Bronchitis and asthma in the setting of vitamin D deficiency

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Background

Given that all human organs have vitamin D receptors, it is not surprising that vitamin D3 deficiency can also cause disease symptoms in the lungs. Known diseases include productive and obstructive bronchitis, asthma, chronic obstructive pulmonary disease (COPD), and frequent respiratory infections [1, 2]. To date, there is insufficient data to support whether vitamin D replacement improves these pulmonary diseases [3].

Therefore, our center began measuring vitamin D3 levels in patients with pulmonary diseases and replacement was initiated where levels were low. Results in two patients are discussed below.

Case report 1

A slim, sportive and otherwise healthy 62-year-old female patient had suffered recurrent respiratory infections, chronic cough with sputum and hoarse voice for several years. No dyspnea was reported, not even during regular hikes in a local range of hills (**Fig. 1**). For this reason, vitamin D deficiency was not initially suspected.

Since the patient had smoked for a number of years during her youth, chronic obstructive pulmonary disease (COPD) was at first considered. Pulmonary function showed moderate obstruction (maximal expiratory flow [MEF] 25: 38 %; normal: > 70 %) accompanied by pulmonary hyperinflation (residual volume: 3.4 l [normal: < 2 l]).

Allergy testing for common inhalant and food allergens using the skin-prick test and radioallergosorbent test (RAST) was negative. Total immunoglobulin E (IgE) and eosinophil cationic protein (ECP) were within normal ranges, as were white blood cell count, immunoglobulin levels IgG, IgG subclasses, IgA, and IgM.

The clinical picture showed normal pulmonary and otolaryngological findings.

Pulmonary function improved upon drug treatment with tiotropium bromide (Spiriva®); however, the

production of clear, non-purulent sputum persisted.

During a follow-up examination in spring, the patient reported that she regularly applied high-factor sunblock to areas of skin exposed to sunlight due to actinic keratosis. Thereupon, the patient's vitamin D3 level was measured and, at 8.4 µg/l (normal: > 20–30 µg/l), was found to be distinctly low.

Vitamin D3 replacement was then initiated with the high-dose preparation Dekristol®, comprising one 20,000 IU colecalciferol capsule every 2 days, totalling 300,000 IU [3]. Follow-up vitamin D3 measurement showed a normal value at 40 µg/l.

Pulmonary function subsequently (and following discontinuation of Spiriva®) reached almost normal values (MEF 25: 76 %, residual volume: 2.6 l). Sputum production resolved completely and the patient has since remained infection-free for a half year.

Case report 2

A 70-year-old professor, still professionally active, of normal weight, and a meticulous observer of his own allergic asthma, noticed a deterioration in his asthma over the winter months and an increase in his use

Key words

Vitamin D3 – bronchitis – asthma – chronic obstructive pulmonary disease

Abbreviations

COPD	Chronic obstructive pulmonary disease
ECLIA	Electrochemiluminescence immunoassay
ECP	Eosinophil cationic protein
IgA	Immunoglobulin A
IgE	Immunoglobulin E
IgG	Immunoglobulin G
IgM	Immunoglobulin M
IOM	Institute of Medicine
MEF	Maximal expiratory flow
RAST	Radioallergosorbent test

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Fig. 1: The fog-free heights of the *Siebengebirge* (a range of hills in western Germany) are conducive to vitamin D synthesis, assuming sunlight comes into contact with exposed skin

of medication despite no apparent cause for these changes. He had suffered several respiratory infections over the course of the year. Measurement of the patient's serum 25-hydroxy vitamin D (25[OH]D) level using the same method as in Case study 1 showed this to be low at 7.6 µg/l (normal > 20–30 µg/l).

The same vitamin D therapy as in the first patient also produced a rise in vitamin D level within the normal range at 39 µg/l. Pulmonary function improved, no infections have been observed for a prolonged period, and asthma medication could be reduced to its former level.

Discussion

The success of treatment with high-dose vitamin D3 administration in these two patients indicates that the vitamin D3 deficiency identified was the cause of disease symptoms.

According to the Institute of Medicine (IOM) and the American literature, 20,000 units of vitamin D3 every other day in adults is the maximum recommended dose at which there is no risk of hypercalcemia or vitamin D intoxication – particularly when vitamin D3 levels are significantly low, as in our patients [4]. Lower doses would have produced far slower results, which would have been detrimental to compliance.

Given their advanced age, both patients are at increased risk of vitamin D3 deficiency, since older individuals are able to produce only 25 % of the vitamin D3 produced by a 20-year-old individual on exposure to sunlight [4].

Since it is known that long-term application of sun protection agents to large areas of skin inhibits vitamin D synthesis, the use of, for example, sun creams represents a risk factor not only for dermatological diseases, but also for pulmonary and respiratory diseases. This knowledge enhances patient history-taking in allergology, pneumology and otolaryngology.

Studies are currently under way to establish whether and at which vitamin D3 dosage vitamin D3 deficiency is optimally treated in the setting of respiratory and pulmonary diseases [1, 2, 3, 4].

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Conflict of interest

The author states that there are no conflicts of interest.

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