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Shifting the focus in fracture prevention from osteoporosis to falls

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Shifting the focus in fracture prevention from osteoporosis to falls

Preventing fractures in older people is important. But **Teppo Järvinen and colleagues** believe that we should be putting our efforts into stopping falls not treating low bone mineral density

Fractures are a rapidly growing problem among older people. Hip fractures alone cost over $20bn (£10bn; €13bn) in the United States in 1997.[1] Any intervention that may reduce the risk of fracture at either the individual or population level therefore warrants critical appraisal. The mainstay of current strategies to prevent fractures is to screen for osteoporosis by bone densitometry and then treat people with low bone density with antiresorptive or other bone-specific drugs.[2-4] However, the strongest single risk factor for fracture is falling and not osteoporosis.[5 6] Despite this fact, few general practitioners will have assessed the risk of falling among their elderly patients or even know how to do it.[7] Risk of falling is also completely overlooked in many important publications on preventing fractures.[4] We argue that a change of approach is needed.

Predictive value of bone density measurements

Bone densitometry does not give reliable estimates of a person's true bone mineral density. The planar scanning principle of dual energy x ray absorptiometry, and assumptions in processing the scan data, can underestimate or overestimate bone mineral density by 20-50%.[8] This means that a patient with a bone mineral density T score of −1.5 may have a true value between −3.0 and 0—that is, a range from clear osteoporosis to normal. Thus, not surprisingly, bone mineral density is a poor predictor of fracture in individuals (fig 1). In addition, when different scanners are used on the same patients, the proportion of patients diagnosed with osteoporosis varies from 6% up to 15%.[9]

Over 80% of low trauma fractures occur in people who do not have osteoporosis (defined as T score ≤−2.5).[11] Even if a T score of −1.5 is used to define osteoporosis, 75% of fractures would still occur in people without osteoporosis.[11] Thus, bone mineral density gives general practitioners little indication which patient will sustain a fracture. In addition, changes in bone density in people taking antiresorptive drugs explain only 4-30% of the reduction in risk of vertebral and non-vertebral fractures.[12]

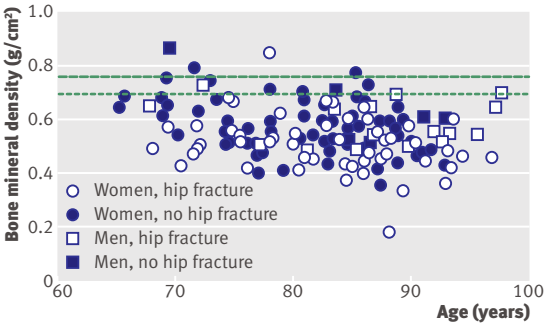

Fig 1 Femoral neck bone mineral density versus age at time of fall in people who did and did not sustain a hip fracture. Dashed lines show 2 SD less than peak bone mass for women (lower line) and men (upper line). Adapted from Greenspan et al[10]

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The fracture index, a simple risk assessment tool based on clinical risk factors (age, previous fracture, mother's hip fracture occurrence, weight, smoking, and ability to rise from a chair without hands) can predict fractures in postmenopausal women as well as bone mineral density.[3] Adding bone mineral density to the index only marginally improves its ability to predict hip or other fractures (see fig 2 on bmj.com).[3]

Absolute fracture risk

Partly because of the limitations of bone densitometry, the World Health Organization is devising a new model to calculate absolute fracture risk. The model combines, age specifically, six clinical risk factors (previous fracture, glucocorticoid use, family history of fracture, current cigarette smoking, excessive alcohol consumption, and rheumatoid arthritis) with bone mineral density to estimate the 10 year probability of hip and other fractures.[13] These probabilities can then be aligned with intervention thresholds for various drugs to combat osteoporosis.

It has been suggested that use of such algorithms would more accurately identify people at high risk of fracture and thus make treatment more cost effective,[13 14] although the evidence to support these claims is insufficient. In addition, high scores in the absolute fracture risk model may be mainly attributable to increased risk of falling rather than skeletal factors. If this proves to be the case, antiresorptive and other bone-specific drugs will not prevent more fractures, as they cannot reduce the risk of falling. The tighter case definition would also leave a larger untreated population and thus may have only a marginal effect on the overall burden of fractures in the population. In fact, tightening the criteria for treatment with bone-specific drugs does not require a specific multifactorial fracture prediction model—the same result would be achieved by moving the T score threshold from, for example, −2.5 to −3.5.

Drug treatment is not a panacea

Bisphosphonates have reduced vertebral fractures in clinical trials of efficacy when about 90% of patients complied with three years of treatment.[4] However, if a T score of ≤ −2.5 is used as the indication for treatment, the cost of preventing one vertebral fracture is

about £23 500 (see table on bmj.com), and 70% of fractures would still occur in the population. Adjusting the threshold to treat more people would sharply increase the costs per averted fracture (see table on bmj.com). One reason for such relatively large costs might be that over half of symptomatic vertebral fractures are related to trauma.[17]

Less evidence exists to support drug treatment to prevent hip fractures than for vertebral fractures. Under idealised circumstances, 577 postmenopausal women must be treated for one year to avert one hip fracture, at a cost of about £120 000.[18] Among women older than 80 (a high risk population), for whom drug therapy would theoretically be most effective, prevention of one hip fracture costs about £28 500 (see table on bmj.com). This case-finding strategy, however, would prevent only about 20% of hip fractures occurring in the total population. Also, the only adequately sized clinical trial assessing the efficacy of bisphosphonates on hip fracture among this older age group, found no significant effect.[19] Additionally, the efficacy, expense, and adverse effects of osteoporosis drugs have not been examined in nursing homes, where many hip fractures occur.[20]

Outside clinical trials, drug treatment is likely to be even less effective. Only 50% of patients are compliant a year after starting treatment, dropping to 20% after three years.[21] An analysis (that assumes an unrealistic 70% compliance with bisphosphonates for five years) showed that we need to screen 731 women aged 65-69 years with bone densitometry and treat 88 of them with oral bisphosphonates (that is, those with osteoporosis) for five years to prevent one hip fracture.[9] Among women aged 70-74, these numbers are 254 and 51, respectively. These figures support our claim that efforts to prevent fractures by bone specific drugs are extremely costly.

Shifting the focus

Numerous studies show that among older people falling, not osteoporosis, is the strongest risk factor for fracture.[5 6 22] When a person falls, the type and severity of the fall (including fall height, energy, and direction) largely determine whether a fracture occurs.[5 6 22] A 1 SD reduction in bone mineral density increases the fracture risk 2-2.5 times. By contrast, a sideways fall increases the risk of hip fracture three to five times, and when such a fall causes an impact to the greater trochanter of the proximal femur, hip fracture risk is raised about 30 times.[22] These fall induced fracture risks are "strong" associations—comparable to those between smoking and lung cancer.

Thus, preventing falls is a logical approach to preventing fracture, but can falls be prevented? Evidence from systematic reviews and meta-analyses of randomised trials shows that at least 15% of falls in older people can be prevented, with individual trials reporting reductions of up to 50%.[6 23] The randomised trials used either a single intervention strategy (such as exercise) or multifactorial preventive programmes that included simultaneous assessment and reduction of predisposing and situational risk factors. Scientific evidence is most consistent for strength and balance training,[24] followed by reduction in the number and doses of psychotropic drugs, dietary supplementation with vitamin D and calcium, and, in high risk populations, assessment and modification of home hazards.[6] In addition, some randomised trials support more specific approaches such as expedited cataract surgery and cardiac pacing where indicated, and use of gait stabilising, antislip devices when walking outdoors under slippery winter conditions.[6 25 26]

IMAGE SOURCE/REX

Exercising can help prevent falls

General practice guidelines for assessment of risk of falling

- Detailed history of current and past falls:
  - Fall in past 12 months
  - Indoor fall
  - Inability to get up after fall
- Review of medical risk factors, especially:
  - Prescribed drugs (especially psychotropic)
  - Visual impairment
  - Cognitive function
- Watch patient walk and move to assess muscle strength, balance, and gait
- Assess time taken to stand from sitting

These interventions can be administered alone or in combination. Prevention will require general practitioners to identify relevant risk factors and organise the appropriate intervention.

Preventing falls is laudable, but the ultimate question is whether it also prevents fractures. Unfortunately, no study into preventing falls has had sufficient power to use fractures as a primary outcome. Nevertheless, some randomised trials have reported that preventing falls among older adults also reduces the numbers of fractures, sometimes by over 50%.[25 27-32] In addition, a meta-analysis of trials of interventions to prevent falls showed that the relative risk of injurious falls could be reduced by the same amount as falls alone (35%).[24] All these findings are, however, preliminary, and we need a large multicentre randomised study to examine the effect of these interventions on fractures.

Preventing fall related fractures in general practice

The risk of falling still remains overlooked in clinical practice[7] as well as in important publications[4] on prevention of fractures. Paradoxically, the WHO omitted assessment of risk of falling from its absolute fracture risk model because it was "too difficult to assess for GPs."[14] This excuse is unacceptable when falling is the main aetiological factor in over 90% of hip fractures. Simple screening identifies populations at risk of falling with reasonable accuracy (box).[33]

As well as recommending interventions such as strength and balance training, sufficient intake of vitamin D and calcium, and smoking cessation, general practitioners should refer people identified as at high risk of

falling for professional environmental assessment—for example, to occupational therapy.[34] People who have difficulty in performing a simple sit to stand test or taking over 13 seconds to complete a simple timed "up and go test"[35] should be referred to a geriatrician or falls clinic for a more comprehensive evaluation.

The physiological profile assessment instrument is a useful, inexpensive tool for evaluating risk of falling.[36] Among older people living in the community, this well validated instrument has a 75% positive predictive accuracy for distinguishing multiple fallers in the next year from those who will fall once or less.[36]

Another question is whether general practitioners should prescribe hip protectors to prevent hip fractures related to falls. Hip protectors are designed to shunt the force and energy of impact away from the greater trochanter, thus preventing fracture.[37] The first randomised clinical trials of hip protectors showed good efficacy, but later, more inconsistent, study results have been attributed to differences in study designs, variation in the devices' capacity to attenuate biomechanical forces, and widely varying user compliance.[20 37] Like antiresorptive drugs, hip protectors seem to have poor long term compliance.[20 37]

SUMMARY POINTS

Falling, not osteoporosis, is the strongest single risk factor for fractures in elderly people

Bone mineral density is a poor predictor of an individual's fracture risk

Drug treatment is expensive and will not prevent most fractures in elderly people

Randomised controlled trials show that falls in older people can be reduced by up to 50%

General practitioners should shift the focus in fracture prevention by systematically assessing risk of falling and providing appropriate interventions to reduce the risk

Nevertheless, current meta-analyses and systematic reviews suggest that in institutions with high rates of hip fracture, the use of hip protectors may reduce hip fractures by 23-60%.[23 37-39] However, there is no evidence of benefit from hip protectors for lower risk people living in the community.[38]

In summary, it is time to shift the focus in fracture prevention from osteoporosis to falls. Falling is an under-recognised risk factor for fracture, it is preventable, and prevention provides additional health benefits beyond avoiding fractures.

Contributors and sources: The authors have a long experience and research interest in methodological issues of bone densitometry, epidemiology, and prevention of osteoporosis, falls, and fractures in elderly people. This article arose out of discussions at several meetings on osteoporosis and hip fracture prevention including, most recently, the Paulo symposium on preventing bone fragility and fractures in Tampere, Finland, May 2006.
TLNJ conceived the paper and wrote the first draft with KMK. All authors contributed to the initial critical review of the literature, planned the rationale for the article, contributed to the serial drafts and agreed the final submission. TLNJ is guarantor.

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Drugs for pre-osteoporosis: prevention or disease mongering?

After looking at data used to support treatment of women with slightly lowered bone mineral density, **Pablo Alonso-Coello and colleagues** argue that proponents have overstated the benefits and underplayed the harms

Osteoporosis is a controversial condition. An informal global alliance of drug companies, doctors, and sponsored advocacy groups portray and promote osteoporosis as a silent but deadly epidemic bringing misery to tens of millions of postmenopausal women.[1] For others, less entwined with the drug industry, that promotion represents a classic case of disease mongering—a risk factor has been transformed into a medical disease in order to sell tests and drugs to relatively healthy women.[2] Now the size of the osteoporosis market seems set to greatly expand, as the push begins to treat women with pre-osteoporosis. These are women who are apparently at risk of being at risk, a condition known as osteopenia that is claimed to affect more than half of all white postmenopausal women in the United States.[3] We examine the evidence from four post-hoc analyses of trials of osteoporosis drugs that is claimed to support this move.

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Expanding an already controversial condition

In 1994 a small study group associated with the World Health Organization defined "normal" bone mineral density as that of young adult women, instantly categorising many older women as having abnormal bones.[4] The working group proposed osteoporosis should be diagnosed when bone mineral density is 2.5 standard deviations below the mean for healthy young adult women and osteopenia be diagnosed when bone density was 1.0 to 2.5 standard deviations below the mean (table 1). The authors of the definition stated these cut-off values were "somewhat arbitrary," and as others have subsequently observed, these criteria were intended for epidemiological studies and not as the clinical treatment thresholds they are being used for today.[6]

As disclosed in the report, the drug industry contributed to the funding of the World Health Organization's study group.[4] The disclosure reads: "This meeting was organized by the WHO Collaborating Centre for Metabolic Bone Disease, Sheffield, England, the World Health Organization and the European Foundation for Osteoporosis and Bone Disease, with financial support from the Rorer