**BACKGROUND**

Low bone density is an important risk factor for fracture. **The aim of assessing bone density and treating osteoporosis is to reduce fracture risk.** Treatment of osteoporosis should be combined with other strategies to prevent fractures e.g. falls reduction.

**BONE MASS**

Peak bone mass is attained in early adult life and is influenced by sex, race, genetic background, diet and exercise. There is a decline in bone mass from the mid-thirties onwards and is accelerated in women after the menopause. Bone mass has a major influence on bone strength which in turn influences fracture risk.

**DEXA SCANNING**

DEXA scanning involves the use of low doses of ionizing radiation to assess bone density at the hip or lumbar spine. The technique is accurate, reproducible and predicts future fracture risk.

**WHO TO SCAN**

The primary objective of treating osteoporosis is to reduce the risk of suffering a fracture. Hence priority should be given to identifying individuals at highest risk of fracturing. Those who have already sustained a low impact fracture are at the greatest risk of having a further fracture particularly if over 60 years old.
Risk factors for osteoporosis

Previous low impact fracture

Premature menopause *(45 years either natural or surgical)*

Long term steroid therapy

Osteoporosis suspected on plain x-ray

Kyphosis

Family history *(e.g. kyphosis, osteoporosis)*

Poor diet or malabsorptive states *(e.g. coeliac disease, inflammatory bowel disease)*

Post-menopausal and BMI <19

Metabolic diseases *(e.g. hyperparathyroidism, thyrotoxicosis)*

Chronic medical conditions *(liver disease impairment, chronic renal disease and inflammatory arthritis)*
When to scan

Age is a very important factor in fracture risk. A patient aged 50 with a t-score of −2.5 has a risk of hip fracture over 10 years of 2% compared to a 75 year old whose risk is 17%. In general scanning patients aged <60 may not be cost effective unless there are very strong risk factors for osteoporosis and fracture.

Routine monitoring of response to therapy by serial DEXA scanning is not recommended. Indications for repeat DEXA may include initial very low bone density or significant change in underlying medical condition. In general at least 2 years should elapse before repeating a DEXA scan.

Table 1: When to scan

<table>
<thead>
<tr>
<th>Age</th>
<th>Women</th>
<th>Men</th>
</tr>
</thead>
<tbody>
<tr>
<td>No fracture</td>
<td>Pre-menopause</td>
<td>Only if significant risk factors</td>
</tr>
<tr>
<td>No fracture</td>
<td>Menopause - 60</td>
<td>2 or more risk factors</td>
</tr>
<tr>
<td>No fracture</td>
<td>&gt;60</td>
<td>1 or more risk factors</td>
</tr>
<tr>
<td>Low impact fracture</td>
<td>&lt;60</td>
<td>1 or more risk factors</td>
</tr>
<tr>
<td>Low impact fracture</td>
<td>60-74</td>
<td>Scan</td>
</tr>
<tr>
<td>Low impact fracture</td>
<td>&gt;75</td>
<td>treat empirically (scan if other issues)*</td>
</tr>
</tbody>
</table>

*e.g. polypharmacy, not keen on therapy etc

4 Guideline for the investigation and management of osteoporosis
INTERPRETATION OF DEXA SCAN RESULTS

Results are expressed as a T-score (standard deviation compared to sex matched young adults) or Z score (standard deviation compared to age and sex matched controls). Patients with a T-score of -1 to -2.5 are defined as osteopaenic and T-scores <-2.5 are defined as osteoporotic. For the hip the femoral neck result is used, as this is the best predictor of future hip fracture risk. For the spine the summary value at L2-L4 is used although caution is required if there are crush fractures or other structural anomalies.

If extent of osteoporosis is unexpected consider further investigation for secondary causes. Investigations may include where appropriate FBC/ESR, U/Es/LFTs/Ca, Ig electrophoresis, TFTs, PTH/Vit D, tissue transglutaminase FSH/LH and in men testosterone/free androgen index.
**PRIMARY PREVENTION OF OSTEOPOROTIC FRACTURES**

The prevention of osteoporotic fractures is best achieved by measures which increase and maintain bone mass in young people and which reduce the risk of falls in the elderly and include:

- Health education regarding the importance of diet (*especially dietary calcium*) and weight bearing exercise in children, adolescents and young adults.
- Ensure adequate dietary calcium *(aim for 1-1.2g calcium per day, which is equivalent to 800-1000ml milk per day)*.
- Smoking cessation
- Moderation of alcohol intake
- Measures to reduce the risk of falls in the elderly e.g. addressing environmental hazards, correcting visual impairment and avoiding sedative drugs.
- Consider administering calcium and vitamin D supplements to frail housebound elderly and those in institutional care *(1-1.2g calcium and 800iu vitamin D daily)*.

**TREATMENT OF ESTABLISHED OSTEOPOROSIS**

Assess all risk factors and correct those amenable to change. In particular assess falls risk and if necessary consider appropriate intervention. Encourage regular weight bearing exercise.

See specific algorithms developed from SIGN, NICE and RCP guidelines.
**CALCIUM AND VITAMIN D**

Calcium and vitamin D are effective in reducing the risk of hip fractures in the frail elderly. The combination may have some effects on muscle strength and therefore reducing the risk of falling as well as more direct effects on bone and reversal of sub-clinical hyper-parathyroidism caused by vitamin D deficiency. The recommended doses are 1-1.2g of calcium +/- 800 iu vitamin D.

*Patients with osteoporosis on bisphosphonates, strontium or raloxifene should be considered for supplementation.*

**BISPHOSPHONATES**

The two most effective bisphosphonates are alendronate and risedronate. Both reduce the risk of vertebral and non-vertebral fractures. Both are given once weekly (*alendronate 70mg and risedronate 35mg*). They should be taken first thing in the morning in an upright position and washed down with a large tumbler of water. This reduces the risk of oesophageal irritation. Further medication and food can be taken after 30 mins. *The majority of patients in clinical trials have also required calcium +/- vitamin D.* Fosavance (*weekly alendronate + vit D*) may be an option for patients who are vitamin D deficient but have an adequate calcium intake. Bisphosphonates should be avoided in patients with oesophageal strictures or uncontrolled dyspepsia and if significant renal impairment is present (*creatine clearance <35ml/min*).

Ibandronate is a once monthly treatment that is only licensed for the prevention of vertebral fracture.
**Strontium Ranelate**

Strontium has anabolic and anti-resorptive effects on bone. A sachet of the drug is made up in a tumbler of water and should be taken in the middle of a 4 hour fast or immediately before bed. The SMC recommend its use for osteoporotic women who cannot take bisphosphonates and are more than 75 and have had a fracture or are otherwise at high risk. Strontium should be avoided in patients with significant renal impairment (creatinine clearance <35ml/min).

**Raloxifene**

Raloxifene is a selective oestrogen receptor modulator and can be used for treating postmenopausal spinal osteoporosis. At a dose of 60mg daily there is a significant reduction in vertebral but not non-vertebral fractures. Raloxifene appears to reduce the incidence of oestrogen receptor positive breast cancers but increases the risk of thrombo-embolic disease similar to HRT. Raloxifene has no effect on menopausal vasomotor symptoms. The cost effectiveness of raloxifene is less favourable than bisphosphonates and strontium.

**Hormone Replacement Therapy**

HRT is effective at preventing post-menopausal osteoporosis. However the risks of breast cancer and cardiovascular disease are significantly increased in women on HRT. HRT is no longer recommended for treating/preventing osteoporosis.
**CALCITONIN**

Calcitonin is not generally advised for treatment of osteoporosis due to poor evidence for fracture reduction. Nasal calcitonin 200 IU daily for 30 days may help with pain from an acute vertebral collapse. Calcitonin may also be considered in patients with renal impairment that precludes other therapies.

**TERIPARATIDE**

Teriparatide is an active fragment of parathyroid hormone. It is used to treat severe osteoporosis. There is good evidence that it significantly improves bone density and strength. It is given by daily s/c injection for 18 months. In view of its cost it should only be prescribed by a specialist in osteoporosis.

**OSTEOPOROSIS CLINIC**

There is an osteoporosis clinic run at Wishaw General which takes referrals from across Lanarkshire. Criteria for referral would include; severe osteoporosis, osteoporosis that has not responded to conventional therapy or other metabolic bone diseases.
Commitment or exposure to oral glucocorticoids for $\geq 3$ months

Age $< 65$ years

No previous fragility fracture

Measure BMD
(*DXA scan, hip +/- spine*)

T score above 0

Reassure

General measures

Repeat BMD not indicated unless very high dose of glucocorticoids required

T score between 0 and -1.5

General measures

Repeat BMD in 1-3 yr if glucocorticoids continued

T score -1.5 or lower

Investigations\(^1\)

Age $> 65$ years

Previous fragility fracture or incident fracture during glucocorticoid therapy

General measures

Advising treatment:\(^3\)

- Alendronate (L)
- Alfacalcidol
- Calcitonin
- Calcitriol
- Clodronate
- Cyclic etidronate (L)
- HRT
- Pamidronate
- Risedronate (L)
Secondary prevention adapted from SIGN 71

In MEN and WOMEN ≥ 60 yr + fracture

Vertebral fracture

≥2 vertebral fractures

DXA not essential BUT EXCLUDE tumour/myeloma

Femoral neck T-1 to -1.59 or Lumbar spine T-1 to -1.99

Alendronate + Ca ± vit D
Risedronate + Ca ± vit D
Strontium ♀ + Ca ± vit D

Raloxifene* ♀ + Ca ± vit D

If none of above, 1-1.2g Ca + 800iu vit D + optimise lifestyle (all)

1 vertebral fracture

Femoral neck T≤ -1.6 or Lumbar spine T≤ -2

If T≤ -1.5

Consider repeat DXA 5 yrs later; optimise Ca intake and lifestyle

Non-vertebral fracture

≥2 vertebral fractures

DXA

Femoral neck T-1 to -2.49 or Lumbar spine T-1 to -1.99

If none of above, 1-1.2g Ca + 800iu vit D + optimise lifestyle (all)

1 vertebral fracture

Femoral neck T≤ -2.5 or Lumbar spine T≤ -2

If none of above, 1-1.2g Ca + 800iu vit D + optimise lifestyle (all)

♀ - Female patients only; * - vertebral fracture protection only
See guideline for more drug information
Primary prevention of osteoporosis

**DEXA indicated** *(see guideline text and figure 1)*

- **T > -1**
  - Normal
  - Re-assure

- **T < -1 & > -2.5**
  - Osteopaenia
  - Lifestyle advice

- **T ≤ -2.5**
  - Osteoporosis
  - **Treat**
    - *Weekly bisphosphonate*
    - *For women unable to tolerate bisphosphonates consider strontium or raloxifene*
    - ± *calcium/vitamin D for all*