Osteoporosis risk assessment and primary prevention

Osteoporosis is characterised by low bone mineral density (BMD) and deterioration of bone structure, resulting in an increased susceptibility to fractures of the hip, spine and wrist.[1]

Osteoporosis contributes to a great deal of morbidity and mortality and is a large burden to the health service. 2 million women in England and Wales are estimated to have osteoporosis and there are 180,000 related fractures per year.[2] 1 in 3 women and 1 in 5 men will have a fragility fracture in their lifetime. The annual cost to the NHS is estimated at £1.73 billion.[3] The ageing of the population in the UK is expected to result in a doubling of fracture figures over the next 50 years unless prevention and management are improved, as 50% of those aged over 80 years are thought to have osteoporosis.[2]

Primary Care is ideally situated to try to identify patients at increased risk before symptoms develop, whilst both orthopaedic surgeons and Primary Care should be vigilant to assess all patients with suspected fragility fractures. There are several risk factors which often co-exist to increase risk substantially.

Clinicians trying to improve early detection of osteoporosis and prevent fragility fractures have conflicting guidelines to follow. In the UK, the main guidance comes from the National Institute for Health and Care Excellence (NICE), the National Osteoporosis Guideline Group (NOGG) and the Scottish Intercollegiate Guidelines Network (SIGN). Unfortunately, the advice between them differs.

Risk factors[2]

Clinical risk factors which are used to assess the risk of fracture are:

- Increasing age (risk increased partly independent of reducing BMD).
- Female sex.
- Low body mass and anorexia nervosa. (Low body mass is defined as <19 kg/m^2 by NOGG and as <18.5 kg/m^2 by NICE.)
- Parental history of hip fracture.
- Past history of fragility fracture (especially hip, wrist and spine fracture).
- Corticosteroid therapy (current treatment at any dose orally for three months or more).
- Cushing's syndrome.
- Alcohol intake of three or more units per day.
- Smoking.
- Falls and conditions increasing the risk of falls such as:
    - Visual impairment.
    - Lack of neuromuscular co-ordination or strength.
    - Cognitive impairment.
    - Sedative medication and alcohol.

- Secondary causes of osteoporosis such as:
    - Rheumatoid arthritis and other inflammatory arthropathies.
    - Prolonged immobilisation or a very sedentary lifestyle.
    - Primary hypogonadism (men and women).
    - Treatment with aromatase inhibitors or androgen deprivation therapy.
    - Primary hyperparathyroidism.
    - Hyperthyroidism.
    - Post-transplantation.
    - Chronic kidney disease.
    - Gastrointestinal disease such as Crohn's disease, ulcerative colitis and coeliac disease.
    - Untreated premature menopause (<45 years) or prolonged secondary amenorrhoea.
    - Type 1 diabetes mellitus.
    - Chronic liver disease.
    - Chronic obstructive pulmonary disease.

Other than aromatase inhibitors and androgen deprivation therapy, other pharmaceutical agents which may increase the risk of fragility fractures include:

- Proton pump inhibitors (PPIs).
- Enzyme-inducing anticonvulsants.
- Long-term depot medroxyprogesterone acetate.
- Long-term antidepressants.
- Thiazolidinediones (anti-diabetic therapy).

Whom to assess: case finding

Guidelines differ in their advice about who should have a fracture risk assessment.

NICE guidelines advise the following have a fracture risk assessment:[4]

- All women aged 65 years and over.
- All men aged 75 years and over.
- Women aged under 65 years and men aged under 75 years in the presence of risk factors, essentially those listed above. For example:
    - Previous fragility fracture.
    - Current use or frequent recent use of oral or systemic glucocorticoids.
    - History of falls.
    - Family history of hip fracture.
    - Causes of secondary osteoporosis.
    - Low body mass index (>18.5 kg/m^2).
    - Smoking.
    - Alcohol intake of more than 14 units per week.

NOGG guidelines advise the following have a fracture risk assessment:[3]

- Postmenopausal women with risk factors as listed in the 'Risk factors' section above (where assessment will influence management). Women with a prior fragility fracture should be considered for treatment directly without necessarily having a risk assessment. NOGG acknowledges, however, that risk assessment and/or BMD measurement may be appropriate, particularly in younger women.
- Men aged 50 or more with risk factors as above (where assessment will influence management).

Active 'case finding' will depend on clinical concern and which guidelines are used. Consider doing full assessments and/or measuring BMD with dual-energy X-ray absorptiometry (DEXA) scans on those considered to be potentially at risk.

Possible strategies for case finding in general practices could involve:

- The following searches of the practice database:
  - Women over the age of 65.
  - Men over the age of 50.
  - People on long-term glucocorticoids.
  - People with rheumatoid arthritis.
- Risk assessment on all people with a hospital discharge letter following a fracture.
- Risk assessment at medication reviews for people on steroids.
- Consider assessing fracture risk during the annual reviews of relevant chronic diseases (eg, rheumatoid arthritis, diabetes, coronary heart disease, chronic obstructive pulmonary disease, chronic kidney disease, coeliac disease, etc).
- Consider assessing fracture risk during NHS health checks.

How to assess fracture risk

A 10-year risk of fracture may be obtained via:

- FRAX® risk assessments.[5] An update is planned.[6]
- The QFracture® calculator (an alternative based on the UK population).[7]

NOGG advises uses of FRAX®, SIGN advocates use of QFracture®, and NICE advises either FRAX® or QFracture® can be used. If BMD has been measured, however, use FRAX®, as QFracture® does not incorporate this measurement, as it was designed to be a tool used to decide who should have BMD tested.

Further recommendations from NOGG[3]

Once a fragility fracture risk has been calculated using the FRAX® calculator, a prompt appears giving the option to view NOGG guidance. The score is then mapped on a chart taking into account the patient details and risk factors. They will come into one of three colour categories, with corresponding advice:

- Green: low risk. No need for treatment or BMD measurement. Lifestyle advice and reassurance.
- Amber: intermediate risk. Arrange a DEXA scan to establish BMD. Then recalculate FRAX® score to determine more accurately the need for treatment.
- Red: high risk. Treat. Measure BMD to guide choice of treatment and have baseline for future monitoring .

Women who have had a fragility fracture do not need further risk assessment; they should be directly considered for treatment. In some, however, BMD measurement may be helpful.

Further recommendations from NICE [4]

- Do not routinely assess fracture risk in people aged under 50 years unless they have major risk factors (eg, current or frequent recent use of oral or systemic glucocorticoids, untreated premature menopause or previous fragility fracture), because they are unlikely to be at high risk.
- Do not routinely measure BMD to assess fracture risk without firstly performing an assessment using FRAX® (without a BMD value) or QFracture®.

- Indications for measurement of BMD with a DEXA scan include:
    - Following risk assessment with FRAX® (without a BMD value) or QFracture®. Consider measuring BMD with DEXA in people whose fracture risk is in the region of an intervention threshold for a proposed treatment, and recalculate absolute risk using FRAX® with the BMD value. (This links with the NOGG guideline, as following the FRAX® algorithm will lead you to a NOGG-created chart which will tell you if you need to then arrange a DEXA scan or not.)
    - Consider measuring BMD with DEXA before starting treatments that may have a rapid adverse effect on bone density (eg, hormone-blocking treatments for breast or prostate cancer).
    - Measure BMD to assess fracture risk in people aged under 40 years who have a major risk factor, such as history of multiple fragility fracture, major osteoporotic fracture, or current or recent use of high-dose oral or systemic glucocorticoids (more than 7.5 mg prednisolone or equivalent per day for three months or longer).
- Monitoring: consider recalculating fracture risk only after at least two years, or if there has been a change in the person's risk factors.
- Warnings about risk assessment tools:
    - Interpret the estimated absolute risk of fracture in people aged over 80 years with caution, because predicted 10-year fracture risk may underestimate their short-term fracture risk.
    - Take into account that risk assessment tools may underestimate fracture risk in certain circumstances - for example, if a person: has a history of multiple fractures, has had previous vertebral fracture(s), has a high alcohol intake, is taking high-dose oral or high-dose systemic glucocorticoids, (more than 7.5 mg prednisolone or equivalent per day for three months or longer) or has other causes of secondary osteoporosis.
    - Take into account that fracture risk can be affected by factors that may not be included in the risk tool - for example, living in a care home or taking drugs that may impair bone metabolism (such as anticonvulsants, selective serotonin reuptake inhibitors, thiazolidinediones, PPIs and antiretroviral drugs).

Further recommendations from SIGN[8]

SIGN recommends that treatment should NOT be initiated on the basis of fracture risk analysis alone without prior BMD measurement. Even postmenopausal women with a history of a fragility fracture should have a DEXA scan, unless this is felt to be impractical or inappropriate.

SIGN guidelines propose that a 10-year fracture risk of 10% should be taken as the level at which DEXA becomes appropriate. *If* osteoporosis is confirmed by DEXA scan, treatment should be offered.

SIGN guidelines highlight the increased risk of glucocorticoid therapy. Those people on long-term (over three months) treatment of prednisolone ≥7.5mg per day or equivalent may be considered for bisphosphonate treatment, and are excluded from other treatment algorithms and thresholds.

Interventions

Patients found to be at increased risk of fracture should be offered a bone-preserving agent, depending on the agreed threshold. See the separate Osteoporosis article for treatments.

Primary prevention

Diet and exercise have a considerable influence on whether patients go on to develop osteoporosis:[2]

- The person should be encouraged to take adequate calcium throughout life. Where intake may be suboptimal, provide supplementation with calcium and vitamin D (for example, in patients with low BMI and patients in residential and nursing homes).[9]
- Although there has been controversy over the role of vitamin D supplementation,[10] it is still universally recommended.[11]
- Calcium-rich foods include milk and dairy products (can be reduced-fat) and vegetables such as broccoli and cabbage.
- Dietary calcium intake may be estimated by one of several online calculators.[12]

- The healthy eating diet, with '5 a day' of fruit and vegetables (vitamin C), fish meals at least weekly (vitamins D and K), is a good start.
- Encourage a reduced salt and phosphate intake, and the moderation of alcohol intake; give anti-smoking advice as appropriate.
- Encourage exercise, both traditional weight-bearing exercise and exercise that involves pulling forces acting on entheses (tendon insertions) of long bones.

Primary prevention of fragility fractures in established osteoporosis is covered in the separate Osteoporosis article.

Further reading

- Bisphosphonates for treating osteoporosis; NICE Technology appraisal guidance, August 2017 - last updated July 2019
- Kanis JA, Cooper C, Rizzoli R, et al; European guidance for the diagnosis and management of osteoporosis in postmenopausal women. Osteoporos Int. 2019 Jan;30(1):3-44. doi: 10.1007/s00198-018-4704-5. Epub 2018 Oct 15.
- Curtis EM, Moon RJ, Harvey NC, et al; The impact of fragility fracture and approaches to osteoporosis risk assessment worldwide. Bone. 2017 Nov;104:29-38. doi: 10.1016/j.bone.2017.01.024. Epub 2017 Jan 22.

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