Pregnancy and Lactation-Associated Osteoporosis: A Case Report

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Abstract   Pregnancy and lactation-associated osteoporosis (PLO) is a rare but severe form of premenopausal osteoporosis, occurring predominantly during the last trimester of pregnancy or the first months postpartum. **Purpose of the Study:** In this study, we report a case of osteoporosis associated with pregnancy and lactation. **Materials and Methods:** Laboratory biochemical studies included: determination of total calcium, phosphorus, vitamin D, alkaline phosphatase, parathyroid hormone (PTH), creatinine, ALT, and AST levels in the blood, as well as biochemical markers of bone remodeling - β-CrossLaps, NTx (N-telopeptide), osteocalcin, OPG, RANKL, P1CP, hormone D, and calcitonin (determined using an automatic ELECSYS analyzer through electrochemiluminescent analysis and ELECSYS kits). **Results:** PLO is a rare clinical condition and should be considered in the differential diagnosis of patients with lower back pain during or after pregnancy. Although not listed as a diagnostic criterion, excluding other causes of osteoporosis and understanding the progressive clinical course is necessary and beneficial in the diagnostic process. At the same time, monitoring and assessing the effectiveness of PLO intervention is also very important.

Keywords   Fractures, Compression, Osteoporosis, Pregnancy

1. Introduction

Pregnancy and lactation-associated osteoporosis (PLO) is a rare but severe form of premenopausal osteoporosis, occurring predominantly during the last trimester of pregnancy or the first months postpartum. Preliminary estimates indicate an incidence of 4-8 cases per 1,000,000 women, though this rate may be higher as PLO often remains undiagnosed [1,2,3].

The most common symptom of PLO is acute lower back pain due to bone marrow edema and vertebral fractures. MRI reveals multiple vertebral fractures (VF) and, less commonly, various types of hip joint involvement [3,4,5].

Pregnancy, childbirth, and lactation cause a series of changes in calcium metabolism and bone tissue. Disruptions in calcium metabolism can trigger the development of osteopenia or osteoporosis in the absence of adequate treatment [6,7,8].

In Uzbekistan, research concerning pregnancy and lactation-associated osteoporosis has not been conducted previously.

2. Purpose of the Study

In this study, we report a case of osteoporosis associated with pregnancy and lactation.

3. Materials and Methods

Laboratory biochemical studies included: determination of total calcium, phosphorus, vitamin D, alkaline phosphatase, parathyroid hormone (PTH), creatinine, ALT, and AST levels in the blood, as well as biochemical markers of bone remodeling - β-CrossLaps, NTx (N-telopeptide), osteocalcin, OPG, RANKL, P1CP, hormone D, and calcitonin (determined using an automatic ELECSYS analyzer through electrochemiluminescent analysis and ELECSYS kits).

Bone mineral density was assessed by dual-energy absorptiometry (DEXA) using the Prodigy bone densitometer by GE Lunar Corporation, USA. This study evaluated the effectiveness of the treatment being conducted.

The measurement results were expressed in absolute values of BMD (bone mineral density - g/cm²) and as a T-score, according to the WHO's generally accepted criteria for diagnosing osteoporosis. Measurements were taken in two standard skeletal regions: the lumbar spine (first four vertebrae L1-L4) and the proximal femur. In interpreting the data for osteoporosis diagnosis of the spine, the Total indicator is assessed in standard deviation units. For evaluating the increase in BMD against the background of osteoporosis pharmacotherapy, the absolute BMD indicator reflecting

bone mineral density was used.

4. Results

The first pregnancy occurred at the age of 22. During pregnancy, there was no toxicosis. The delivery was natural at 37-38 weeks of pregnancy. Breastfeeding duration was 3 months. A 23-year-old woman presented with complaints of

moderate back pain, which began in the last trimester of pregnancy. A week after delivery, the back pain intensified, interfering with childcare and daily activities. Two months postpartum, the patient consulted an orthopedic surgeon, who referred her for an MRI of the lumbosacral spine.

The MRI conclusion indicated signs of a compression fracture of the Th2 vertebral body. The patient was recommended to consult an endocrinologist.
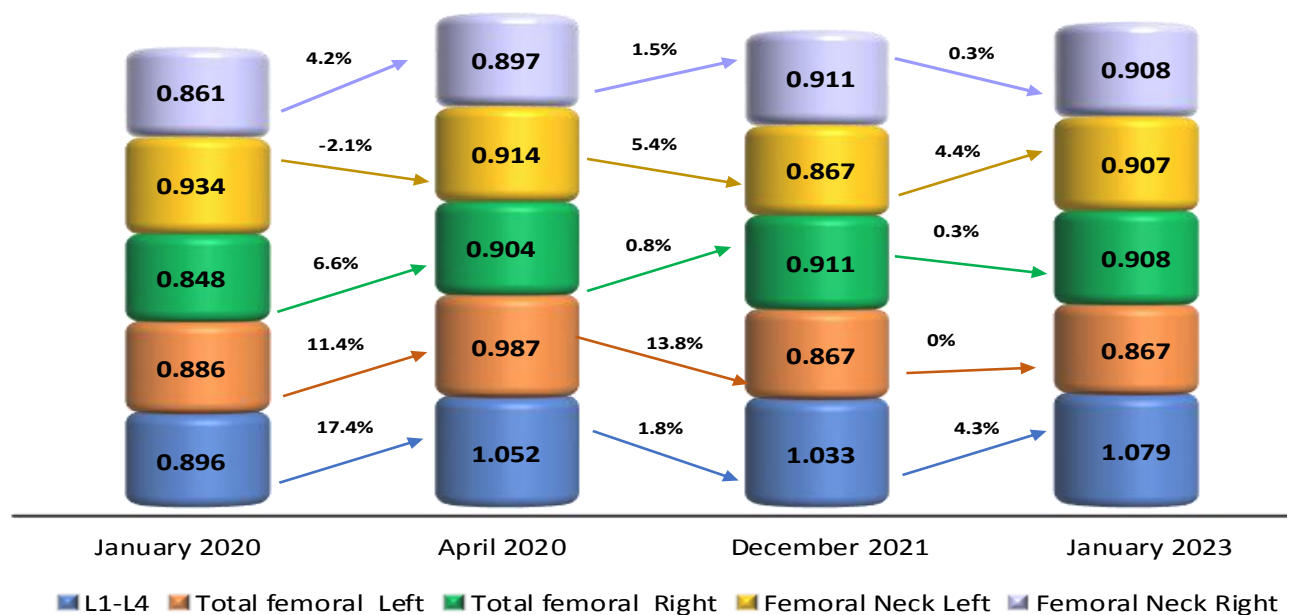
Table 1.   Biochemical Indicators in Dynamics

Indicators	2020				2021		2022	
	January	March	June	October	April	December	May	November
Calcium, mmol/l	2.59	2.3			2.29			2.47
Phosphorus, mmol/l								
Vitamin D, ng/ml	28.2↓	45.3	26.6	65.9	64	56.8	58.7	44.9
PTH, pg/ml	78.6↑	83.4↑	94.8↑		57.7	49.7	37.1	
NTx(N-telopeptide), nM BCE	121.3↑				20.2		45.7	
β-cross laps, ng/ml								
Osteocalcin, ng/ml	45.9		22.37		36.2	21.3	28.6	27.5
Alkaline phosphatase, U/L	70		59		57			
Creatinine, μmol/l	53							
AlAT, U/L	39							
AsAT, U/L	61							

Table 2.   Z-score results over time

Regions	January 2020	April 2020	December 2021	January 2023
L1–L4	-2.2	-0.9	-1.1	-0.7
Total femoral Left	-0.8	0	-0.9	-0.9
Total femoral Right	-1.1	-0.6	-0.6	-0.6
Femoral Neck Left	-0.2	-0.3	-0.7	-0.4
Femoral Neck Right	-0.8	-0.5	-0.3	-0.3

BMD, g/cm²

Figure 1.   Dynamics of BMD changes and percentage of increase

Laboratory tests, including measurements of calcium, phosphorus, vitamin D, parathyroid hormone, N-telopeptide, β-cross laps, osteocalcin, alkaline phosphatase, creatinine, and liver enzymes, revealed a vitamin D deficiency and elevated levels of N-telopeptide, as well as a tendency toward increased PTH levels over a 4-month period (Table 1).

Due to the high PTH level, the patient was referred for parathyroid scintigraphy with a suspicion of secondary hyperparathyroidism. The scan did not reveal any pathology of the parathyroid glands.

Regarding the BMD of the spine and hip, follow-up BMD increased after treatment. We did not encounter any new fractures during the treatment. Bone mineral density (BMD) was measured using dual-energy X-ray absorptiometry (DEXA).

Analysis of DEXA results initially showed that the patient had osteoporosis according to the Z-score (-2.2) in the L1–L4 region. The Total Femoral Left (Z-score -0.8 - normal) and Total Femoral Right (Z-score -1.1 - osteopenia). The Femoral Neck Left (Z-score -0.2) and Femoral Neck Right (Z-score -0.8) were normal for the same age, gender, race, height, and weight (Table 2).

Bone mineral density did not significantly differ across various skeletal regions (Fig. 1).

Low BMD and a vertebral fracture were interpreted as pregnancy and lactation-associated osteoporosis (PLO). The patient was advised to stop lactation once PLO was established.

The patient was prescribed alendronic acid 75 mcg (February 6, 2020) and Nutri D3 60,000 IU for 4 days, followed by cholecalciferol 1,000 IU daily. After one month, alendronic acid was discontinued and replaced with ibandronic acid 3 mg/3 ml (March 16, 2020, 4 injections) along with daily cholecalciferol 1,000 IU.

The patient was warned that a subsequent pregnancy carried a moderate risk of further fractures. However, she reported a pregnancy in March 2022.

She was given dietary recommendations to consume calcium-rich foods and take additional vitamin D at a dose of 2,000 IU daily. The pregnancy progressed smoothly with no complaints of back pain. The delivery occurred naturally at 38-39 weeks (Table 3).

Minor changes in biochemical parameters, bone marker results, and bone mineral density may be related to certain changes that occur in a woman's body during pregnancy.

5. Discussion

Pregnancy and lactation-associated osteoporosis (PLO) is a rare condition characterized by fractures occurring in late pregnancy or the postpartum period. Its etiology is undetermined, and its treatment and natural course are poorly understood. Although the exact cause remains unclear, risk factors have been identified, including having first-degree relatives with PLO, low BMI, physical inactivity, poor nutrition, insufficient calcium intake, and smoking [9].

Pregnancy and breastfeeding lead to temporary bone loss because calcium is transferred from the mother to build the skeleton of the fetus and infant [7,10].

PLO is characterized by high bone turnover, initially manifesting as a loss of trabecular bone, where the bone surface area to volume ratio is greatest [10].

Back pain resulting from vertebral fractures can be acute or chronic. Early diagnosis and treatment are crucial to prevent further fractures and chronic pain, as well as to optimize bone structure [11].

Table 3. Biochemical Indicators in Dynamics

Показатели	2022								
	June	August		September		October		November	
Calcium, mmol/l	1.68	1.66	**-1.2**	1.76	**6.0**	1.65	**-6.3**	2.17	**31.5**
Phosphorus, mmol/l	0.63	0.76	**20.6**	0.7	**-7.9**	0.65	**-7.1**	1.51	**132.3**
Vitamin D, ng/ml	36.7	33.1	*-9.8*	42.3	*27.8*	39.3	*-7.1*	31.1	*-20.9*
PTH, pg/ml	21.4	20.7	*-3.3*	43.4	*109.7*	66.5	*53.2*	43.2	*-35.0*
β-cross laps, нг/мл	0.23	0.17	*-26.1*	0.24	*41.2*	0.23	*-4.2*	1.07	*365.2*
Osteocalcin, ng/ml	16.3	18.4	*12.9*	11.2	*-39.1*	16.5	*47.3*	32.3	*95.8*
Alkaline phosphatase, U/L	30	47	*56.7*	40	*-14.9*	69	*72.5*	97	*40.6*
Creatinine, μmol/l	59	66	**11.9**	73	**10.6**	76	**4.1**	66	**-13.2**
AlAT, U/L	5	6	**20.0**	5	**-16.7**	12	**140.0**	35	**191.7**
AsAT, U/L	10	8	**-20.0**	14	**75.0**	24	**71.4**	20	**-16.7**
OPG	0.80	0.85	*6.3*	1.6	*88.2*	1.45	*-9.4*	0.85	*-41.4*
RANKL	43	51.5	*19.8*	67.5	*31.1*	60.5	*-10.4*	216	*257.0*
OPG/RANKL	0.019	0.017	*-10.5*	0.024	*41.2*	0.024	*0.0*	0.004	*-83.3*
RANKL/OPG	53.8	60.6	*12.6*	42.2	*-30.4*	41.7	*-1.2*	254.1	*509.4*
P1CP	46.43	39.46	*-15.0*	53.86	*36.5*	46.59	*-13.5*	57.73	*23.9*
Hormone D	119.85	122.39	*2.1*	136.85	*11.8*	132.46	*-3.2*	140.95	*6.4*
Calcitonin	3.2	2.21	*-30.9*	1.52	*-31.2*	1.57	*3.3*	2.46	*56.7*

PLO is more common during the first pregnancy than in subsequent pregnancies [12].

The goal of treatment was to improve bone mineral density to a level that would allow the patient to undergo another pregnancy and subsequently breastfeed with minimal risk of new vertebral fractures. Interdisciplinary monitoring was important to ensure rapid treatment and recovery to normal activity levels.

There is no universally agreed-upon opinion or guideline for treating this condition. Treatment options are limited to those practiced in documented cases. Most cases recommend cessation of breastfeeding [13,14].

Other options include calcium and vitamin D supplementation [15], bisphosphonates [9], teriparatide [16], strontium ranelate [17], and kyphoplasty for treating postpartum vertebral fractures [18].

Thus, PLO is associated with significant morbidity, a high prevalence of recognized osteoporosis risk factors, and a risk of recurrence in subsequent pregnancies. Bisphosphonate therapy, administered shortly after the onset of symptoms, significantly increases spinal bone density in patients with PLO [9].

It is crucial to monitor and evaluate the effectiveness of treatment, which determines the success or failure in managing PLO. In our case, with regular follow-up, education, and monitoring, the patient was able to achieve a normal level of 25(OH)D3. During follow-up, attention should be given to assessing new fractures both clinically and visually. Since vertebral fractures differ from hip and forearm fractures, which often occur without clinical symptoms and with a clear history of falls, they are easily missed during diagnosis. Therefore, spinal imaging is an effective method for detecting new fractures during follow-up.

6. Conclusions

PLO is a rare clinical condition and should be considered in the differential diagnosis of patients with lower back pain during or after pregnancy. Although not listed as a diagnostic criterion, excluding other causes of osteoporosis and understanding the progressive clinical course is necessary and beneficial in the diagnostic process. At the same time, monitoring and assessing the effectiveness of PLO intervention is also very important.

Fractures associated with PLO can be a significant cause of long-term disability. Early diagnosis and treatment with calcium and vitamin D, as well as regular monitoring of these cases, are particularly important for preventing fractures and improving the quality of life for patients.

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