The Controversy over Bone Density Monitoring

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Abstract:

Using of BMD (bone mineral density) test for diagnoses of osteoporosis is important to diagnose right population.

According to different studies we reviewed, the test should be used only in certain population, who fits special criteria, to avoid false positive results, and to get accurate diagnoses.

Osteoporosis increases with certain factors, so checking those patients will help clinically, and it's cost effective too.

Key words:

Osteoporosis, BMD scan, calcium, vit D, major risk factors, minor risk factors.

الملخص:

إن استخدام اختبار BMD (كثافة المعادن في العظام) لتشخيص هشاشة العظام مهم لتشخيص الأشخاص المناسبين.

وفقًا للدراسات المختلفة التي قمنا بمراجعتها ، يجب استخدام الاختبار فقط في عدد معين من الناس وفقاً لمعايير خاصة ، لتجنب النتائج الإيجابية الكاذبة ، والحصول على تشخيص دقيق.

تزداد هشاشة العظام مع عوامل معينة ، لذا فإن فحص هؤلاء المرضى مفيد سريريًا ، وهو أيضًا قليل التكلفة.

الكلمات المفتاحية:

هشاشة العظام ، فحص BMD ، الكالسيوم ، فيتامين D ، عوامل الخطر الرئيسية ، عوامل الخطر الثانوية.

Introduction:

Before we go deep in to the question of, shall I send this patient to BMD test or not, we will talk briefly about osteoporosis and healthy bones.

What is Osteoporosis?

Osteoporosis happens when bone resorption is greater than bone deposition, so when Osteoclasts become more active than Osteoblasts, bone started to lose its calcium and becomes more fragile.

The World Health Organization (WHO) defines osteoporosis as a bone density of 2.5 standard deviations (SDs) below the young healthy adult mean value (T-score ≤ -2.5) or lower. Values between −1 and −2.5 SDs below the young adult mean are termed 'osteopenia'. The rationale for this definition is the inverse relationship between bone mineral density and fracture risk in postmenopausal women and also older men. However, this definition should not be applied to younger women, men or children.

Any reason makes Calcium in blood low for extended periods, will stimulate PTH, and this will increase release of calcium out of bones, and this leads to Osteoporosis.

Calcium is important for transmitting nerve stimuli, muscles' contractions, blood coagulation, and cell division. The bones losing calcium in both genders over years, so women lose 8% of body mass each decade, and men lose 3% each decade.

What is Bone Mineral Density Measurement test:

It's a test measures amount of minerals in bones, by low dose of X ray, most common one is DXA scan.

▪ Dual energy X-ray absorptiometry (DXA) measures areal bone density (mineral per surface area rather than a true volumetric density), usually of the lumbar spine and proximal femur. It is precise, accurate, uses low doses of radiation and is the gold standard in osteoporosis diagnosis. Because of osteophytes, spinal deformity and vertebral fractures, spinal values may be artefactually elevated and should be interpreted with caution in the elderly.

RISK FACTORS FOR OSTEOPOROSIS (Modified from')

There are major and minor criteria or risk factors for patients who needs screening, and we should use this to select patients for BMD test's referral.

*Major Risk Factor*s

• Age 65 years

• Low trauma vertebral compression fracture

• Low trauma fracture over age 40

• Family history of osteoporotic fracture

(especially maternal hip fracture)

• Current systemic glucocorticoid therapy of > 3 months duration

• Malabsorption syndrome

• Primary hyperparathyroidism

• Hypogonadism

• Early menopause (before age 45)

Minor Risk Factors

• Past history of clinical hyperparathyroidism

• Chronic anticonvulsant therapy

• Low dietary calcium intake

• Smoking

• Excessive alcohol intake

• Excessive caffeine intake (e.g. > 4 cups coffee/day)

• Weight < 57 kg

• Short term weight loss > 10% from weight at age 25

• Chronic heparin therapy

• Rheumatoid arthritis

Bone Mineral Density Measurement:

The Question of "Should Bone Mineral Density Measurement done for ever body",

What is the cost effectiveness, and Benefit value of screening of whole

population??

Those are important questions for everyday practice of general practitioners,

family physicians and internists.

As a Physicians we see allot of patients older than 40 years in our daily practice, and many of them are concerned about their bone's strength., so who I will send for further tests.

By reviewing many literatures, BMD scan is not a screening test for whole population, and to get best results, patients should be selected carefully.

By using right criteria, 33.3% of BMD and be avoided. one of those studies, was carried on 3998 people (male and female), and it was done over 20 years, by using right criteria to select patients for BMD, the PPV increased from 11.3% to 15.1% for hip, and from 34.8% to 42.9% for other bone sites. This is significant increase in BMD test's value, when we use right population.

Research problem:

The study is focusing on the criteria for BMD, and who is the eligible patient for BMD test

Aim and objectives:

Aim:

This paper is aiming to guide physicians how to chose patients for Bone Density Test, and

Objectives:

Metanalysis of 3 studies on BMD screening for osteoporosis

Research importance:

The study focuses on the recommends sending eligible patients only, who meet certain criteria, to avoid false positive results, and avoid un-necessary treatment.

Reviewing the Studies supporting our conclusion:

By looking at different studies on screening for osteoporosis, we found that, all agreed to do BMD test only on people meet certain criteria.

This kind of selection is cost effective, and decrease the false positive results, and help giving treatment to right people.

We included those studies in the paper.

1). Johansson H, Oden A, Johnell 0, Jonsson B, de Laet C, Oglesby A, McCloskey EV, Kayan K, JalavaT, Kanis JA (2004). Optimization of BMD measurements to identify high risk groups for treatment--a test analysis. J Bone Miner Res. 2004;19(6):906.

Introduction: The aim of this study was to develop a methodology to optimize the role of BMD measurements in a case finding strategy. We studied 2113 women>or = 75 years of age randomly selected from Sheffield, UK, and adjacent regions. Baseline assessment included hip BMD and clinical risk factors. Outcomes included death and fracture in women followed for 6723 person years.

Materials and methods: Poisson models were used to identify significant risk factors for all fractures and for death with and without BMD and the hazard functions were used to compute

fracture probabilities.

Women were categorized by fracture probability with and without a BMD assessment. A 10-year fracture probability threshold of 35% was taken as an intervention threshold.

Discordance in categorization of risk (i.e., above or below the threshold probability) between assessment with and without BMD was examined by logistic regression as probabilities of reclassification.

Age, prior fracture, use of corticosteroids, and low body mass index were identified as significant clinical risk factors.

Results: A total of 16.8% of women were classified as high risk based on these clinical risk factors.

The average BMD in these patients was approximately 1 SD lower than in low-risk women; 21.5% of women were designated to be at high risk with the addition of BMD. Fifteen percent of all women were reclassified after adding BMD to clinical risk factors, most of whom lay near the intervention threshold.

When a high probability of reclassification was accepted (without a BMD test) for high risk to low risk (p1<or = 0.8) and a low probability accepted for low to high risk (P2<or = 0.2), BMD tests would be required in only 21% of the population.

Conclusion: We conclude that the use of clinical risk factors can identify elderly women at high fracture risk and that such patients have a low average BMD. BMD testing is required, however, in a minority of women--a fraction that depends on the probabilities accepted for classification and the thresholds of risk chosen. These findings need to be validated in other cohorts at different ages and from different regions of the world.

Statistician, Romelanda, Sweden.

2) Cadarette SM, Jaglal SB, Murray TM, McIsaac WJ, Joseph L, Brown JP, Canadian Multicenter Osteoporosis Study (2001). Evaluation of decision rules for referring women for bone densitometry by dual-energy x-ray absorptiometry. JAMA. 2001;286(1):57.

Context: Identification of women with low bone mineral density (BMD) is an important strategy in reducing the incidence of osteoporotic fractures. However, screening all women is not recommended.

Objectives: To assess the diagnostic properties of 4 decision rules--Simple Calculated Osteoporosis Risk Estimation (SCORE), Osteoporosis Risk Assessment Instrument (ORM, Age, Body Size, No Estrogen (ABONE), and body weight less than 70 kg (weight criterion) -for selecting women for dual-energy x-ray absorptiometry (DXA) testing and to compare results with recommendations made in the National Osteoporosis Foundation (NOF) practice guidelines.

Design and setting: Analysis of data from the Canadian Multicenter Osteoporosis Study, a

population-based community sample collected from 9 study centers across Canada between February 1996 and September 1997.

Participants: Postmenopausal women aged 45 years or older (N = 2365) without bone disease who had DXA data for the femoral neck, data to apply selection criteria, and who were not currently taking estrogens or who had been taking hormone replacement therapy for 5 or more years.

Main outcome measures: Sensitivity, specificity, and area under the receiver operating characteristic (AUROC) curve of each of the 4 decision rules and the NOF guidelines for identifying women with a BMD T score of less than -1.0 SD, less than -2.0 SD, and no more than -2.5 SD at the femoral neck, and percentages of women recommended for testing, stratified by BMD level and age.

Results: The percent of women with a BMD T score less than -1, less than -2, and no more than -2.5 were 68.3%, 25.4%, and 10.0%, respectively. The AUROC curves were greatest using SCORE and ORAI.

The sensitivity for identifying women with a BMD T score of less than -2.0 was 93.7% (95% confidence interval [CI], 91.8%-95.6%) using the NOF guidelines and was 97.5% (95% CI,

96.3%-98.8%), 94.2% (95% CI, 92.3%-96.1%), 79.1% (95% CI, 75.9%-82.3%), and 79.6% (95% CI, 76.4%-82.8%), respectively, using the SCORE, ORAI, ABONE, and weight criterion. However, the NOF guidelines also resulted in 74.4% (95% CI, 71.3%-77.6%) of women with a normal BMD (T score of -1.0 or higher) being tested compared with 69.2% (95% Cl, 65.9%-72.5%), 56.3% (95% CI, 52.7%-59.8%), 35.8% (95% CI, 32.4%-39.2%), and 38.1% (95% CI, 34.6%-41.6%), respectively, using the 4 decision rules. Assessments suggest that ABONE and weight criterion are not useful case-finding approaches.

Conclusion: The SCORE and ORAI decision rules are better than the NOF guidelines at targeting BMD testing in high-risk patients. The acceptability of these rules in clinical practice merits further investigation given their potential effect on the use of densitometry services.

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3) Cadarette SM, Jaglal SB, Kreiger N, McIsaac WJ, Darlington GA, Tu JV (2000). Development and validation of the Osteoporosis Risk Assessment Instrument to facilitate selection of women for bone densitometry. CMAJ. 2000;162(9):1289.

Background: Although mass screening for osteoporosis is not recommended among postmenopausal women, there is no consensus on which women should undergo testing for low bone mineral density. The objective of this study was to develop and validate a clinical tool to help clinicians identify which women are at increased risk for osteoporosis and should therefore undergo further testing with bone densitometry.

Methods: Using Ontario baseline data from the Canadian Multicenter Osteoporosis Study, we identified all cognitively normal women aged 45 years or more who had undergone testing with dual energy x-ray absorptiometry (DXA) at both the femoral neck and the lumbar spine (L1-L4).

Participants who had a previous diagnosis of osteoporosis or were taking bone active medication other than ovarian hormones were excluded. The main outcome measure was low bone mineral density (T score of 2 or more standard deviations below the mean for young Canadian women) at either the femoral neck or the lumbar spine. Logistic regression analysis and receiver operating characteristic (ROC) analysis were used to identify the simplest algorithm that would identify women at increased risk for low bone mineral density.

Results: The study population comprised 1376 women, of whom 926 were allocated to the development of the tool and 450 to its validation. A simple algorithm based on age, weight and current estrogen use (yes or no) was developed. Validation of this 3-item Osteoporosis Risk Assessment Instrument (ORAI) showed that the tool had a sensitivity of 93.3% (95% confidence interval [C1]86.3%-97.0%) and a specificity of 46.4% (95% Cl 41.0%-51.8%) for selecting women with low bone mineral density. The sensitivity of the instrument for selecting women with osteoporosis was 94.4% (95% Cl 83.7%-98.6%).

Use of the ORAI represented a 38.7% reduction in DXA testing compared with screening all women in our study.

Interpretation: The ORAI accurately identifies the vast majority of women likely to have low bone mineral density and is effective in substantially decreasing the need for all women to undergo DXA testing.

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Conclusion:

So, putting check list for sending patients to BMD test, is important guide to physicians to send right population for this test.

Most eligible patients will have one major factor, or two minor factors.

Choosing right population for this test is cost effective, and brings the best results, without many false positive results, and helps all practitioners answering the question, who needs BMD test.

References

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