In the first part of our series on osteoporosis, we take a look at what it is, what causes it and how it is diagnosed.

Osteoporosis is defined as a 'progressive systemic skeletal disease characterised by low bone mass and micro-architectural deterioration of bone tissue, with a consequent increase in bone fragility and susceptibility to fracture' (WHO 1994).

According to the World Health Organisation (WHO 1994), osteoporosis is described as being present when bone mineral density is more than 2.5 standard deviations below the young adult mean. Osteopaenia, a milder form, is said to be present when bone density lies between one and 2.5 standard deviations below the mean for young adults.

In the UK each year, there are 230,000 osteoporotic fractures, at an estimated cost to the NHS of between £1bn and £1.5bn. Of these, 60,000 are hip fractures, 50,000 are forearm fractures, and about 120,000 are in the spine, with almost two-thirds of spinal fractures going undetected initially (Bates 2001, p102, Wilson 2001 p535).

The human consequences of osteoporotic fracture include death within the first six months for 20% of those who suffer hip fractures, with only half of these patients regaining full independence. Vertebral fracture causes chronic pain and reduced mobility, and one in five patients will suffer a further fracture within a year before the condition is recognised.

How osteoporosis occurs

The amount of bone in the adult human skeleton at any one time reflects the amount of bone formed (or remodelled) during growth, less any that is lost. Peak bone mass or density is usually reached during the third decade of life, after which there is a gradual decrease in density. This decline in bone mineral density (BMD) is similar in both men and women until the latter reach the menopause, when the lack of oestrogen (see below) causes women to lose bone rapidly. Bone is continuously re-modelled or re-formed. Re-modelling involving the resorption of bone by cells known as osteoclasts and the formation of new bone by cells called osteoblasts. There is usually a tightly coupled relationship between the osteoclasts and the osteoblasts. Yet formation is not matched by resorption after peak bone mass has been reached and there is an annual loss of around 0.3% – 0.5%, which is accelerated following the menopause.

Types of osteoporosis

Primary osteoporosis, of which there are two types:

Type I: mainly affects trabecular bone and is characterised by vertebral and wrist fractures, for example in post-menopausal women.

Type II: this is age-related and affects people over 80. It is characterised by fractures of the hip, humerus and tibia. Studies have found that women over 85 years are nearly eight times more likely than women aged 65-74 years to be hospitalised for hip fracture. As people live longer this will become an even bigger challenge for future generations (Woolf, 1998, pp30-34).

Secondary osteoporosis

This is associated with a number of factors, briefly described here.

At the age of 50, the lifetime risk of an osteoporotic fracture for women is around 40%. Lifetime risk in men is approximately half of that in women. The female ovarian hormone oestrogen is the most significant factor in maintaining bone mineral density. Circulating levels of oestrogen have a very significant positive impact on bone health. In one large study of 63,000 women over a 29-year period, 465 were found to have died as a result of a hip fracture (Torgerson DJ, Bell-Syer SE, 2001). Note that the longer the time between a woman’s first period and the onset of menopause, the better her chances of surviving a broken hip. If the gap between first menstrual period and menopause was less than 30 years, subjects were found to be twice as likely to die from the fracture than those with a 38-year gap. Having children later in life and being overweight also appeared to cut the risk of death as the result of a fracture. If the mother’s age at the birth of her first baby was over 35 years there was also a lower risk of her having a fatal
hip fracture. This demonstrated how women with more reproductive years are better protected because they are exposed to natural oestrogens for longer.

hormone replacement therapy
Evidence now exists that HRT can significantly reduce the risk of developing osteoporosis if taken long term at the optimum bone-sparing dosage. Its effect wears off within five years of termination of treatment. Taking HRT for more than five years has shown 70% less likelihood of suffering bone fractures than not taking it. (Torgerson DJ, Bell-Syer SE, 2001). HRT is available as pills, patches, implants, gels and vaginal rings and creams.

pregnancy and lactation
Pregnancy causes a lowering of bone mass with additional losses in the first five months of lactation. There is little data examining the long-term positive effect on bone health of the high oestrogen levels during pregnancy, however it has been suggested that it is the calcium required by the growing baby that cause bone loss in the mother.

race
Osteoporosis is more prevalent in people of Asian or Caucasian origin than in people of Afro-Caribbean origin. According to Woolf (1998), Afro-Caribbean subjects have been found to have larger, heavier bones, compared with age and sex matched bone density of Caucasian subjects.

family history
The chance of an individual suffering from osteoporosis is higher if there is a family history of the condition, although diet, smoking behaviour and other lifestyle factors may also be significant.

medical risk factors
These include:
• Taking corticosteroids (more than 7.5mg Prednisolone per day long term)
• Eating disorders
• Inflammatory bowel disease, and other diseases that cause malabsorption of nutrients
• Primary hypogonadism, delay or absence of protective hormones
• Rheumatoid arthritis
• Chronic liver or renal disease
• Hyperthyroidism
• Hyperparathyroidism
• Low body mass index (less than19 kg/metre²)

lifestyle factors
These include:
Smoking: bone mass in smokers has been found to be significantly lower than that of non-smokers, with smoking increasing the lifetime risk of vertebral fracture by 13% in women and 32% in men, and the risk of hip fracture by 31% for women and 40% for men. Effects can be partly reversed by stopping smoking.

Alcohol Intake: studies show a positive effect of moderate alcohol intake of two units a day on whole body and spinal BM D, when wine consumption was studied, and one unit equals 125ml. However, there is however a negative effect of regular excessive alcohol intake of more than 14 units a week.
diagnosis
The identification of osteoporosis is made difficult by the fact that it generally has no symptoms until a fracture occurs. People with vertebral fractures may have back pain, increasing kyphosis or loss of height, or low impact wrist fractures. In younger women, the finding of osteopaenia on routine X-rays may indicate impending osteoporosis.

Generally, the most effective way to diagnose osteoporosis and determine fracture risk is through testing for BMD. Other diagnostic tests include urinary calcium measurement, and spine or hip X-rays.

references
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other resources
National Osteoporosis Foundation. www.nof.org/osteoporosis/bonehealth

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