CASE REPORT

Vitamin D-deficient osteomalacia due to excessive self-restrictions for atopic dermatitis

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SUMMARY

A 34-year-old Japanese woman presented with a 2-year history of generalised bone pain, muscle weakness and gait disturbance. The patient had been following a restricted diet (without fish or dairy products) and avoiding ultraviolet exposure for 8 years to manage her worsening atopic dermatitis. Physical examination revealed generalised bone tenderness and bilateral symmetric proximal muscle weakness. Vitamin D-deficient osteomalacia was diagnosed based on the laboratory examination findings, which indicated high serum alkaline phosphatase, high intact parathyroid hormone, and low 25-hydroxyvitamin D levels. Her symptoms improved after oral active vitamin D and calcium administration. To the best of our knowledge, this case is the first report of vitamin D-deficient osteomalacia in an adult patient due to excessive dietary restriction for managing atopic dermatitis. We emphasise the importance of increasing awareness of vitamin D deficiency as a risk factor for the development of osteomalacia, and caution against excessive avoidance of sun exposure and dietary restriction.

BACKGROUND

Osteomalacia is a metabolic bone disorder characterised by the decreased mineralisation of newly formed osteoid at sites of bone turnover.¹ The clinical symptoms associated with osteomalacia include progressive generalised bone pain, muscle weakness and gait disturbance.²

Although vitamin D deficiency is among the most common causes of osteomalacia, there is no case report of vitamin D-deficient osteomalacia due to excessive self-restriction for managing atopic dermatitis. In the present report, we describe a case of osteomalacia caused by vitamin D deficiency in an adult patient who strictly complied with dietary restrictions and avoidance of sun exposure to manage her worsening atopic dermatitis.

CASE PRESENTATION

A 34-year-old Japanese woman was referred to our department with a 2-year history of slowly progressive generalised bone pain, muscle weakness and gait disturbance. The generalised bone pain—especially in the lower back, pelvis and legs—was aggravated by loading. The patient had been following a restricted diet (exclusion of fish and dairy products), and had been avoiding ultraviolet exposure for 8 years, which was part of the management plan prescribed by her dermatologist for worsening atopic dermatitis. The patient had no reported digestive symptoms that would have suggested an

absorption disorder. She had been receiving topical steroids for her atopic dermatitis. Her family and personal histories were unremarkable. Physical examination revealed the following normal findings: body temperature, 36.3°C; blood pressure, 110/72 mm Hg; pulse rate, 88 bpm (regular); and respiration rate, 12 breaths/min. However, the examination also indicated generalised bone tenderness with associated indirect pain, bilateral symmetric proximal muscle weakness and a waddling gait.

INVESTIGATIONS

Laboratory examination revealed high serum alkaline phosphatase (1345 U/L (bone type, 71.2%)), high intact parathyroid hormone (511 pg/mL), low serum calcium (7.6 mg/dL), low phosphorus (2.2 mg/dL) and low 25-hydroxyvitamin D (<5 ng/mL, RIA) levels. Liver, pancreas and renal functions were normal. The bone mineral density (BMD) T-score, as measured by dual-energy X-ray absorptiometry, was −5.7 at the lumbar spine and −5.8 at the femoral neck, indicating a low BMD for her chronological age. Moreover, increased bone turnover markers for bone resorption (deoxypyridinoline, 31.2 nmol/mmol Cr (normal range, 2.8–7.6 nmol/mmol Cr)) and formation (osteocalcin, 7.8 ng/mL (normal range, ≤7.0 ng/mL); urinary type I collagen cross-linked N-telopeptide, 2938 nmol BCE/mmol Cr (normal range, 9.3–54.3 nmol BCE/mmol Cr)) were noted.

Arterial blood gas analysis revealed mild metabolic acidosis (pH, 7.37; partial pressure of carbon dioxide, 23.2 mm Hg; partial pressure of oxygen, 98 mm Hg; and bicarbonate, 22.3 mmol/L). The urine analysis results were as follows: protein, negative; glucose, negative; pH, 6; phosphorus, 0.19 g/day; and calcium, 29.3 mg/day. The tubular reabsorption of filtered phosphorus (%TRP, 94%; normal range, 85–95%) and the maximum tubular reabsorptive rate of phosphate (tubular maximum phosphate reabsorption/glomerular filtration rate, 2.93 mg/dL; normal range 2.6–4.4 mg/dL) were within the normal range. Immunoelectrophoretic studies did not show any monoclonal protein in the serum or any Bence-Jones protein in the urine. Anti-SS-A/SS-B antibody tests yielded negative results.

Plain film radiography revealed a pseudofracture in the left inferior pubic rami (figure 1). Fluorodeoxyglucose-positron emission tomography images showed no tumour lesions or abnormal uptake.

Thus, the patient was diagnosed with osteomalacia due to vitamin D deficiency, which was

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Figure 1 Plain film radiography revealing pseudofracture in the left inferior pubic rami.

attributed to the restriction of vitamin D intake and sun exposure avoidance for the management of atopic dermatitis.

DIFFERENTIAL DIAGNOSIS

Although the main cause of vitamin D deficiency is impairment of endogenous vitamin D₃ synthesis due to the lack of ultraviolet exposure and dietary vitamin D deficiency, this condition is also manifested in cases of malabsorption syndrome due to gastrectomy, intestinal diseases, hepatobiliary diseases and pancreatic insufficiency.^{3 4} However, the patient's medical history and laboratory examination results were not suggestive of these conditions.

Hypophosphatemia—a condition in which osteomalacia is caused by impaired phosphorus absorption and reabsorption—is known to be caused by tumour-induced osteomalacia (TIO) and renal tubular acidosis.^{5 6} The FGF23 marker is useful for the diagnosis of TIO, as its levels are high in TIO patients and rapidly decrease after resection of the tumours responsible for the TIO.⁵ In our patient, the FGF23 level was within the normal range (24 pg/mL), and the presence of apparent tumour lesions was also ruled out by positron emission tomography-CT. Although our patient had mild metabolic acidosis, the urinary findings suggest that it is unlikely to have been caused by renal tubular acidosis. Moreover, the medical history and laboratory examination results did not reveal any findings suggestive of Sjogren syndrome, multiple myeloma or nephrotic syndrome.

TREATMENT

Oral administration of active vitamin D (0.75 µg/day) and calcium (1 g/day) was initiated.

OUTCOME AND FOLLOW-UP

At the 12-month follow-up, the pain, muscle weakness and gait disturbance had been alleviated. Moreover, the serum levels of 25-hydroxyvitamin D, parathyroid hormone, alkaline phosphatase, calcium and phosphorus had improved, with no recurrence of the condition.

DISCUSSION

Vitamin D plays an important role in bone mineralisation.⁷ Thus, the deficiency of vitamin D causes secondary hyperparathyroidism and increased bone turnover, which may eventually result in osteomalacia.⁸

The National Health and Nutrition Examination Survey (2001–2004) reported that vitamin D deficiency, including

asymptomatic cases, occurs in approximately 6% of the population in the USA and is considered a relatively common disease even in developed nations.⁹

The amount of ultraviolet skin exposure in ordinary life contributes to the production of 90–95% of the body's vitamin D requirement. It has been reported that sun exposure at approximately one-fourth the minimal erythema dose to at least one-fourth the total skin area of the body is equivalent to an intake of approximately 250 µg of vitamin D₃,^{10 11} which fully satisfies the daily required intake of 15 µg.¹² In cutaneous synthesis, vitamin D is synthesised through the effects of ultraviolet-B light, which has a wavelength of 280–320 nm and is also known to be able to cause sunburn.¹³ Thus, people who avoid sun exposure or use sunscreen that blocks ultraviolet-B may have a higher risk of vitamin D deficiency, as observed in the present case.

In patients who receive an average dietary intake of vitamin D, the occurrence of osteomalacia as a result of vitamin D deficiency is unlikely. However, extremely unbalanced and restricted diets can cause a significantly impaired dietary intake of vitamin D, and may thus result in osteomalacia. For instance, diets deficient in foods containing large amounts of vitamin D such as fish, dairy products and mushrooms,¹⁴ can lead to vitamin D deficiency—this was a pertinent cause of our patient's vitamin D deficiency.

There are occasional case reports stating that paediatric patients with atopic dermatitis developed rickets as a result of vitamin D deficiency caused by inadequate dietary intake.^{15–18} To the best of our knowledge, the present case is the first report of an adult patient with osteomalacia associated with atopic dermatitis. Although the treatment for atopic dermatitis includes ultraviolet light therapy,¹⁹ sun exposure is also considered to be an exacerbating factor for atopic dermatitis.²⁰ In the present case, the excessive avoidance of sun exposure is assumed to be a major factor for the development of osteomalacia caused by vitamin D deficiency. Furthermore, inadequate intake of foods containing vitamin D due to dietary restrictions also promoted the development of osteomalacia. In this case, it was assumed that complete elimination of food allergens and avoidance of sun exposure, to prevent worsening of the atopic dermatitis, caused the vitamin D deficiency, resulting in osteomalacia.

Moreover, other factors such as excessive orientation towards a healthy lifestyle and natural foods and avoidance of ultraviolet exposure in our modern lifestyle can contribute to the development of osteomalacia. Therefore, a possible increase in the prevalence of vitamin D deficiency in the future remains a concern. Thus, this case report highlights the importance of increasing awareness of vitamin D deficiency as a risk factor for the development of osteomalacia, and cautions against excessive avoidance of sun exposure and dietary restrictions.

Learning points

- ▶ Vitamin D deficiency is among the most common causes of osteomalacia.
- ▶ Vitamin D deficiency is considered a relatively common disease even in developed nations.
- ▶ Excessive orientation towards a healthy lifestyle and natural foods and avoidance of ultraviolet exposure in our modern lifestyle can contribute to vitamin D deficiency.
- ▶ Awareness of vitamin D deficiency as a risk factor for osteomalacia, and its association with excessive avoidance of sun exposure and dietary restrictions are important.

Competing interests None.

Patient consent Obtained.

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