Usefulness of trabecular bone score in a misdiagnosed case of osteoporosis:
clinical image of a woman with multiple fractures

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Title: Usefulness of trabecular bone score in a misdiagnosed case of osteoporosis: clinical image of a woman with multiple fractures

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Short title: TBS in clinical practice

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Trabecular bone score (TBS) is a new diagnostic tool, which improves identification of new patients, who are at risk of fractures due to the deteriorated bone microarchitecture. So far, bone mineral density (BMD) assessment is the gold standard for osteoporosis diagnosis. However, according to statistics, a number of fractures occur in patients with osteopenia [1]. In addition, TBS has been considered a BMD independent risk factor for fractures. It helps identify patients at high risk of fractures.

We report a case of 68-year old, postmenopausal women, who suffered from pelvic, thoracic and lumbar spine pain without any previous injury. Computed tomography revealed advanced bone loss, compression fractures of the L1, L2, L5 vertebral bodies, hemangioma in L3 vertebral body, fractures of the Th10, Th11 vertebral bodies and of the lower right pubic bone branch and lateral surface of sacral bone. Basic laboratory tests, calcium, phosphorus, vitamin D, thyroid stimulating hormone (TSH), parathyroid hormone (PTH) concentrations, serum protein electrophoresis, calcium and phosphorus 24-hour excretion remained within normal limits. Additionly patient suffered from heartburn and gastroscopy revealed gastroesophageal reflux. Dual X-ray absorptiometry (DXA) of the spine was performed (Fig.1A), unfortunately L1, L2, L3 vertebral bodies could not be evaluated because of compression fractures in L1, L2 and hemangioma in L3. DXA of the proximal femur revealed total hip T-score (-1.7) corresponding to osteopenia (Fig. 1B). Being convinced that the patient has a severe osteoporosis the distal one-third of radius DXA of the non-dominant forearm was performed, it indicated osteopenia: T-score value (-1.9) (Fig. S1). In further examination trabecular bone score (TBS) of the spine was evaluated and revealed strongly deteriorated bone microarchitecture (Fig.1C).

TBS evaluation is possible through a software which is compatible with densitometers. It helps to assess the microarchitecture of trabecular bone on the spine DXA images. It shows the bone texture inhomogeneity (“holes” and “fills”). Studies have shown an incremental improvement in fracture prediction when TBS is used with Fracture Risk Assessment Tool (FRAX) [2]. Official position of International Society of Clinical Densitometry (ISCD) states, that TBS values are associated with
vertebral, proximal femur and other major osteoporotic fracture risk in postmenopausal women and in men over the age of 50 years. TBS can be used with FRAX calculator to predict fractures. However, TBS should not be used alone to decide on a treatment in clinical practice, because so far it is not included in official guidelines [2, 3]. The advantage of TBS is an absence of falsely high results due to osteoarthritis. Furthermore TBS may play a role in the evaluation of fracture risk in cases of secondary osteoporosis (i.e. primary hyperparathyroidism, glucocorticoid-induced osteoporosis, etc) [2, 4, 5].

In our case, TBS L1-L4 numerical value was 1.080, which points to strongly deteriorated bone microarchitecture. Values above 1.35 are considered correct, between 1.2-1.35 intermediate and below 1.2 incorrect, indicating osteoporosis [4].

The patient received denosumab due to contraindications for oral bisphosphonates.

Our case proves that TBS identifies patients, who are presently underdiagnosed, because they do not meet the BMD criteria of osteoporosis.

References:

2. Kanis J.A., Cooper C., Rizzoli R., Reginster J.-Y. European guidance for the diagnosis and management of osteoporosis in postmenopausal women Osteoporosis International 2019; 30:3-44
3. Martineau P, Leslie WD. The utility and limitations of using trabecular bone score with FRAX. Curr Opin Rheumatol 2018; 30:412-419
Figures:

Figure 1A Report of lumbar spine dual X-ray absorptiometry

T-score value of (-2.3) indicates osteopenia. Report is not suitable for analysis due to hemangioma in L3 vertebral body and compression fractures in L1, L2 vertebral bodies. Arrow on Fig. 1 shows hemangioma. Typical of hemangioma is significantly lower bone mineral density value in L3 compared to adjacent vertebrae.

<table>
<thead>
<tr>
<th>Region</th>
<th>BMD [g/cm²]</th>
<th>T-score</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1</td>
<td>0.809</td>
<td>-1.6</td>
</tr>
<tr>
<td>L2</td>
<td>0.800</td>
<td>-2.1</td>
</tr>
<tr>
<td>L3</td>
<td><strong>0.704</strong></td>
<td><strong>-3.5</strong></td>
</tr>
<tr>
<td>L4</td>
<td>0.832</td>
<td>-2.1</td>
</tr>
<tr>
<td>Total</td>
<td>0.791</td>
<td>-2.3</td>
</tr>
</tbody>
</table>
**Figure 1B** Report of proximal femur dual X-ray absorptiometry.

T-score value of (-1.7) indicates osteopenia.

<table>
<thead>
<tr>
<th>Region</th>
<th>BMD [g/cm²]</th>
<th>T-score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neck</td>
<td>0.690</td>
<td>-1.4</td>
</tr>
<tr>
<td>Total</td>
<td>0.730</td>
<td>-1.7</td>
</tr>
</tbody>
</table>
Figure 1C Report of lumbar spine trabecular bone score.

Trabecular bone score L1-L4 value of (1.080) means strongly deteriorated bone microarchitecture.