Management of the patient after an osteoporotic fracture

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These guidelines are for practicing orthopedic surgeons who do not have a special interest in treatment of osteoporosis or prevention of falls, but who should have basic knowledge about how to prevent new fractures.

Background

Since patients with osteoporotic fractures are among the highest risk patients for other osteoporotic fractures they must be taken care of.

Previous osteoporotic fractures have been reported in numerous studies to increase the risk of fractures (hip, spine and other fractures). Therefore patients with a clinically diagnosed fracture run an increased risk of suffering another fracture. In a meta-analysis, Klotzbuecher et al. (2000) studied the literature and made a statistical synthesis of the risk of further fractures in those with a history of a prior fracture. The strongest associations were found between a previous and subsequent vertebral fracture, with a risk about four times greater than in those without a previous fracture. The risk was also higher for other clinical fractures and most studies have reported a relative risk of approximately 2 for other combinations of previous and subsequent fractures, such as of the hip, spine, wrist, or any other site (Table).

The authors concluded that the history of a previous fracture at any site is an important risk factor for subsequent fractures. Patients with a history of a fracture should therefore be evaluated for osteoporosis and risk of fracture.

In the EPIDOS study, Garnero et al. (1998) found that the risk of later fracture in those who had had a prior fracture was similar in those who had a 1 SD (about 10–12%) decrease in age-matched BMD (Z-score = –1). They also showed that addition of—e.g., BMD or biochemical markers to a prior fracture—could add to the evaluation of risk.

Among the studies in the above-noted meta-analysis, there were several from Scandinavia and they also pointed out that patients having a prior fracture run a high risk of another fracture and that these subjects must be taken care of.

In patients with a prior fracture, low BMD predicts the likelihood of a new fracture (Gärdsell et al. 1989). This indicates that it should be useful to add a BMD evaluation in patients with osteoporotic fractures, to detect those who run a high risk of new fractures.

Guidelines for BMD measurements

The AAOS (American Academy of Orthopaedic Surgeons) has started program called "Bone up on bone loss". In the guidelines for treatment of osteoporosis, the importance of taking care of patients having a prior fracture is always highlighted (see, for example, the NOF guidelines (National Osteoporosis Foundation) (www.nof.org)). Their physicians' guide to osteoporosis summarizes the data.

Pooled associations between previous and subsequent fractures. From Klotzbuecher et al. (2000)

Location of previous fracture/Population	Location of subsequent fractures				
	Wrist	Vertebral	All (except spine)	Hip	Pooled
Wrist					
Peri/postmenopausal	3.3 (2.0, 5.3)	1.7 (1.4, 2.1)	2.4 (1.7, 3.4)	1.9 (1.6, 2.2)	2.0 (1.7, 2.4)
Other	3.6 (1.9, 6.7)	7.2 (3.6, 15)	2.0 (1.7, 2.4)	1.5 (1.3, 1.7)	2.6 (1.9, 3.5)
Vertebral					
Peri/postmenopausal	1.4 (1.2, 1.7)	4.4 (3.6, 5.4)	1.8 (1.7, 1.9)	2.3 (2.0, 2.8)	1.9 (1.7, 2.3)
Other	1.4 (1.1, 1.9)	19 (6.5, 55)	2.7 (1.8, 3.9)	2.1 (1.6, 2.7)	2.3 (1.8, 2.9)
Other (all, or specific sites)					
Peri/postmenopausal	1.8 (1.3, 2.4)	1.9 (1.3, 2.8)	1.9 (1.3, 2.7)	2.0 (1.7, 2.3)	1.9 (1.7, 2.2)
Other	–	–	1.4 (1.2, 1.7)	2.1 (1.2, 3.5)	1.7 (1.4, 2.2)
Hip					
Peri/postmenopausal	–	2.5 (1.8, 3.5)	1.9	2.3 (1.5, 3.7)	2.4 (1.9, 3.2)
Other	–	–	2.1 (1.3, 3.4)	1.6 (1.3, 1.9)	1.7 (1.4, 2.0)
Pooled					
Peri/postmenopausal	1.9 (1.3, 2.8)	2.0 (1.6, 2.4)	1.9 (1.6, 2.2)	2.0 (1.9, 2.2)	2.0 (1.8, 2.1)
Other	2.3 (1.7, 3.3)	7.2 (3.6, 15)	1.8 (1.6, 2.2)	1.8 (1.6, 2.2)	2.2 (1.9, 2.6)

Consider all postmenopausal women who present with a vertebral or hip fracture candidates for treatment of osteoporosis. In the section on who should be tested with BMD, it is stated that postmenopausal women who present with fractures should have a BMD performed (to confirm the diagnosis and determine severity of the disease). In those who are candidates for pharmacological treatment, apart from what has been stated before about vertebral and hip fractures, it is also stated that women over the age of 70 having several risk factors (especially those with previous fractures not affecting the hip and spine) run a high enough risk of fracture to start treatment without BMD. In the Swedish National Board of Health and Welfare "State of the Art of Osteoporosis" report (Swedish National Board of Health and Welfare 2000), indications and methods of treatment are also presented (www.sos.se/mars/sta084/sta084.htm).

The Swedish Osteoporosis Society has written guidelines. If one of the major risk factors is present, such as a previous osteoporotic fracture after a low-energy trauma, they recomend a bone density measurement to assess the patient's risk of a fracture risk. Those who have had a vertebral fracture should be treated if the BMD T-score is below –1, and those who have had other types of osteoporotic fractures should be treated if the T-score is below –2. A BMD T-score means the older person's BMD value, compared to the mean value of the same-sex healthy young adult's, expressed as standard deviations. The WHO definition for a diagnosis of osteoporosis is a T score < –2.5

Several other guidelines also show that patients with a prior osteoporotic fracture are a major target group for BMD measurement and treatment.

Guidelines for assessing osteoporosis

Patients should be evaluated (mainly with a BMD scan) to see whether they have sustained a fracture, especially a spine, hip, or wrist fracture, after the age of 50, due to low-energy trauma.

Special attention should be paid to patients who usually have a high risk of osteoporosis, such as those with rheumatoid arthritis, diabetes mellitus, thyroid and intestinal disorders, as well as those on or planning to start glucocorticoid treatment.

Evaluate patients who are clinically suspected of osteoporosis before surgery, especially those scheduled for spinal surgery or total hip replacements.

A BMD measurement should be performed only if the patient is interested in receiving treatment. It is not necessary to measure BMD in the biologically oldest and frailest patients since most of them have a BMD below the T-score of –2.

Assessments

BMD measurement (the "gold standard" at present is the total hip DXA measurement) is used at present although new and more accurate techniques to evaluate bone structure, geometry and strength and their changes during treatment will soon be in general use (such as peripheral QCT devices).

Laboratory tests: hemoglobin, sedimentation rate, serum calcium, TFT (thyroid function tests), creatinine.

If secondary osteoporosis (osteoporosis due to other diseases) is suspected, laboratory tests should focus on these diseases and the patient should be referred to a specialist in osteoporosis.

As mentioned above, we consider that osteoporosis should be treated in postmenopausal women and in men, if they have a vertebral fracture and the T-score is below –1, or, if they have another osteoporotic fracture and the T-score is below –2.

Further management of patients with osteoporotic fractures

Orthopedic surgeons usually face the problem of osteoporosis and fall-related fractures, but when treating an older patient with a fracture, they should have a good basic knowledge how to prevent new fractures. Management of a patient with an osteoporotic fracture can be divided into three parts: 1. treatment of osteoporosis, 2. prevention of falling, and 3. prevention of fractures despite osteoporosis and falling (injury-site protection).

Treatment of osteoporosis

The results of treatment seem to be best in those with a prior fracture and low BMD, at least for bisphosphonates. Most clinical trials have been done in those having a vertebral fracture. In such cases as well as in hip and all clinical fractures, significant reductions have been obtained with biphosphonates and SERMs (Selected Estrogen Receptor Modulators) (raloxifene) in vertebral fractures. It is not only because we know that the treatment works in patients with prior osteoporotic fractures, but there is also strong evidence from large clinical trials that in those with a fracture, the absolute risk of a new fracture is much higher. The risk is the indicator that is used in the number needed to treat (NNT) analysis, and with a high absolute risk it is much more cost-effective to treat than with a low absolute risk, even though the relative risk would be the same. This has been summarized by Johnell (2000).

In a prospective randomized trial with alendronate over 3 years, Liberman et al. (1995) showed that in a subgroup of women without a previous vertebral fracture, 2% of the persons in the placebo group sustained a new vertebral fracture, compared to 1% of those treated with alendronate. In patients with previous fractures, 19% of the subjects in the placebo group and 13% in the treatment group sustained a new fracture. Although the alendronate-induced reduction in the relative risk was slightly lower in those with a previous fracture, the benefit of treating the high-risk patients with a high absolute risk is obvious—the NNT for those with a previous vertebral fracture was 18, compared to 100 for those without a previous fracture.

In the vertebral fracture arm of the Fracture Intervention Trial (FIT) (i.e., all patients had a vertebral fracture at baseline), the fracture rate was reduced from 15% in the placebo group to 8% in the alendronate group during the 3-year treatment (Black et al. 1996). In the other FIT arm (those without a baseline fracture), the absolute fracture risk was much less. In the vertebral fracture arm, risk for hip fracture was reduced by 50%. In the other FIT arm, hip fracture was also reduced by 50%—but only among those in the lowest tertile of BMD (Cummings et al. 1998). Similar findings have been obtained with another bisphosphonate, risedronate (McClung et al. 2001). Thus, the treatment works best in those with a vertebral fracture and low BMD (i.e., in established osteoporosis). They also have a high absolute risk, so it is most cost-effective to treat these patients.

In studies of SERMs, the absolute fracture risk has also been much higher among those with a baseline vertebral fracture.

In conclusion, it is important to realize that these patients are mainly seen in the offices of orthopedic surgeons and no screening has to be done to identify this high risk group. Thus there is no extra cost for detecting these patients, they are already in the health-care system. Treatment has also been shown to be most effective in this group. This means that the physicians who take care of such patients—

mainly orthopedic surgeons—must decide how to treat them, either by themselves or by referring them to a GP. This is also important since today's patients know of available treatments and the patient organizations have an educational program for the general public.

Recommendations concerning treatment

Advise all patients to avoid smoking and participate in weight-bearing or muscle-strengthening exercises, regardless of their age. Weight-bearing or similar exercises should be performed in 20–30 minute sessions 3–4 times/week.

Patients should take adequate amounts of calcium and vitamin D (at least 1000 mg calcium/day and 400–800 IU vitamin D) in food or as supplements. For the biologically oldest, calcium and vitamin D supplements are the only recommended treatments.

Hormone replacement therapy (HRT) can be considered in all postmenopausal women if they have menopausal symptoms and there will be an added benefit in prevention of osteoporosis. Progesterone (gestagen) should be added in women with an intact uterus to reduce the risk of uterine cancer. There are other possible but not proven effects of hormonal replacement therapy, such as reduced risk of coronary heart disease and improved cognitive function. However, the risk of breast cancer is higher. It should be remembered that the fracture reduction are mainly based on epidemiological observational studies.

In large randomized trials, SERMs, raloxifene (60 mg/day), have been shown to reduce the occurrence of spine fractures by 30%. No data are yet available about other fractures. The risk of breast cancer is reduced by about 50%. However, the risk of deep venous thrombosis is increased and raloxifene increases postmenopausal symptoms.

Of bisphosphonates, only alendronate, risedronate and etidronate have been approved for treatment of postmenopausal osteoporosis. Alendronate, dose 10 mg/day, has been shown to reduce the occurrence of hip and vertebral fractures by 50%, but of nonvertebral fractures, only in patients with very low BMD (established osteoporosis) or prevalent vertebral fracture (Black et al. 1996, Cummings et al. 1998). Alendronate has also proved to be effective in steroid-induced osteoporosis. Risedronate is a new drug and has also been tested in large randomized trials. It reduces the occurrence of vertebral fractures and, in women with very low BMD, also of hip fractures (McClung et al. 2001).

Calcitonin is the oldest of the specific bone resorption inhibitors and is used especially in vertebral osteoporosis. However, it is not approved in Sweden.

Summary of recommendations for treating osteoporosis in patients with a low-energy fracture

All patients should avoid smoking and take sufficient amounts of calcium and vitamin D daily. Supplements of calcium and vitamin D should often be added. Weight-bearing and muscle-strengthening exercises for 20–30 minutes, 3–4 times/week should be encouraged as well.

A BMD measurement should be offered to those with an osteoporotic fracture. In patients with low BMD (T-score < -1 if the patient has had a vertebral fracture or T-score < -2 for the other osteoporotic fractures), treatment with drugs that affect bone should be considered, such as HRT, bisphosphonates, SERMs, or calcitonin, depending on the patient's age, sex, general condition and other diseases.

After treatment has been started, the patient should be seen after 4 months for a discussion about compliance with the drug and other problems with osteoporosis. A new BMD measurement is recommended after 2 years. The total duration of treatment with bisphosphonates and SERMs, the new recommended medication, is at present about 5 years since follow-up studies have only been done for 5 years. Only when we have more long-term data will we know whether the treatment should be continued.

Finally, it must be noted that all the above-mentioned scientific data concern women. At present, we have only a few studies in men. However, it has been shown that in men, bisphosphonates (alendronate) have the same effect on BMD as in women, which indicates a similar reduction in incidence of vertebral fracture. Bisphosphonates probably have similar effects in women and men.

Prevention of falls

Since falls by an older adult entail a major risk of osteoporotic fractures, prevention of these is essential (Dargent-Molina et al. 1996, Greenspan et al. 1998). Recent randomized trials have consistently shown that training balance and strength reduce the older person's risk of falls, injurious and not (Campbell et al. 1997, Carter et al 2001). This is to be expected since exercise improves many risk factors connected with falling, such as muscle strength, flexibility, balance, coordination, proprioception, reaction time, and gait—even in very old and frail people (Carter et al. 2001). Thus, orthopedic surgeons should recommend regular weight-bearing exercise for their older patients who have had fractures—not only to maintain bone-health, but also to keep the patients safely on their feet. Reduction in the number and doses of sedatives has also been shown to reduce elderly persons' risk of falling (Carter et al. 2001).

Measures taken to modify many various risk factors simultaneously likewise prevent falls by affecting many intrinsic and extrinsic risk factors in falling (Tinetti et al. 1994, Close et al. 1999). The problem with these measures is that they can not distinguish between the independent role of each modified risk factor, and so it cannot be determined which measure is effective and which is not. Such multifactorial approaches are laborious and their cost-effectiveness has not always been ascertained (Carter et al. 2001).

Prevention of osteoporotic fractures despite osteoporosis and falls (injury-site protection)

Since most (80–90%) hip fractures are caused by sideways fall with direct impact on the greater trochanter of the proximal femur (Parkkari et al. 1999), it is tempting to try to prevent them by a specially designed external hip protector, so that at the time of the fall, the impacting force and energy are weakened and diverted away from the greater trochanter by the protector. Kannus et al. (2000) recently presented the results of a large randomized multicenter trial with the KPH Hip Protector (N = 1801) and showed, with intention-to-treat analysis, that the risk of a hip fracture was 55% less in the protector group (than in the control group), and that by protector efficacy or active treatment analysis, the risk reduction was 84% if the protectors were actually worn at the time of falling. These results are rather encouraging to recommend scientifically tested external hip protectors for high-risk frail elderly people, especially those who have fallen before, had fractures, poor balance, and impaired mobility.

Very little is known about the injury mechanisms of osteoporotic fractures, other than hip fractures. A recent study with controls from the Accident & Trauma Research Center of the UKK Institute, Tampere, Finland, indicates that most osteoporotic upper extremity fractures are caused by a direct, fall-induced impact on the fractured site (Palvanen et al. 2000). Although this finding may help to prevent these fractures by injury-site protection, no such study has been done, and therefore definite recommendations for protecting the older adults' sites other than the hip can not be made at present.

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