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Research article

The role of rehabilitation and anabolic treatment in severe osteoporosis associated with significant vitamin D deficiency – case report

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Abstract: It is well known that vitamin D deficiency increases the risk of osteoporosis and that vertebral compressions fractures are a manifestation of osteoporosis. This paper presents the case of a patient with severe osteoporosis associated with vitamin D deficiency who developed over the course of two years multiple vertebral compression fractures. Method: We present the case of a 76-year-old caucasian female diagnosed with osteoporosis and significant vitamin D deficiency who was investigated for mechanical pain and functional deficit at the level of the spine and walking disorders. The patient was hospitalized in our Rehabilitation department twice. At the first hospitalization two years ago, the deficiency of vitamin D was found and the treatment was initiated. During the second hospitalization, biochemical and radiological investigations were per-formed to establish the diagnosis. Numerous vertebral compression fractures were dis-covered which were not revealed in the imaging investigations performed two years earli-er. She underwent symptomatic and appropriate medical rehabilitation treatment. Results and discussion: The evolution was favorable after the hospitalization period, with a decrease in pain and functional deficit, as well as walking improvement. After endocrinological consultation it was decided to initiate therapy with Teriparatide which can decrease the risk of future fractures and reduce the back pain. Conclusions: Adequate and prompt treatment of vitamin D deficiency and osteoporosis is very important to avoid vertebral compression fractures or other complications of this disease. Physical and rehabilitation medicine also plays an important role in management of these patients.

Keywords: osteoporosis, vitamin D deficiency, vertebral compression, teriparatide

1. Introduction

Vitamin D deficiency causes secondary hyperparathyroidism and bone loss, leading to osteoporosis and fractures. It also causes a decrease in muscle strength, balance and neuromuscular function, increasing the risk of falling [1].

Osteoporosis and vitamin D deficiency can cause significant disability and affects the quality of life. Therefore a proper management is necessary [2].

Several studies demonstrated that vitamin D deficiency correction leads to increased bone mineral density and reduced fracture incidence [3].

Teriparatide is an anabolic treatment for osteoporosis recommended in those patients with prior fragility fractures or indicators of high fracture risk. This drug reduces the risk of vertebral compression fractures and also helps to reduce back pain [4].

Physical therapy has been shown to be useful in osteoporosis by improving movement, reducing the risk of falls, and increasing bone density with weight-bearing activity [5,6].

1. Results

The magnetic resonance imaging of the lumbar spine Figure 1 performed at the first hospitalization two years ago, when osteoporosis was diagnosed, did not reveal any vertebral compression, but some disc protrusions.

Figure 1. The magnetic resonance imaging of the lumbar spine: C4-C5 and C5-C6 disc protrusions with anterior medullary contact and bilateral recessive root contacts, minimal cervical and upper dorsal hydromyelia, degenerative changes of the intervertebral discs L3-L4-L5, L4-L5 circumferential disc protrusion with bilateral recessive root contacts, L5-S1 medial disc protrusion with bilateral interrecessive root contact.

The X-ray examination Figure 2 of the lumbar spine (anterior and profile) from the last hospitalization in our clinic revealed: vertebral static disorders, diffuse demineralization, multiple vertebral compressions, degenerative changes, and calcification of the abdominal aorta.

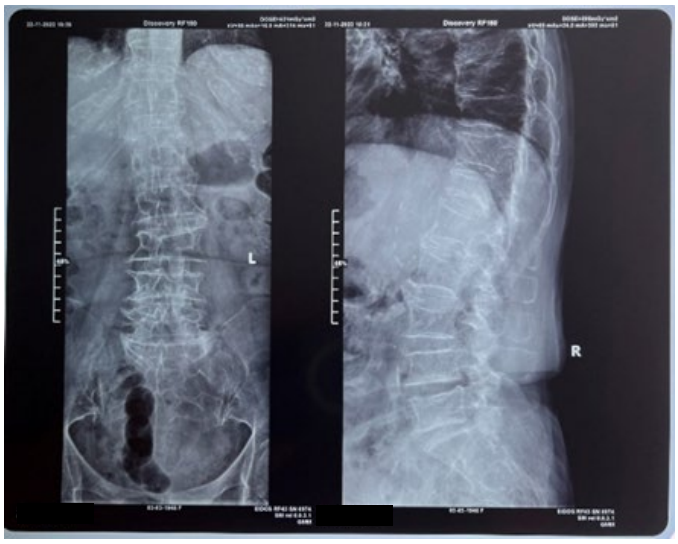

Figure 2. The X-ray examination of the lumbar spine (anterior and profile): diffuse bone demineralization, osteosclerosis of the vertebral plateaus, levoconvex lumbar scoliosis and dextroconvex thoracic scoliosis, multiple vertebral compressions predominantly at the level of the T12, L3, L4 vertebrae, narrowing of the intervertebral space L4-L5, lateral and anterior osteophytes, calcification of the abdominal aorta.

The results of these tests showed normal values of thyroid hormones, cortisol, parathormone, osteocalcin and beta-crosslaps, as well as an insufficiency of 25 OH-hydroxy

vitamin D. T-score on Dual-energy X-ray absorptiometry (DXA) revealed a value of -3.3 in the right hip, -2.9 in the left hip and -4.0 in the left forearm Table 1,2,3,4.

Table 1. Bone mineral density testing in the distal third of the left forearm

DXA: T-score in the distal third of the left forearm (Standard Deviations)	
Two years ago	- 4.2
At the last hospitalization	- 4.0

Table 2. Bone mineral density testing in the hips

DXA: T-score in the hips (Standard Deviations)	
Right hip	*-3.3*
Left hip	*-2.9*

Table 3. 25 hydroxy- vitamin- D values

25 hydroxy vitamin D values	
Two years ago	9,6 (30-100 ng/ml)
At the last hospitalization	22 (30-100 ng/ml)

Table 4. Biochemical analysis values

Biochemical analysis values performed at the last hospitalization	
Plasma Cortisol AM	9,25 (5,27-22,45 μg/dl)
Free – T4	1,06 (0,89-1,76 ng/dl)
TSH	1,077 (0,5-4,78 mlU/L)
Parathormon	33,2 (18,5-88 pg/ml)
Osteocalcin	46,39 (13,0-48,0 ng/ml)
Beta-CrossLaps	0,927 (0,104-1,008 ng/ml)

2. Discussion

The major etiological factor in osteoporosis is sexsteroid deficiency in both women and men [7]. Vitamin D deficiency may increase the risk of redution bone mineral density and cause or exacerbate osteoporosis [8].

In our patient, the severe vitamin D deficiency worsened the osteoporosis and led to the occurrence of several vertebral fractures. Treatment with teriparatide was decided to reduce the risk of further vertebral fractures and to reduce back pain.

There are many studies that provide important information about the efficacy of teriparatide for osteoporosis treatment [2].

Treatment with teriparatide can be recommended only after a rigorous hormonal evaluation that includes the dosage of PTH, 25 OH-hydroxy vitamin D, calcemia, calciuria, phosphoremia, osteocalcin and beta-crosslaps, the morphological evaluation of parathyroids to exclude a possible primary hyperparathyroidism [9].

A study including 321 patients with osteoporosis and percutaneous kyphoplasty post vertebral compression fracture revealed that Teriparatide therapy prevents, but not completely, new vertebral compression fractures; but good efficacy is reported on increasing quality of life and reducing back pain. Its effect during therapy seems to be maintained even 12 months after its discontinuation [10].

Another study comparing therapies with a bisphosphonate (risendronate) and parathormone analogue (teriparatide) shows that: in post-menopausal women with severe osteoporosis, the risk of new vertebral and clinical fractures is significantly lower in patients receiving teriparatide than in those receiving risedronate [11].

A 2021 study compares the therapeutic effects of teriparatide with calcium and vitamin D3 supplements, particularly in reducing pain, in patients with osteoporotic vertebral fractures. Teriparatide showed better therapeutic effect. However, more adverse events were found in Teriparatide group, but symptoms were relatively mild and of short duration [12,13].

Lost bone in osteoporotic patients increases the risk of fractures and back pain, and decreases quality of life. In a recent study it is revealed that teriparatide was found to increase the quality of life in these patients (measured with the European Quality of Life Questionnaire) [14]. During hospitalization, the patient followed medical rehabilitation treatment, the evolution being favorable with improvement of symptoms. Measures of osteoporosis rehabilitation play an important role in the management of this patient. Studies have shown that physiotherapy and physical activities increase bone mineral density and reduce spinal pain [15,16]. Moreover, the use of physical agents in rehabilitation treatments do not have the adverse effects of drugs and represent optimal therapeutic alternatives [17,18].

3. Material and Methods

We report the case of a caucasian female, aged 76 years, admitted in the our Rehabilitation department for mechanical pain and functional deficit at the spine, especialy in the low back, and walking disorders. The study was approved by the Ethical Committee of the Academic Emergency Hospital of Sibiu (approval no. 2995 from 09.02.2023).

From the patient's personal history we mention three natural births and menopause onset at 48 years old. The patient is known with essential hypertension, ischemic heart disease and chronic gastritis.

The patient is also known with generalized osteoarthritis for which she underwent medical treatment with painkillers and non-steroidal anti-inflammatory drugs during the painful periods of exacerbation, and two years ago she is also undergoing medical rehabilitation for the first time in our department. On this occasion, paraclinical investigations were performed and she was diagnosed with severe osteoporosis (T-score on osteodensitometry in the distal third of the left forearm = -4,2) and 25 OH-hydroxy vitamin D deficiency (a value of 9,6 ng/ml). Vitamin D supplement treatment was recommended.

At the time of the admission after two years the patient was conscious and cooperative, with intact comprehension, with a heart rate of 72 beats per minute and blood pressure of 130/70 mmHg.

Clinical examination revealed: patient with an analgesic anteflexion of the trunk; pronounced thoracic kyphosis; moderate lumbar vertebral syndrome with lumbar rectitude, dorso-lumbar scoliosis levoconvex in the lumbar region and dextroconvex in the dorsal region, tenderness to percussion of spinous apophyses, a value of 10/11 centimeters at Schober test, bilateral negative Lasegue test, global osteotendinous hyperreflexivity.

It was observed: shoulders with crepitus on mobilization and algic loss of range of motion; hips with reduced mobility for abduction (35 degrees in right hip and 30 degrees in left hip) and internal rotation (20 degrees in right hip and 10 degrees in left hip); knees with crepitus on mobilization and tenderness on palpation of the internal joint interline on the left side; bilateral hallux valgus; Heberden and Bouchard nodules; difficult and unsteady gait.

During the last hospitalization in our service the patient underwent endocrinological consultation and further investigations were recommended. So, a series of thyroid hormones (TSH - Thyroid-stimulating hormone, Free-T4 - thyroxine hormone), plasma cortisol (8:00 am), osteocalcin, beta-crosslaps, 25 OH-hydroxy vitamin D and parathormone (PTH) were dosed. DXA was also performed on bilateral hips and left forearm.

The patient received symptomatic medication and followed an individualized rehabilitation program, the evolution being slightly favorable. The rehabilitation objectives were: improving disability, preventing falls, relieving pain, improving paravertebral, gluteal and abdominal muscle tone and strength, walking training. The patient underwent analgesic physical therapy and specific kinetic exercises.

The following were recommended for discharge: a diet rich in vitamins and minerals, the continuation of specific kinetic exercises, a dose of Vitamin D3 of 2000 units once a day, and initiation of teriparatide therapy as recommended by the endocrinologist.

4. Conclusions

In conclusion it is important to early diagnose osteoporosis and vitamin D deficiency and also to treat them promptly and effectively. This can be a method of preventing vertebral compression fractures. Teriparatide is useful for patients with very high risk for fractures both in lumbar spine and femoral neck as well. Medical rehabilitation is necessary and very important for osteoporotic patients.

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All authors had equal contribution in this paper.

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Institutional Review Board Statement: The study was approved by the Ethical Committee of the Balneal and Rehabilitation Sanatorium of Techirghiol, Rehabilitation Division (approval no. 2995 from 09.02.2023), and complied with the revised ethical guidelines of the Declaration of Helsinki.

Informed Consent Statement: Informed consent was obtained from the subject involved in the study.

Data Availability Statement: Not applicable.

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Conflicts of Interest: The authors declare no conflict of interest.

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