



ELSEVIER

Contents lists available at [ScienceDirect](https://www.sciencedirect.com)

Respiratory Medicine Case Reports

journal homepage: www.elsevier.com/locate/rmcr

Case report

Asymptomatic lung nodules in dental professionals: A diagnostic challenge

Anuradha N. Godallage^a, Shailesh Kolekar^{a,b}, Karen Ege Olsen^c,
Barbara Bonnesen^d, Jesper Koefod Petersen^a, Paul F. Clementsen^e,
Uffe Bødtger^{a,f,g}, Pradeesh Sivapalan^{a,d,*}

^a Department of Internal Medicine, Zealand University Hospital, Roskilde, Denmark

^b Department of Clinical Medicine, University of Copenhagen, Copenhagen, Denmark

^c Department of Pathology, Odense University Hospital, Denmark

^d Section of Respiratory Medicine, Herlev and Gentofte Hospital, Hellerup, Denmark

^e Copenhagen Academy for Medical Education and Simulation (CAMES), University of Copenhagen and the Capital Region of Denmark, Rigshospitalet, Copenhagen, Denmark

^f Institute for Regional Health Research, University of Southern Denmark, Odense C, Denmark

^g Department of Respiratory Medicine, Naestved Hospital, Naestved, Denmark

A B S T R A C T

Dental care workers are frequently exposed to various types of volatile organic and inorganic compounds. In addition to biological materials, these compounds include silica, heavy metals, and acrylic plastics. Such exposures may cause respiratory symptoms, but the nonspecific nature of these symptoms often means that the etiology is difficult to discern. The disease severity depends on the particle size and type of the inhaled compounds, as well as the duration and intensity of exposure, which varies markedly among dental workers. Here, we present two unique cases with the same occupational exposure. Both patients showed radiological changes in the lungs that were suspicious for lung cancer.

The first patient did not undergo a biopsy due to cardiac comorbidities and risk of bleeding, and the diagnosis was based on thoracic computer tomography (CT) which confirmed multiple, bilateral, solid, smooth, partly calcified lung nodules, normal positron emission tomography (PET)-CT and the relevant occupational exposure. In the second case, a CT-guided biopsy and thoracoscopic resection was done with histopathological findings consistent with granuloma. The multi-disciplinary team decision of both cases was consistent with occupational exposure related lung disease.

This is the first case study report whereby same occupational exposure related health condition is compared with two different approaches. Respiratory clinicians should be aware of this potential diagnosis, especially for asymptomatic patients with relevant exposures. Careful attention to the occupational history may help to prevent unnecessary, invasive diagnostic procedures or surgeries.

1. Introduction

The lungs are the main target organ for toxic exposures and inhalation injuries due to occupational inhalation of hazardous chemicals and dust [1,2]. Dental care workers may be exposed to various types of volatile organic and inorganic compounds. In addition to biological materials, these compounds also include silica, heavy metals, acrylic plastics from polishing and grinding dental prostheses or from dental operations, and compounds used in tooth filling [2–4]. Such exposure may cause respiratory symptoms [4], but the nonspecific nature of these symptoms often means that the etiology is difficult to discern [5]. Here, we describe two cases with suspected lung cancer with occupational history supporting a diagnosis of non-malignant, occupation-associated lung disease.

* Corresponding author. Department of Internal Medicine, Zealand University Hospital, Roskilde, Denmark.
E-mail address: Pradeesh.s@dadlnet.dk (P. Sivapalan).

<https://doi.org/10.1016/j.rmcr.2022.101691>

Received 15 February 2022; Received in revised form 5 June 2022; Accepted 20 June 2022

Available online 26 June 2022

2213-0071/© 2022 The Authors. Published by Elsevier Ltd. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

1.1. Case 1

A 71-year-old man with no symptoms had a routine chest X-ray performed. He was a retired dental technician, who had regularly inhaled silica and other inorganic dust particles throughout his working career. He is also a current smoker with 50 pack-years. Recently, he was diagnosed with a myocardial infarction and hypertension, and was treated with thrombocyte inhibitors, cholesterol-lowering drugs, beta-blockers, and two types of diuretics. Lung function assessments showed a forced expiratory volume in 1 s (FEV1) of 2.26 L (74% of predicted value), a forced vital capacity (FVC) of 4.47 L (111%), FEV1/FVC of 67% and diffusing capacity for carbon monoxide of 70%.

The patient was referred for workup of suspected cancer as the chest X-ray showed bilateral round nodules that were suspicious for lung metastases. The patient was systematically asked for exposures which revealed working with silica. Contrast-enhanced thoracic and abdominal computed tomography (CT) confirmed multiple, 5–10 mm, bilateral, solid, smooth, partly calcified central lung nodules predominantly on upper lobes and there were enlarged lymph nodes in the mediastinum and hilar regions. But the scans were otherwise normal (Fig. 1A). Positron emission tomography (PET)-CT revealed no abnormal metabolic activity (Fig. 1B). Comprehensive blood test results including analyses of markers for connective-tissue diseases were normal. The patient was referred for follow-up as risk of lung cancer was 6.8% or 2.0% using the Brock or Herder probability models, respectively [6]. Due to recent history of myocardial infarction and antiplatelet therapy the MDT decision of non-invasive approach was contemplated. CT results at 3, 6, and 12 months were unchanged, and the patient remained well. The multidisciplinary team concluded that the patient had pulmonary granulomas, secondary to occupational inhalation of silica and other inorganic dust.

1.2. Case 2

A previously healthy 55-year-old female dentist, who had never smoked, was admitted to hospital with transient pneumonia and bilateral consolidation (mainly in the right upper and middle lobes) on the chest X-ray. Pneumonia was resolved with antibiotics treatment. Throughout her professional life, she has been exposed to various types of volatile organic and inorganic compounds. In addition to biological materials, these compounds include silica, heavy metals, and acrylic plastics. She worked with dental prosthesis, various dental operations, and compounds which are used in tooth filling. There was no other specific exposure suspected such as beryllium, aluminum, etc., neither other potential exposures from other jobs or hobbies.

Lung function assessments showed a FEV1 of 4.2 L (118% of predicted value), a FVC of 3.3 L (107%), and a FEV1/FVC of 72%. Contrast-enhanced thoracic and abdominal CT revealed an 8 mm nodule in the right upper lobe, growing into the surrounding lung parenchyma and a 7 mm nodule in the interlobular fissure between the right upper lobe and middle lobe. Two pleural nodules with 4 mm in size were seen in the right-side dorsal aspect of the pleura. There was no pleural fluid or pathologically enlarged lymph nodes in the axilla or mediastinum.

PET-CT revealed faint metabolic activity in a 9-mm nodule in the right upper lobe, suggesting a Herder model cancer probability of 52%. Therefore, the patient underwent CT-guided biopsy. The first biopsy found suspicious cells, but the second biopsy showed no signs of malignancy. No granulomas were present, and the patient was referred for wedge resection by video-assisted thoracoscopic surgery. Histological examination showed several 3–12 mm necrotizing granulomas; however, no malignancy. Bacterial culture and polymerase chain reaction analysis for *Mycobacterium tuberculosis* from surgical specimens were negative. Various blood tests and clinical examinations showed no signs of infectious diseases, Wegener's granulomatosis, rheumatoid arthritis, or sarcoidosis. The multidisciplinary team concluded that the patient had pulmonary granulomas secondary to occupational inhalation of silica and other inorganic dust. The patient was referred for control CT scans at 3 and 9 months, and the results were unchanged. The patient was asymptomatic.

2. Discussion

Dental professionals are at risk of inhaling substances such as silica, hard metals, dental alloys, and acrylic resins [4,7]. These substances can accumulate in terminal airways and alveoli, hereby activate inflammatory processes in lung parenchyma, and lead to lung injury and symptoms [2,8,9]. Disease severity depends on the size and type of inhaled compounds, and on the duration and

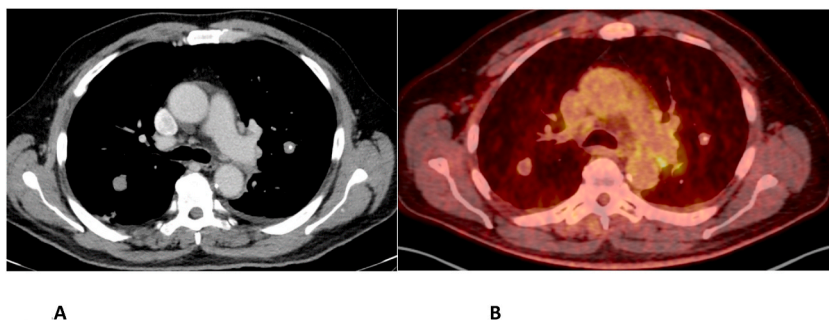


Fig. 1. A: Computed tomography (CT) showing bilateral round nodules with partial calcification.

Fig. 1B: 18F-fluorodeoxyglucose positron emission tomography-computed tomography (18-FDG PET-CT) showing no metabolic activity in bilateral nodules and normal mediastinal and hilar lymph nodes.

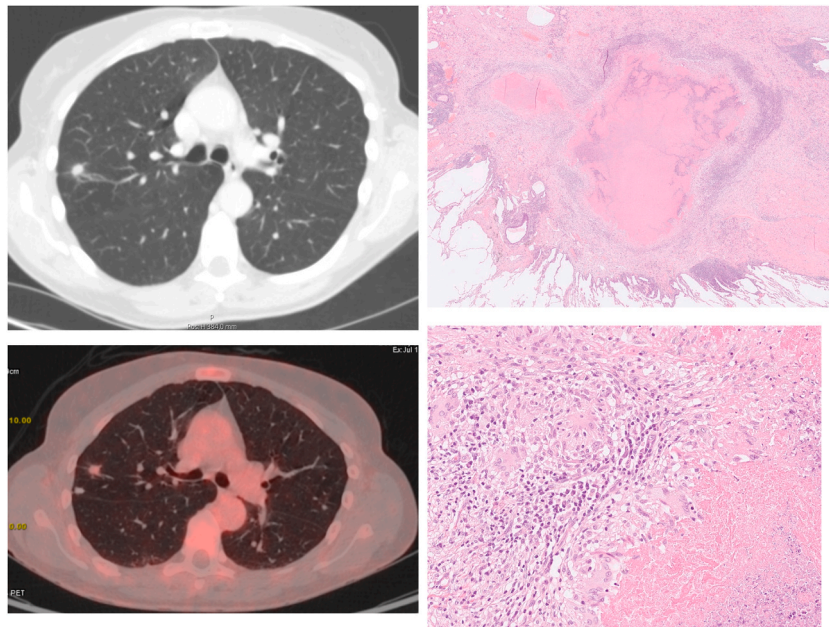


Fig. 2. A: Thoracic and abdominal CT revealed bilateral nodules ranging from 4 mm to 9 mm in size. Although a few nodules showed calcification, there was no adenopathy, pleural effusion, or other lesions.

Fig. 2B: 18-FDG PET-CT demonstrated faint metabolic activity in the 9-mm nodule situated in the right upper lobe.

Fig. 2C: Histological sections of a granuloma with necrosis surrounded by lymphocytes, histiocytes and foreign body giant cells.

intensity of exposure [5], which varies markedly among dental workers (e.g., due to substances used, procedures performed, use of protective barriers, and ventilation) [4,5].

We report two dental workers, one asymptomatic and the other with a transient productive cough, who were referred for suspected lung malignancies. In both cases, findings were partially consistent with silicosis as the pulmonary nodules were bilateral with upper lobe predominance and few nodules showed calcifications. However, in both cases, typical manifestations of mediastinal lymphadenopathy with eggshell calcifications were not present.

After the establishment of health European Agency for Safety and Health at Work (EU-OSHA) policy and laws in respective countries related to better ventilation in 1980s at workplaces, incidents have been drastically fallen. However, patients exposed before 1980s are still sporadically seen in recent practice. Limitations in our case series were that we were not able to analyze the silica content of the biopsy samples and the results were based on retrospective constellation of radiology, exposure history, and expert opinion.

In conclusion, the respiratory clinician should be aware of this potential diagnosis, especially for asymptomatic patients with relevant exposure, a balanced approach with patients underlying condition and risk of complication should be considered. Careful history of occupational exposure may help to prevent unnecessary, invasive diagnostic procedures or surgeries.

References

- [1] H. Kahraman, et al., Pneumoconiosis in dental technicians: HRCT and pulmonary function findings, *Occup. Med. (Lond.)* 64 (6) (2014) 442–447.
- [2] T. Hirano, et al., The first case of multiple pulmonary granulomas with amyloid deposition in a dental technician; a rare manifestation as an occupational lung disease, *BMC Pulm. Med.* 18 (1) (2018) 77.
- [3] D. Choudat, Occupational lung diseases among dental technicians, *Tuber. Lung Dis.* 75 (2) (1994) 99–104.
- [4] S.J. Chung, et al., Pulmonary foreign body granulomatosis in dental technician, *Tuberc. Respir. Dis.* 78 (4) (2015) 445–449.
- [5] A. Cimrin, et al., Pneumoconiosis and work-related health complaints in Turkish dental laboratory workers, *Tuberk Toraks* 57 (3) (2009) 282–288.
- [6] M.E. Callister, et al., British Thoracic Society guidelines for the investigation and management of pulmonary nodules, *Thorax* 70 (Suppl 2) (2015) ii1–ii54.
- [7] M.M. Tiraboschi, et al., Early signs of pneumoconiosis in a dental technician in Italy: a case report, *BMC Pulm. Med.* 21 (1) (2021) 352.
- [8] D. Ozdemir Dogan, et al., Prevalence of respiratory abnormalities and pneumoconiosis in dental laboratory technicians, *Tuberk Toraks* 58 (2) (2010) 135–141.
- [9] D. Choudat, et al., Respiratory symptoms, lung function, and pneumoconiosis among self employed dental technicians, *Br. J. Ind. Med.* 50 (5) (1993) 443–449.