

Repeated vertebral augmentation for new vertebral compression fractures of postvertebral augmentation patients: a nationwide cohort study – how useful is the current clinical gold standard for fracture risk?

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Dear editor

Further to the recent publication on the “Repeated vertebral augmentation for new vertebral compression fractures of postvertebral augmentation patients: a nationwide cohort study”,¹ current data highlight the limitations of dual-energy X-ray absorptiometry scans. In this context, at best, dual-energy X-ray absorptiometry scans (which measure bone mineral density) can account for no greater than 50% of overall bone strength (defined as the ability to resist fracture). This is because the resulting images are two-dimensional and therefore unable to capture skeletal micro-architecture, which also contributes to bone strength.²

A better clinical measure of overall bone strength that more accurately reflects the ability of that bone to resist fracture and hence fracture risk reflect an unmet need and is urgently required. Recent evidence suggests that micro-computed tomography scans, which enable three-dimensional imaging, might provide a solution but use so far has necessarily been limited to ex vivo assessment owing to radiation hazards as well as technical and accessibility issues.^{3,4} However micro-computed tomography images have identified bone volume fraction (the volumetric distribution of bone mass) as a strong determinant of bone strength ($r^2 > 0.8$).^{5,6}

Further, perhaps other potential tools, alone or in combination with imaging may also play a role. For example, serum biomarkers of bone metabolism^{7,8} along with other imaging modalities such as magnetic resonance imaging could capture the complex factors that make up bone strength.⁹ Preexisting algorithms like the FRAX (a fracture risk assessment tool calculator)¹⁰ might help reduce the overprediction issue currently faced.

With regard to the aforementioned evidence, there is a pressing need to consider first how we use bone densitometry in the diagnosis of osteoporosis in prostate cancer patients, before the National Health Service itself becomes fractured.

Disclosure

The authors report no conflicts of interest in this communication.

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Authors' reply

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Dear editor

We thank the authors for their interest and comments regarding our article.¹ The diagnosis of osteoporosis can be made using conventional radiography and by measuring the bone mineral density (BMD).² The most popular method of measuring BMD is dual-energy X-ray absorptiometry (DEXA) scans. DEXA scan is currently recommended by the World Health Organization; however, it maybe not a gold standard. The accuracy of this density estimate is affected by many factors. For example, smaller people with smaller bones will lower the scores, machines from different manufacturers use different algorithms and yield noncomparable results, and anatomic abnormalities, such as previous spine surgery or compression fractures, will also skew the measurement. DEXA calculates BMD using an area; it is not an accurate measurement of true BMD, which is mass divided by a volume. It is unable to represent the skeletal micro-architecture, which also contributes to bone strength.³ In one study, some other technologies such as peripheral quantitative computed tomography and micro-computed tomography were able to improve the ability to assess structural parameters of cancellous and cortical bone.⁴

Recently, some progress has been made in measuring biomarkers of bone metabolism. Biomarkers of bone

metabolism are broadly divided into two categories:⁵ markers of bone resorption, which reflect osteoclast activity and are for the most part degradation products of type I collagen; markers of bone formation, which reflect osteoblast activity and are byproducts of collagen synthesis, matrix proteins, or osteoblastic enzymes. These biomarkers can be easily measured in serum or urine.

Biomarkers of bone resorption are significantly elevated in postmenopausal women with osteoporosis, but the biomarkers of bone formation are not elevated and may indeed be decreased.^{6,7} Biomarkers seem to be promising for prediction of bone loss, fracture, and response to therapy. However, their use alone to predict fracture and for osteoporosis diagnosis has yet to be established.⁸

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