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EMAS position statement: Bone densitometry screening for osteoporosis

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ABSTRACT

Introduction: Osteoporosis and its consequent fractures is a major public health problem.
Aim: To formulate a position statement on the use of bone densitometry in screening postmenopausal women for osteoporosis and in their management.
Materials and methods: Literature review and consensus of expert opinion.
Results and conclusions: Bone densitometry has an important role in screening postmenopausal women for osteoporosis. For higher sensitivity and specificity, there may be a stronger case for screening in later life, depending on the extent to which risk factors add to the value of bone mineral density tests.

Contents

1. Introduction

The aim of this position statement is to provide evidence-based advice for health professionals on the use of bone densitometry in screening postmenopausal women for osteoporosis and in their management.

Osteoporosis is still an often under-recognized disease and considered to be an inevitable consequence of ageing [1]. The morbidity of osteoporosis is secondary to the fractures that can occur in the spine, hip, forearm and proximal humerus. These fractures, especially hip fractures, lead to high morbidity and mortality, as well as an increase in direct costs for health services. The lifetime probability of hip fractures in women at the age of 50 exceeds 20% in developed countries. Vertebral fractures in the elderly can be regarded as a risk factor for subsequent, long-term morbidity, especially in women, and for mortality in both genders [2]. In fact, the

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risk for total osteoporotic fractures is over 40% in postmenopausal women. In high-income countries, osteoporotic fractures account for a larger number of hospital bed days than those for myocardial infarction or breast cancer [3,4].

In the past two decades, there have been major improvements in diagnostic technology and assessment facilities, and it is now possible to detect the disease before fractures occur. There have been advances in the development of treatments of proven efficacy. Stratification of risk is best assessed by consideration of clinical risk factors in conjunction with bone mineral density (BMD). Two individualized fracture risk calculation tools that are increasingly used and are web-based, are the FRAX algorithm [5] and the Garvan fracture risk calculator [6]. These tools integrate BMD and clinical risk factors for fracture risk calculation in individual patients [7]. The FRAX tool has been developed by the World Health Organization (WHO) [8]. It is based on individual patient models, developed from studying population-based cohorts from Europe, North America, Asia and Australia, that integrates clinical risk factors and BMD at the femoral neck. The FRAX algorithms give the 10-year probability of hip fracture and of a major osteoporotic fracture (clinical spine, forearm, hip or shoulder fracture) [9]. The risk of fracture can be calculated on clinical risk factors alone or with femoral neck BMD in addition. Although both tools include straightforward risk factors, such as age, gender, previous fractures, body weight and BMD, they differ in several aspects, for example, the inclusion of other clinical risk factors, fall risks and number of previous fractures. Both models still need to be validated in different populations before they can be generalized to other populations, since the background risk for fractures is definitely population-specific. Further studies are needed to validate their contribution in selecting patients who will achieve fracture risk reduction with anti-osteoporosis therapy [7,10,11].

2. Bone mineral density measurements and the diagnosis of osteoporosis

The most widely validated technique used to assess BMD at multiple sites, including those where osteoporotic fractures predominate, is dual energy X-ray absorptiometry. In conformity with the WHO Scientific Technical Report [12], the term DXA for dual energy X-ray absorptiometry will be used throughout this position statement. DXA is usually applied to sites of biological relevance, including the hip, spine and forearm. DXA gives measurements of BMD that predict fracture with an increase in fracture risk of approximately 1.5/standard deviation (SD) decrease in bone mineral density (termed the gradient of risk). The highest gradient of risk is provided by DXA at the femoral neck for hip fracture prediction, where the gradient of risk is approximately 2.6/SD. In postmenopausal women and men aged 50 years or more, T-scores should be reserved for diagnostic use. The T-score is defined as the number of standard deviations below the average for a young adult at peak bone density, adjusted for gender and ethnicity [13,14].

The World Health Organization has defined the following categories based on bone density:

- Normal bone: T-score greater than −1
- Osteopenia: T-score between −1 and −2.5
- Osteoporosis: T-score less than −2.5
- Established (severe) osteoporosis includes the presence of a non-traumatic fracture.

The aim of risk assessment is to identify patients at particular risk of fracture so that intervention can be considered. The approaches most widely considered are population-based screening and opportunistic case-finding. So far, case-finding strategies have focused on the identification of individuals with low BMD.

3. Population screening

Population screening of apparently healthy individuals identifies that part of the population at greatest risk of fracture who might then be considered for treatment. This is considered to be an extension of the physician–patient relationship in the sense that the intervention is considered appropriate by the individual concerned, and motivation is high, both for the patient and doctor. However, this is expensive and may be difficult to organize. Osteoporosis justifies a screening programme because it is an important public health problem and treatment is available There is clear understanding of the pattern of change in BMD with age, and the contribution of BMD to fracture risk [1].

4. Screening at the menopause

Menopause accelerates bone loss in women. Since the menopause is a readily recognizable event, a number of analyses have been carried out where it has been used as a time when to start screening women for osteoporosis using BMD [15–17]. The cost of screening itself is not the dominant factor, because most treatments are more expensive (though this may vary between countries) and may have side effects. These analyses, in general, do not seem to indicate that BMD mass screening at the time of the menopause is justified. The reasons relate to sensitivity and specificity of the bone density measurement, when applied to a population aged 50 years or more as there is a low risk of hip fracture probability at that age. Ideally, the screening tool should have a high specificity of 90% or more, in order to direct the interventions to those in need, and to avoid treatment of healthy individuals who will never fracture. The problem is that the whole idea of prevention is to detect the subpopulation who would fracture in the future or who are at higher risk of fracture [18]. It can be calculated that, in order to achieve this kind of specificity, 11% of the postmenopausal population might be selected as a high risk category. However, the sensitivity (detection rate) of the test is low, even with relatively high gradients of risk. Assuming that fracture risk increases 1.5-fold for each standard deviation decrease in BMD, sensitivity is only 18%, i.e., 82% of all fractures would occur in individuals designated by the test to be low risk. Therefore, 1000 patients would need to be screened to find 100 needing treatment. The maximal benefit to the community after the menopause using widespread testing with BMD alone appears to be the prevention of about 8% of fractures [12]. In spite of good evidence from randomized controlled studies that treatment is effective [19], compliance is low [20]. Another factor that needs to be considered is the economics of screening using BMD alone. Furthermore only a small proportion of reduction in fractures attributable to treatment is explained by a change in bone mineral density as illustrated by the MORE study of raloxifene [21].

5. Screening later in life

If higher risk individuals can be selected, screening may be more effective. One approach is to select individuals older than 65 years. The rationale is that there is an exponential rise in the risk of fractures with age [22], and older individuals may be more amenable to treatment. The major advantage of screening in later life is to increase the proportion of individuals identified who will sustain fractures and be targeted for treatment. Assuming a gradient risk of 1.5/SD and where 10% of the population could be targeted, the

positive predictive value increases from 11% at the age of 50 years to 24% at the age of 65 years [23].

In North America, it is advocated to screen all women aged 65 years or more, however this is not recommended in many other countries [17]. Health economics, willingness to pay for health care, the availability of DXA, differing clinical practices and attitudes to prevention [24,25], all have a bearing on the various recommendations.

6. Opportunistic screening

The National Osteoporosis Guideline Group (NOGG) [26] provides a clinical guideline for the management of men and women at high fracture risk. This guideline seeks to integrate the expression of a patient's fracture risk as a 10-year probability (the output from FRAX) with the clinical management of osteoporosis, including the need to define thresholds for BMD measurement and treatment [27]. FRAX can assess fracture risk with and without BMD [28].

The NOGG guideline is based on an opportunistic case finding strategy in which physicians are alerted to the possibility of osteoporosis and high fracture risk by the presence of clinical risk factors. Postmenopausal women with a prior fragility fracture should be considered for treatment without the need for further risk assessment, although BMD measurement may sometimes be appropriate, particularly in younger postmenopausal women. It is recommended that assessment by the FRAX tool should be undertaken in:

- Men aged 50 years or more (with or without fracture) but with a WHO risk factor or a BMI < 19 kg/m^2.
- All postmenopausal women without fracture but with a WHO risk factor or a BMI < 19 kg/m^2.

Following the assessment of fracture risk using FRAX, the patient may be classified to be at:

- Low risk, in which case the patient is reassured and reassessed in 5 years or less depending on the clinical context.
- Intermediate risk, in which case the BMD is measured and the fracture risk is recalculated to determine whether an individual's risk lies above or below the intervention threshold.
- High risk, where the patient can be considered for treatment without the need for BMD, although BMD measurement may sometimes be appropriate, particularly in younger postmenopausal women.

7. Where do we stand in Europe?

In 2004, the International Osteoporosis Foundation published a report on screening for osteoporosis in the European Union [29]. It was recommended that DXA scans to diagnose osteoporosis must be reimbursed for all Europeans with risk factors for osteoporosis. However, although there is now a greater awareness on the management of osteoporosis, screening is still not widely available and reimbursed. Since then more countries reimburse DXA but may impose certain conditions. In epidemiological studies, Quantitative Ultrasonometry (QUS) bone measurements have also been used to estimate the osteoporotic fracture risk [30–32]. QUS is a low-cost, non-invasive method, easy to use and safe, since there is no radiation load on the patient. Nevertheless, currently, there is a general a consensus that DXA remains the "gold standard" for the diagnosis of osteoporosis, for prediction of fracture risk.

8. Summary recommendations

- Bone densitometry has an important role in screening postmenopausal women for osteoporosis.
- For higher sensitivity and specificity, there may be a stronger case for screening in later life.
- The FRAX tool will aid the non-specialist in assessing fracture risk.

Contributors

Mark Brincat prepared the initial draft, contributed significantly to the intellectual input and writing of the final version. Jean Calleja-Agius also contributed significantly to the intellectual input and in the preparation of the document. The draft was circulated to all EMAS board members for comment and approval. Production was coordinated by Margaret Rees.

Competing interest

None declared.

Provenance

EMAS position statement.

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