Osteoporosis and fragility fractures: identifying those at risk and raising public awareness

An outline of the epidemiology, risk factors, risk assessment and treatment for this common but often neglected condition, which is set to increase in prevalence

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This article outlines key points for nurses in delivering optimal osteoporosis care. It describes the epidemiology of the condition, risk factors, risk assessment, screening and treatment. It also discusses the importance of raising awareness and future developments in treating this increasingly common condition.

INTRODUCTION

Osteoporosis is a progressive systemic skeletal disease characterised by low bone mass and micro architectural deterioration of bone tissue. There is a consequent increase in bone fragility and susceptibility to fracture (National Institute of Health Consensus Development Panel, 2001).

The most significant clinical outcome is the increased likelihood of fracture. Although the spine, hip and wrist are most typical sites, fractures of other bones – such as the ribs, humerus and pelvis – are not uncommon.

Osteoporosis is a silent condition. In most patients the condition is diagnosed on presentation of a low trauma fracture. Wrist or spinal fractures are presenting signs in younger postmenopausal women, while hip fractures are more common in older people. Generally, the lower the bone mass, the lower the trauma necessary to incur a fracture.

Current medical consensus is that the bone mineral density (BMD) measurement of the hip is the gold standard for diagnosing osteoporosis. This is undertaken using a dual energy X-ray absorptiometry (DEXA) scanner (NICE, 2008a; 2008b).

To monitor changes in BMD over time and with treatment, the value for the spine is more useful. A DEXA report provides BMD values calculated as T scores and Z scores for the spine, femoral neck and total hip. Box 1 outlines the World Health Organization's (1994) criteria for diagnosing osteoporosis.

In general the fracture risk doubles for each standard deviation fall in BMD, and a fracture is associated with an increased risk of a subsequent one (NICE, 2008b).

Currently, a high-risk case screening approach is used in some organisations; for other areas, patients are identified

PRACTICE POINTS

● Osteoporosis results in substantial morbidity and mortality, so raising awareness of risk factors is vital.
● Nurses have a key role in supporting or leading the development of services to improve screening and risk assessment.
● The UK's ageing population means there is an urgent need to commission services to meet patients' needs.

opportunistically. Many organisations do not have guidelines in place and there is wide variation in services available across the UK.

EPIDEMIOLOGY

Prevalence of osteoporosis increases markedly with age after menopause. By age 60, approximately 15% of women have osteoporosis, and this figure increases to over 25% by the age of 80 (NICE, 2008a) (see Fig 1). The annual incidence of osteoporotic fractures (including recurrent ones) is 180,000 in England and Wales. This does not include most vertebral fractures, which are difficult to diagnose (Ralston and Kleerekoper, 2003).

Osteoporosis therefore represents a major health problem. The combined lifetime risk for hip, forearm and vertebral fractures coming to clinical attention is around 40%, equivalent to the risk for cardiovascular disease (Kanis, 2002).

The condition has a huge personal and economic toll. In Europe, the disability due to osteoporosis is greater than that caused by cancers (with the exception of lung cancer) and is comparable with or greater than that resulting from a variety of chronic non-communicable diseases, such as rheumatoid arthritis (Johnell and Kanis, 2006).

Fractures result in severe pain and disability. The cost of osteoporotic fractures to the NHS per year is over £1.8bn (Burge et al, 2001). With an ageing population, it is estimated that the number of osteoporotic fractures will double in Europe over the next 50 years (Elffors, 1998).

There is considerable morbidity after hip fracture, with 25-50% of patients becoming more dependent and many needing residential or nursing care (Cryer and Patel,

2001). With mortality of around 10-20% after hip fracture, an estimated 14,000 people die each year in the UK after an osteoporotic hip fracture (Bandolier, 1998).

RISK FACTORS

Since the clinical outcome of osteoporosis is bone fracture, attention now increasingly focuses on identifying patients at high risk of fracture rather than those with osteoporosis as defined by BMD alone (Kanis et al, 2008; Siris and Delmas, 2008).

Although osteoporosis is defined in terms of BMD and micro architectural deterioration of bone tissue, BMD is just one component of fracture risk. Accurate assessment should ideally take into account other risk factors that add further information (Kanis et al, 2008; Siris and Delmas, 2008).

Osteoporosis has been shown to have a large genetic component. A parental history of fracture (particularly hip fracture) confers an increased risk of fracture independent of BMD (Kanis et al, 2004a). Studies have demonstrated that weight in infancy is a determinant of bone mass in adulthood (Cooper et al, 1997).

Physical inactivity, a sedentary lifestyle and impaired neuromuscular function (such as reduced muscle strength, impaired gait and balance) are risk factors for fragility fractures (Albrand et al, 2003; Nguyen et al, 1998). Smoking can lead to lower bone density and higher risk of fracture and this risk increases with age (Kanis et al, 2005a). High alcohol intake confers a significant risk of future fracture (for example, over four units of alcohol per day can double the risk of hip fracture) (Kanis et al, 2005b).
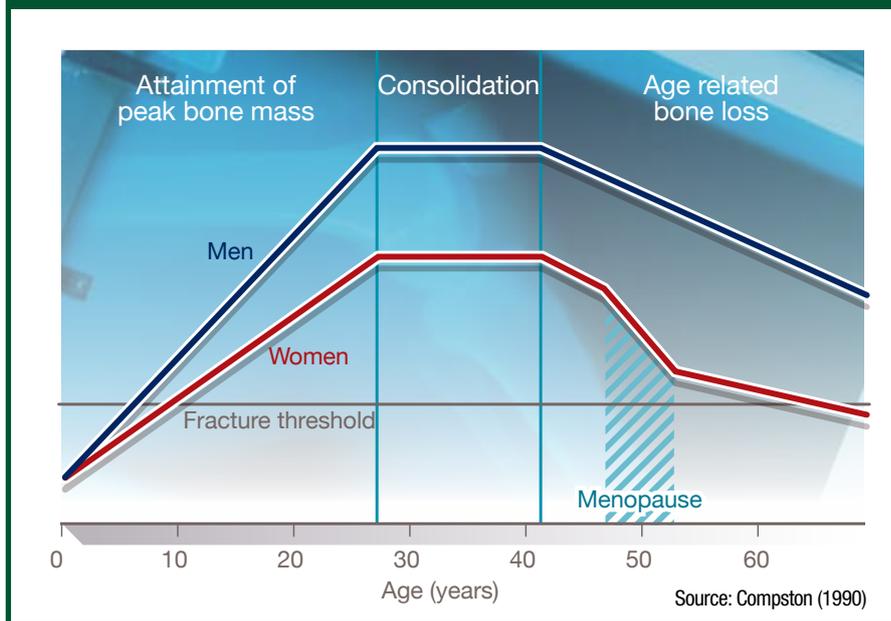
Prolonged use of corticosteroids is the most common cause of secondary osteoporosis. An estimated 30-50% of patients on long term corticosteroid therapy will experience

FIG 1. AGE RELATED CHANGES IN BONE MASS

Attainment of peak bone mass — Consolidation — Age related bone loss

Men

Women

Fracture threshold

Menopause

Age (years): 0 10 20 30 40 50 60

Source: Compston (1990)

fractures (Reid, 1997), with a two fold increased risk of hip fracture in women and 2.6 fold in men (Kanis et al, 2004b).

Proton pump inhibitors can reduce the absorption of calcium from the stomach and long term use can significantly increase the risk of osteoporosis related fractures (Targownik et al, 2008). Low body weight and weight loss is associated with greater bone loss and increased risk of fracture (De Laet et al, 2005). Some young women, particularly those training for elite athletic competition, exercise too much, eat too little, and experience amenorrhoea, which puts them at risk of low bone mass and fractures.

After an initial low trauma fracture from a simple fall, both older men and women have an increased equivalent risk of all types of subsequent fractures, especially in the next 5-10 years (Center et al, 2007).

Falls contribute to fractures, and around 90% of hip fractures result from falls (Tinetti, 2003). A third of people over 65 fall annually, with approximately 10-15% of falls in older people resulting in fracture, and almost 60% of those who fell the previous year will fall again (Tinetti, 2003).

FRACTURE RISK ASSESSMENT

The adoption of the WHO (1994) definition of osteoporosis brought enormous benefits to the routine clinical application of bone densitometry, and was a major factor behind its rapid expansion. Not only did this offer a

method of identifying high risk patients before they sustained a fracture, the WHO T-score algorithm is also easy and simple to apply in practice.

Marshall et al (1996) reported on how well BMD predicted occurrence of osteoporotic fractures. This led to the widespread acceptance that a hip BMD measurement is the most reliable method of assessing hip fracture risk and spine BMD is optimal for assessing vertebral fracture risk. A limitation with using T scores, however, is that age as well as BMD is an important factor when deciding patients' short term risk of osteoporotic fracture (Kanis, 2002). It may be more appropriate to treat at the age of 50 but not at 90 for the same T score.

The WHO Fracture Risk Assessment (FRAX) approach seeks to improve clinical decision making on treatment by basing assessment on the 10 year probability of osteoporotic fracture, and DEXA scan results, if available, can also be incorporated in the decision making pathway.

The FRAX algorithm is based on a series of meta-analyses of data from 12 independent fracture studies covering North America, Europe, Asia and Australia. A further validation study incorporated data from another 11 independent population based patient cohorts.

The FRAX tool (www.shef.ac.uk/FRAX) incorporates BMD information from hip DEXA scans. Although femoral neck BMD was used to develop the algorithm, the

BOX 1. OSTEOPOROSIS DEFINED USING WHO CRITERIA

A T score is the number of standard deviations that separate the patient from the mean value of a healthy young population. A Z score is the number of standard deviations that separate the patient from an age-matched healthy population. The WHO (1994) definition characterises:
● Osteopenia: T score of between -1 and -2.5 SD;
● Osteoporosis: T score of -2.5 SD or below;
● Established (severe) osteoporosis: T score of -2.5 SD or below with one or more associated fractures.

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website states that total BMD may be used instead. Accepting that all DEXA sites are more or less equally effective at predicting a fragility fracture at any site, FRAX provides information on the 10 year probability of hip fracture and any major osteoporotic fracture (defined as a hip, wrist, humerus or clinical vertebral fracture).

The UK National Osteoporosis Guideline Group uses a traffic light system to divide patients who have had a FRAX assessment into groups for appropriate management (see www.shef.ac.uk/NOGG/index.html).

SCREENING AND DETECTION

As the prevalence of osteoporosis is higher among older postmenopausal women, at over 25% by the age of 80 (NICE, 2008a), it is hard to justify extensive investigation in all cases as many are simply due to age related bone loss. Investigations should be targeted to high risk groups to include:
● Low BMD for age – this may indicate low peak bone mass, accelerated bone loss or a combination;
● Presence of vertebral fractures;
● Unexplained, accelerated bone loss as assessed from serial scans;
● Clinical suspicion of an underlying cause for osteoporosis may be present in around 50% of patients. Treatment of the underlying cause may in itself lead to an improvement in bone health (for example, demineralisation due to vitamin D deficiency may be the cause of low BMD rather than osteoporosis).

TREATMENT

NICE has published technology appraisals for primary and secondary prevention of osteoporosis (NICE, 2008a; 2008b). They identify treatment thresholds for various osteoporosis treatments, including:
● The oral bisphosphonates alendronate, etidronate and risedronate;
● The selective oestrogen receptor modulator raloxifene;
● Strontium ranelate with its dual anti-resorptive and bone forming modes of action;
● Teriparatide, a parathyroid anabolic treatment given by injection, and reserved for high risk patients intolerant to more traditional treatments (for secondary prevention only).

NICE recommends generic alendronate as the first line treatment suitable for most patients with osteoporosis (see the technology appraisals for details on when other treatments are recommended).

Treatments not evaluated by NICE as they were outside the scope set include the injectable bisphosphonates ibandronate (given three monthly) and zoledronate (annual infusion) and oral ibandronate.

NICE is developing a clinical guideline for osteoporosis. The remit includes supporting clinical decision making on patient care and advising on treatment for patient groups not considered in the technology appraisals. These include patients using long term oral corticosteroids and people with osteopenia (NICE, 2008a; 2008b; 2003).

It is important that all patients have sufficient levels of calcium and vitamin D; if there is a nutritional deficiency then supplements should be prescribed before bone sparing therapy is initiated.

Compliance and persistence rates for such therapy are poor, especially for bisphosphonate drugs where they range from 30-80% (Cotté et al, 2009; Siris et al, 2009; NICE, 2008a). These drugs are extremely sensitive and patients need to adhere to a strict routine in order to ensure efficacy (NICE, 2008a). Older patients on multiple treatments may find it difficult to remember to take all their medicines or inadvertently miss doses or take treatments incorrectly (Varenna and Sinigaglia, 2009). They need to be supported to ensure good compliance.

PREVENTION AND RAISING AWARENESS

There is a real need to raise awareness of risks of osteoporosis and the importance of lifestyle interventions to ensure good bone health throughout life. This could be done by public health campaigns. The availability of the FRAX tool should also be highlighted. Finally, there should be adequate commissioning of dedicated services for patients with osteoporosis and fractures.

Public health campaigns at national and local level would pay great dividends at population level, helping to raise awareness of both the importance of maintaining BMD and reducing risks for osteoporotic fractures. They should highlight osteoporosis-associated modifiable risk factors.

Lifestyle interventions that are important for good bone health include a healthy balanced diet, containing adequate protein, carbohydrates with good calcium and vitamin D intake (Ralston and Kleerekoper, 2003). Regular weightbearing exercise is important to ensure good bone turnover. Smoking and alcohol intake equal to or above four units per day are risk factors for

osteoporosis, as is a low BMI ($<22kg/m^2$) (NICE, 2008b).

The results of a recent survey conducted on behalf of the National Osteoporosis Society (2008) show that young adults have poor understanding of bone health and what they can do to reduce their risk of osteoporosis. Over two thirds of respondents were not aware they can take positive steps to improve bone health, while only a third were aware that physical inactivity increases the risk of osteoporosis. Less than half knew that eating dairy products is beneficial.

Key steps are to increase knowledge and understanding about bone health during childhood and adolescence. Nurses are ideally placed to support public health campaigns, ensuring key messages are delivered to mothers and children. They could also raise awareness of the 'bones4life' campaign – a web based tool for children, parents and teachers (www.bones4life.org).

At practice level, results from the FRAX assessment could be used in consultations to decide on appropriate management for osteoporosis risk, including referral for a DEXA scan or specialist advice. Osteoporosis clinical criteria are not included in the GP Quality and Outcomes Framework, raising concern that care for patients with osteoporosis in primary care is placed at a disadvantage (Sutcliffe, 2006).

In April 2008, the Department of Health published its clinical directed enhanced service (DES) specification for osteoporosis for the general medical services contract, based on NICE technology appraisal criteria for secondary prevention. However, no information is available on its uptake by practices across the UK. Nurses working in primary care could improve patient care by proactively supporting implementation.

Fracture liaison services and medicines management

There is increasing evidence of the benefits of dedicated fracture liaison services (FLS). These include dedicated nurses tasked with ensuring integrated patient care delivery across the primary and acute care interface (Murray et al, 2005).

In Harrow, work is under way to develop a multidisciplinary model incorporating a fracture liaison service integrated with the local falls service. This model will work closely with the falls coordinator, orthogeriatricians, orthopaedic consultants, consultant for metabolic bone disorders and a pharmacist-led medication management service (Tanna, 2004). The Harrow model

will also ensure data input to the National Hip Fracture Database (www.nhfd.co.uk). Supporting this database could become mandatory for NHS services from next year.

Medication management and patient support – ensuring good compliance and concordance with osteoporosis management plans and with prescribed treatments – are vital. Not only is there a need to ensure that patients adhere to management plans, but if they have difficulty with medication it is important to ensure they are supported.

The Northwick Park medication management clinic has been designed to support patients with medication related issues. It provides quick access to advice for all practitioners via a dedicated healthcare professional linkline (Tanna et al, 2007).

FLS services have the potential to improve osteoporosis medication management further and, in primary care, an extension of the model could include cross-referral to community pharmacists with a request to undertake a medicines usage review.

Work on supporting staff and patients in care homes with correct medication taking has also been reported, with a particular focus on ensuring good calcium and vitamin D intake by elderly frail patients with risk factors for osteoporosis (Mayne et al, 2008).

FUTURE DEVELOPMENTS

There is a need for further research on the effective use of bone turnover markers and their role in osteoporosis care.

Research is ongoing to develop the FRAX tool to include vertebral fractures. Newer treatment modalities include denosumab, a fully human monoclonal antibody that is being tested to see if it will be an effective treatment for osteoporosis. There is interest in the newer tissue-selective oestrogen complex (TSEC), a combination of bazedoxifene – which is a selective oestrogen receptor modulator – and conjugated equine oestrogen, as the oestrogen component in the TSEC. The working hypothesis is that these treatments will be the future "designer" type of drugs, used to treat patients with expected benefits but reduced risk.

CONCLUSION

This article has examined diagnostic criteria for osteoporosis, the importance of preventing fractures and the current medical consensus that evidence based risk factors in addition to BMD measurements provide improved assessment for future fracture risk.

The FRAX risk assessment tool may become the future method of assessment. Bone turnover markers are currently used only by specialist units, as there is a need to identify their role before wider use. Multidisciplinary teams, with nurses playing a central role, are vital in delivering optimal care for patients with osteoporosis. ●

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