is diagnosed.

Fractures that result from osteoporosis cause considerable morbidity and mortality. Their incidence is increasing in

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## Key points

- It is important to prevent osteoporosis before the first fracture; bone density should be measured in patients at risk of fracture
- Effective, inexpensive treatments are available that reduce the risk of fracture; it is important to encourage compliance with these treatments
- It is usual to stop oral bisphosphonates after 5 years of treatment in order to reduce the risk of atypical femur fracture

developed countries, as a result of the increase in the proportion of elderly people in the population, as well as increased fracture rates within the elderly population, perhaps resulting from a more sedentary lifestyle.

It is now possible to determine an individual's risk of osteoporosis and fracture accurately, and to monitor their response to treatment by bone densitometry. The prediction algorithm FRAX™ (<http://www.shef.ac.uk/FRAX/tool.jsp>)<sup>1</sup> allows estimation of 10-year risk, and treatment guidance can be based on this. Many cases of osteoporosis are preventable, and treatment is effective in reducing the number of further fractures in patients with established osteoporosis.

## Pathophysiology

Bone undergoes a continual process of resorption and formation in discrete bone remodelling units (see *Medicine* 2013; **41**(10):581–85). About 10% of the adult skeleton is remodelled each year; this turnover prevents fatigue damage and is important in maintaining calcium homeostasis. Bone loss results from an imbalance between the rates of resorption and formation.

The human skeleton comprises about 80% cortical bone and 20% trabecular bone, which is more metabolically active. Osteoporotic fractures tend to occur at sites comprising >50% trabecular bone. Bone loss leads to thinning, and sometimes perforation, of the trabecular plates. Trabecular perforation occurs where there is increased bone turnover; the resulting change in architecture leads to loss of strength disproportionate to the amount of bone lost.

Key changes in bones are:

- peak bone mass is achieved by 30 years of age (**Figure 1**)
- after skeletal maturity, bone is lost in both sexes at a rate of about 1% per year
- women experience a phase of accelerated bone loss for 5 years after the menopause
- various factors affect the rate of bone loss (**Table 1**)

## Consequences of osteoporosis

Osteoporosis does not in itself cause pain or deformity; its importance lies in the fact that it greatly increases the risk of fracture (**Figure 2**), notably involving the:

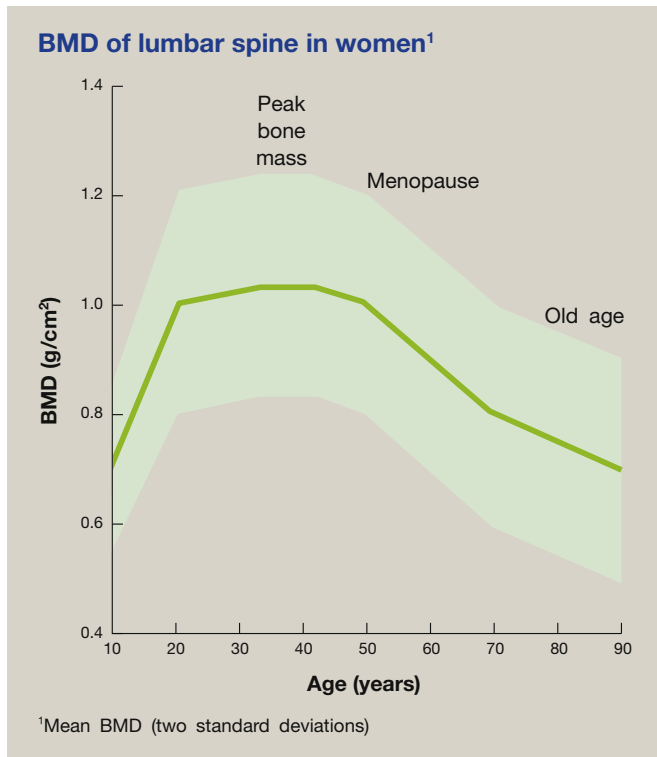


Figure 1

- forearm (Colles')
- hip
- vertebral body.

After the age of 50 years, the risk of sustaining one of these fractures is 40% in women and 15% in men. This 'lifetime fracture risk' can be useful when communicating the results of BMD measurements.

#### Increased mortality

Mortality is increased by 20% in the first year after a hip fracture. It is also increased after vertebral fracture, possibly as a result of diseases that increase the risk of fractures and death.

#### Pain

Pain usually occurs in the early stages after vertebral fracture and subsides after 3 months. Prolonged pain can result from secondary osteoarthritis. Pain can also occur when the costal margin impinges on the pelvic brim in severe kyphosis.

#### Deformities

Deformities include kyphosis, loss of height and abdominal protrusion.

#### Loss of independence

Loss of independence can have a considerable financial impact if it necessitates long-term community support or care in a nursing home.

#### Investigations

Patients with an osteoporosis-related low-trauma fracture should undergo systematic investigation (Table 2). Identification of low-trauma fracture (a fall from standing height or less) of the hip or distal forearm is straightforward. However, identification of vertebral fractures can be difficult because they may not be painful.

#### Radiology

The most reliable finding on a spine radiograph to support the diagnosis of osteoporosis is the presence of a deformed vertebra. Vertebral fracture is characterized by depression of the endplate and can appear as a:

- wedge deformity (loss of anterior height)
- endplate deformity (loss of middle height)
- compression deformity (loss of anterior, posterior and middle height).

Subtle changes of osteoporosis can be identified on spine radiographs (e.g. low density compared with soft tissue, prominence of vertical trabeculae), but these changes are unreliable and the apparent low bone density seen on a radiograph may be a technical artefact introduced by overexposure. Osteoporosis must therefore be confirmed by BMD measurement.

#### Factors affecting rate of bone loss

	Nutrition	Body weight	Lifestyle	Genetic
Increase bone loss	Sodium Caffeine	Thinness	Alcohol abuse Cigarette smoking Bed rest	Family history Female gender
Decrease bone loss	Calcium	Obesity	High activity	Race (black)
Unknown effect on bone loss	Phosphate		Normal activity	
Increase bone loss	<b>Sex hormones</b> Early menopause Oophorectomy Postmenopause Amenorrhoea	<b>Diseases</b> Cushing's syndrome Hyperthyroidism Hyperparathyroidism	<b>Drug therapy</b> Glucocorticoids Thyroxine Heparin Diuretics (furosemide) Aromatase inhibitors	
Decrease bone loss			Hormone replacement therapy	

Table 1

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