DEFINITION

1. The term **Osteoporosis** is used to describe a reduction in bone mass without a change in bone composition; it is clinically important because of an accompanying increase in liability to fractures of affected bone.

CLINICAL MANIFESTATIONS

2. Osteoporosis can affect people of all ages and both sexes, but is most common in the elderly. It is commoner in women than in men.

3. Osteoporosis may be suspected on clinical grounds where a fracture results from trauma that would not normally be expected to result in bony damage. It may become apparent, especially in women, with the development of increased curvature of the thoracic spine (kyphosis) due to vertebral collapse. Other common sites include the bones of the wrist and neck of the femur.

4. Measurement of bone mineral density is more helpful and is undertaken by a number of methods which vary in reproducibility, precision, accuracy and radiation dose. Dual-energy x-ray absorptiometry (DXA) of the lumbar spine or forearm is generally used because of its precision, rapid examination time and low exposure to radiation (1-3 mrem).

5. Osteoporosis in itself does not usually give rise to any symptoms until advanced, remaining undetected until the occurrence of **fractures**. X-ray films do not detect osteoporosis until there has been considerable bone loss.

6. **Fracture and collapse of vertebral bodies**, especially in the lower thoracic and upper lumbar regions, gives rise to pain in the back and deformity of the spine. Postmenopausal women are especially prone to fractures of this type. The vertebral fractures may not be related to any obvious trauma. Loss of stature may be noticed by the patient or others, with the appearance of thoracic kyphosis. X-rays show irregular anterior wedging of the affected vertebrae.

7. Osteoporotic **limb fractures** most often occur in the femoral neck and the wrist, less often in the humerus and tibia. They are more frequent in elderly women.

CLASSIFICATION

8. Osteoporosis may be **primary**, or may be **secondary**, when it is a manifestation of some other pathological process.

9. Primary osteoporosis

9.1. In the normal body, bone mass reaches a peak at about 30 years of age, and is higher in men than in women. From young adult life onwards bone is progressively lost in men at a steady rate, and in women rapidly after the menopause for some 10 years and then at the same rate as men. Loss of ovarian function at the menopause (or after oophorectomy) results in the most profound alteration of skeletal homoeostasis and loss of bone tissue.

9.2. Primary osteoporosis may, rarely, affect children and young adults; it is then termed **juvenile or idiopathic osteoporosis**. Much more often , it arises in **postmenopausal women (type 1 osteoporosis)** due to oestrogen deficiency, and is associated with accelerated bone loss and vertebral fractures. A further type of primary osteoporosis affects the elderly of both sexes due to the general effects of ageing, and is also known as **senile (type 2) osteoporosis**.

10. Secondary osteoporosis

10.1 **Immobilisation**. Particularly with increasing age, prolonged immobilisation leads to disuse osteoporosis affecting trabecular and cortical bone. It may be localised around inflamed joints and limbs, or generalised. Rapidly progressive osteoporosis may follow severe injury in the young where there is enforced immobilisation, due to an upset in the normal balance between bone resorption and bone formation. It may occur as a late complication of trench foot. Treatment is difficult but the osteoporosis will improve when mobility is resumed.

10.2 **Disorders of nutrition**. Severe protein deficiency resulting from malnutrition, failure in absorption or abnormal protein excretion, can result in osteoporosis. Anorexia nervosa and Vitamin C deficiency can also be a cause.

10.3 **Diabetes mellitus**. The precise relationship - in particular whether it is causal - between diabetes ad bone metabolism remains controversial. Several studies over the past 50 years have reported an association between diabetes and osteoporosis, and it has been shown that there is a significant loss of bone mass (osteopenia), of the order of 10%, in both types of primary diabetes. Some studies have shown an increased incidence of hip fractures in diabetics; these occurred in young patients and in the presence of minimal trauma. Recent studies have generally concluded that diabetics have an increased incidence of osteoporosis. The time course is important. Decrease in bone mass accompanies the clinical onset of diabetes: significant reduction continues for about 2 years, with a stable state reached within 5 years of diagnosis of diabetes.

10.4 **Other medical disorders**. Pituitary deficiency and hypogonadism may give rise to osteoporosis, as may chronic liver disease. Thyrotoxicosis, rheumatoid arthritis and ankylosing spondylitis are conditions known to be associated with osteoporosis; the common factor in these is thought to be a genetic predisposition to an autoimmune reaction, rather than one being a cause of another.

10.5 **Corticosteroids**. Osteoporosis is a common complication of systemic steroid therapy, and the prevalence of fractures depends on the dose of drug used and its duration. A mean long term daily oral dose of over 7.5 mg of Prednisolone has been found to be of significance for fractures, and fracture incidence of over 30% has been recorded in some studies. Bone loss is usually most rapid in the first 6-12 months, but continues indefinitely with prolonged therapy. There is wide individual variation and in susceptible subjects vertebral collapse may occur within a month of starting steroids. The use of inhaled steroids and topical preparations in therapeutic doses has not been shown to lead to osteoporosis.

10.6 **Other drugs**. Prolonged heparin therapy is recognised as a cause of osteoporosis. Some anticonvulsant drugs, such as Phenytoin and Carbamazepine, Phenothiazine derivatives, diuretics producing calciuria, and long term Tetracycline or Lithium use, are also reported as giving rise to osteoporosis.

AETIOLOGY

11. The term **primary osteoporosis** is used where there is no co-existing associated disease process and no discernible underlying pathology. Hormonal and ageing changes involved are essentially physiological variables, influenced by genetic and lifestyle factors.

Genetic factors

12. Constitutional makeup is important in that the degree of bone mass is influenced by the vitamin D receptor gene. Bone mass varies among individuals and as much as 80% of age-specific variation in bone mass can be accounted for on a genetic basis. Bone density in the daughters of osteoporotic women is lower than in the daughters of non-osteoporotic women. Black men and women have a higher bone density than white men and women and therefore less risk of osteoporosis.

Lifestyle factors

13. Bone loss is increased by a number of lifestyle factors, grouped as osteoporosis risk factors. These include smoking, alcohol excess, lack of regular physical exercise, excessive thinness (body weight less than 58 kilograms) and possibly nulliparity. Paradoxically, female athletes may develop decreased bone mass due to oestrogen deficiency with amenorrhoea, and are prone to tibial stress fractures.

Trauma

14. Medical authority has **not** identified physical trauma as an aetiological factor in osteoporosis. Fractures are a result of the disease process rather than its cause.

15. The cause of **secondary** osteoporosis is that of the underlying condition or medication. It is important to recognise that many patients have more than one cause for osteoporosis; for example, a patient with rheumatoid arthritis may suffer bone loss due to the disease itself as well as to treatment with corticosteroids.

CONCLUSION

16. **Osteoporosis** is the term used to describe loss of bone mass greater than that for normal individuals of comparable age, race and sex and to a level below that required for adequate mechanical support function. In **primary** osteoporosis there is no identified associated disease process and constitutional factors predominate. The main causes of **secondary** osteoporosis are listed above.

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