

Fragile bones, osteoporosis and fracture prevention



Fragility fractures have an enormous impact on health.

We build bones as children and in early adulthood through a combination of exercise and good dietary intake. Genetic and racial factors also contribute significantly to the development and maintenance of a healthy skeleton. Bone mass declines from about the mid-thirties onwards.

Women are particularly at risk following the menopause, due to increased bone loss that results from reduced oestrogen production.

Osteoporosis occurs when there is accelerated bone loss due to an imbalance between the rate of new bone formation and the normal breakdown and removal of bone (bone resorption).

It is a world-wide health issue and the most common skeletal disorder in medicine today. There is a progressive decrease in bone density, which results in bone becoming weakened and easily fractured.

Osteoporosis rarely causes symptoms until there is what is termed a "Fragility Fracture" i.e. one occurring with minimal trauma. The lifetime risk at 50 of any hip, vertebral or forearm fracture is 40 per cent in women and 15 per cent in men. Hip fractures are particularly dangerous as up to 20 per cent of hip fracture patients die within the first year after a fracture and only one-third regain full, independent living.

Early diagnosis is important due to the availability of treatments that may slow, or even reverse, osteoporosis.

Prevention of falls

While this article is focusing on osteoporosis and fragile bones, it is first and foremost essential to prevent falls in a given patient – "no fall – no fracture". All patients prone to falls or blackouts should be comprehensively assessed for treatable causes, preferably by a specialist physician in this area.

Establishing a diagnosis of osteoporosis

If a middle-age or elderly person has a history of a fracture due to minimal trauma, then it is imperative to investigate fully for osteoporosis.

Patients who are at risk of osteoporosis include:-

- (a) Those with a family history of osteoporosis or fractures related to minimal trauma.
- (b) Women with an early menopause.
- (c) Patients on corticosteroids.
- (d) A history of an over-active thyroid.
- (e) Concurrent illnesses such as rheumatoid arthritis, liver disease, malabsorption syndromes and inflammatory bowel disease.

Osteoporosis is diagnosed on the basis of history, physical examination, laboratory tests and by performing a special x-ray of the bones known as a DXA Scan (pronounced "DEXA"). Underlying possible causes, such as a myeloma or an over-active thyroid, must be excluded.

Bone biochemistry, kidney and liver function tests should be carried out in all patients. A normal full blood count, and a normal ESR (erythrocyte sedimentation rate), will exclude any major marrow problem in most cases.

We also carry out plasma protein electrophoresis and check the urine for Bence Jones protein. The science of bone turnover markers has made significant advances in recent years and can help to refine the decision of a bone specialist in deciding which bone strength drugs to use for an individual patient.

They are used mainly in specialised bone protection and osteoporosis clinics.

Provided that these less common causes of osteoporosis have been excluded then the underlying cause in the vast majority of cases will be "idiopathic" or what is termed "post-menopausal" osteoporosis. All patients

over 45 years of age, who have suffered from a fracture due to minimal trauma, should all be investigated for osteoporosis. Patients on long-term corticosteroids should be treated to reduce the probability of osteoporosis developing.

When a DXA scan is carried out it is standard practise to do a DXA scan on both the lumbar spine and on the hip. In DXA scanning, a standard reference point to the bone density of a healthy young adult is now routinely used and this is called a "T score".

A lumbar spine DXA scan is an accurate method of diagnosing osteoporosis and of monitoring the progress of treatment and of the disease. A DXA scan with a "T score" above "- 1" is classified as normal.

The diagnostic label, "Osteopaenia", in a DXA scan is made when a "T score" is between "- 1" and "- 2.5" and a diagnosis of "Osteoporosis" is made when the T score is less than "- 2.5". Another often used method of assessing osteoporosis is "calcaneal ultrasound", which is an ultrasound scan of the heel of the foot. This is good at hip fracture prediction in the elderly but it is not as sensitive a tool as DXA scanning, and it will miss many of those who are at risk of osteoporosis.

On the other hand, some patients will come in as osteopaenic or even normal on a DXA scan, while their score on an ultrasound may indicate that they are at increased risk of a fragility fracture. They are thus complementary tests and both provide information about the amount of bone and, to a lesser extent, the quality of bone in a given patient.

All patients who are frail and who have a tendency to fall, should have their risk for osteoporosis assessed. It is imperative that all identified risk factors for falling should be treated and, for those at high risk of recurrent falls, the wearing of hip protectors has been proven in a major article, published in the *New England Journal of Medicine*, as being an extremely efficient method of lessening the probability of a hip fracture occurring.

Hip protectors are especially valuable in frail nursing home residents.

Prevention and treatment

There is no excuse for leaving patients with osteoporosis untreated, and it is also imperative that any patients who are at risk of developing osteoporosis, such as those on long-term steroids, are given adequate preventative therapy.



***Prof J Bernard Walsh** says as new treatment options increase, treatment can now be targeted to the individual patient.

Fortunately, there are many treatments now available that will reduce further loss of bone, increase bone density and slow, and often stop, the progression of osteoporosis.

Hip Protectors

At least a dozen types of hip protectors are commercially available. The soft shell "Hip Saver" is the brand we use in our unit. Hard shell brands are also available and are effective. Studies have shown hip protectors to be effective in at-risk patients in residential care settings such as nursing homes.

Compliance rates with hip protectors can be a problem and virtually all fractures that have occurred in patients prescribed hip protectors have occurred when they were not being worn. If encouraged by staff to wear hip protectors, patient compliance increases.

Once prescribed it is essential that they are worn 24-hours a day by "at risk" patients.

Non-Drug Therapy

"Non-Drug" therapy has three major components – diet, exercise and smoking cessation. Diet must include an adequate intake of calories as well as extra Calcium and Vitamin D. In addition to dairy produce, oily fish, broccoli and nuts are dietary sources of these nutrients.

Vitamin D fortified milk (e.g. Supermilk) is a good source of Vitamin D and Calcium, but a patient with established osteoporosis will have to take extra supplements as described below.

In addition a good balanced diet is important.

Alcohol should be limited and smoking stopped as smokers have, on average, a 10 per cent reduction in bone density by menopause.

Exercise

Weight-bearing exercise is essential, e.g. walking, jogging, climbing or dancing! for at least 30 minutes, three times per week (beneficial before and after the menopause).

As the benefits of exercise are quickly lost if exercise is stopped, it must be maintained throughout the year. This is helped if it is ensured that the regular exercise is structured so that it is an enjoyable part of the day.

Gentle Whole Body Vibration Therapy, e.g. standing on a vibration platform like a weighing scales in design, has been shown to be effective at stimulating bone formation in animal and sheep studies, and early studies in humans are promising. It is recommended that it be used for about 20 to 30 minutes a day.

Drug treatments

Calcium and Vitamin D supplements

Every patient with osteoporosis should supplement their diet with a gram of cal-

cium and 800 units of Vitamin D a day. This would be contained in combined Vitamin D and Calcium tablets.

e.g. Calcichew D3 Forte - one tablet, twice daily.

Ideos - one tablet, twice daily.

Osteofos D3 - one sachet, daily.

These preparations will ensure an adequate intake of Vitamin D and Calcium. It is imperative that, no matter what other therapy a patient is taking for their osteoporosis, an adequate intake of Calcium and Vitamin D must also be taken at the same time.

Bisphosphonates

e.g. Alendronate (Fosamax), Risedronate (Actonel) and Ibandronate (Bonviva).

These drugs inhibit the resorption of bone and they have had a major impact in our management of fragile bones. Alendronate (Fosamax) and Risedronate (Actonel) slow bone turnover to premenopausal levels and are very effective at reducing the incidence of all types of fractures by a level of 50 per cent over a three-year period.

Ibandronate (Bonviva), a recently released once-monthly bisphosphonate, prevents vertebral fractures and is licensed in Ireland for this indication. Its efficacy in preventing hip fractures has yet to be confirmed but its effect on improving bone mineral density, and in reducing bone turnover marker levels, parallels the other bisphosphonates.

HRT

Because of the possible small increase in breast cancer and vascular events with HRT, this treatment is no longer routinely recommended as first line in osteoporosis.

Selective Oestrogen Receptor Modulators (SERMs)

e.g. Raloxifene (Evista).

This drug is used in post-menopausal women to help prevent and to treat osteoporosis. It reduces the incidence of vertebral fractures and it may reduce breast cancer risk.

Strontium Ranelate (Protelos)

This new drug is given at night in a powder form. In women with vertebral fractures, the risk of a new fracture was decreased by 41 per cent over three years. It also increased bone mineral density and reduces hip fractures. It has a dual role of action. It stimulates new bone formation and slows bone resorption. It is a very welcome addition in our battle against osteoporosis and its proven efficacy against hip fracture makes it a potent tool and a valuable alternative treatment option.

PTH – Parathyroid Hormone e.g. Teriparatide (Forsteo)

When given in low dose

this drug stimulates bone formation. It is given by daily subcutaneous injection for 18 months for severe osteoporosis.

It is more effective at increasing new bone formation at spinal level than any other available treatment. It reduces the incidence of vertebral fractures over an 18 month period by over two-thirds and of severe vertebral fractures by 90 per cent. After completing an 18-month course, a patient is put on to long-term maintenance therapy with one of the other drugs.

Monitoring response to treatment

Up to one-fifth of patients may fail to respond to treatment. How best to measure a patient's response to treatment is a continuing challenge in the area of bone health.

Methods of assessing response to a given therapy have only partial reliability, as it has been shown that patients with a low bone mineral density response on treatment may yet have an excellent response from a fracture reduction point of view. Therefore, a combination of the following is most often used.

- (a) A repeat DXA scan after about three to five years.
- (b) Measuring changes in bone marker turnover levels.
- (c) Clinical response to treatment.

Summary

Osteoporosis is a common condition that is both preventable and treatable. As the number of treatment options increase, we can now aim to target the treatment to the individual patient.

The initial steps include an accurate diagnosis of the condition and non-drug interventions, with particular emphasis on falls prevention, diet, "no smoking" and regular exercise.

The next stage in treatment involves the choice of a therapy from a range of an ever-increasing number of drugs effective in this condition.

This will mean that many people in the future can avoid the development of fragility fractures, which have an enormous impact on health especially as age increases.

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This article was commissioned by Vhi Healthcare and can also be accessed on www.vhi.ie, one of Ireland's most comprehensive online health and fitness websites.