


CASE REPORT

Occupational exposure to coal and risk of multiple health outcomes: A case report

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Abstract

Occupational cutaneous squamous-cell carcinoma has an increased incidence, but rarely suspected. When located in an uncovered skin area, it is closely linked to polycyclic aromatic hydrocarbons exposure. However, single pulmonary anthracosis nodule is rarely described in the literature. The association of both diseases due to the same exposure remains uncommon.

KEYWORDS

anthracosis, aromatic polycyclic hydrocarbons, case report, coal tar, skin cancer

1 | INTRODUCTION

Cancer is becoming a health problem worldwide. Especially skin cancer is rarely suspected but is concerning health providers. Its incidence is significantly increasing in time.¹ Risk factors are still partly ignored. Occupational exposure is known as a major factor in carcinogenesis.² Cutaneous squamous cell carcinoma can be recognized as an occupational disease.

Occupational skin cancer is not frequently aborded in the literature. The exposure to coal tars containing aromatic polycyclic hydrocarbons (PAH) is a major risk factor of this type of cancer. Several professional fields and activities are concerned.

It has been proven that excessive exposure to PAH often results not only in lung cancer,³ but also in benign pulmonary and non-pulmonary diseases. In fact, PAH causes anthracosis, a particular type of pneumoconiosis. Little is known about single pulmonary nodules due to coal tars occupational exposure.

In this report, we present the case of cutaneous squamous cell carcinoma and a single pulmonary anthracosis nodule due to PAH exposure. The objective is to highlight the importance of the occupational history and adopt an adequate preventive attitude.

2 | CASE OBSERVATION

We report the case of a 65-year-old man, with the history of type 2 diabetes, 10 pack-year smoking, and who was operated on an under-palpebral birthmark at an early age.

The patient has been addressed to the occupational department of the public Hospital of Sfax (Tunisia) in January 2019 for the etiological diagnosis of a single pulmonary nodule. This was located at the left lung and has been revealed by a thoracic tomography scan. Actually given its suspicious aspect, a biopsy was indicated to confirm or infirm a potential malignancy, but histopathologists concluded to a “reactive hyperplastic lymphadenitis

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with anthracosis pigments.” As occupational specialists, we suspected a long-term exposure to PAH. The inquest demonstrated that the patient was employed as a public worker in road asphalt surfacing for 20 years. He was then directly exposed to PAH found in asphalt, mainly without adopting protective measures. However, there was no specific way to retain the certitude of the diagnosis.

Furthermore, a careful clinical examination revealed the presence of a pigmented lesion on his lower lip that was neglected for 2 years but was a little annoying. At the observation, the lesion was infiltrated, centrally ulcerated, and measuring 3 cm of diameter (Figure 1). Initially, it was asymptomatic but for the last 6 months, it became painful. There were no other skin lesions, and no superficial lymphadenopathies. There were no laboratory abnormalities. The patient was addressed to the dermatology department at the same public Hospital. Upon histopathological examination, an epidermoid carcinoma of the lower lip was confirmed, 3 x 3 cm sized. The treatment consisted mainly in the excision of the lip lesion associated to some adjuvant therapy. This skin cancer lesion confirmed the hypothesis of an occupational etiology for both diseases.

Specialists in occupational disease retained by presumption the link between the occupational exposure to

PAH and both the epidermoid carcinoma and the pulmonary anthracosis nodule. The latter has been declared as occupational diseases to the national health insurance to be repaired in accordance with the law that compensates work injuries and diseases in Tunisia.

3 | DISCUSSION

Polycyclic aromatic hydrocarbons (PAH) are recognized as a major occupational risk factor for both skin and lung cancer. They are classified as group 1 by the International Agency for Research on Cancer CIRC.⁴ Some industrial processes are also classified in group 1 because of the high levels of exposure to PAH in these industries (coking plants, aluminum production, production, and use of coal tar).⁴ PAH contained in shale oil, creosote, asphalt, and chimney soot have all been associated with skin cancer (basal cell and squamous cell carcinoma). According to the meta-analysis conducted by Partanen and Boffetta, the risk of skin cancer was significantly increased in asphalt workers.⁵

In addition, a long-term exposure to coal dust can cause coal workers' pneumoconiosis (CWP), also known as “black lung disease” or “black lung.” The consequences of this pneumopathy can be serious. In 2013, it actually resulted in 25,000 deaths globally.⁶ Moreover, several studies reported the association between pulmonary injuries and occupational PAH exposure. A three-year case study of lung cancer risk to atmospheric PAH in North China demonstrated that the risk of developing lung cancer due to inhalation exposure to PAHs was calculated at 12.0% using the overall population attributable fraction.⁷ CWP is largely aborbed in literature. It was demonstrated by epidemiologic and pathologic studies that its prevalence is increasing especially in younger miners and those with a shorter mining tenure.⁸ More than that, AlMBERG and al. concluded recently that CWP can clinically progress even absent further exposure.⁹

Other differential diagnoses were evoked during the etiological investigation of the anthracosis nodule. Anthrax, caused by *Bacillus anthracis* pathogens potentially contaminating the road asphalt, could be a major cause, yet remains exceptional nowadays. Actually, our patient had no significant respiratory symptoms, and biological tests did not show any bacterial trace. While this pathology became very uncommon in many countries, it still can be observed in rare occupational conditions.¹⁰ However, anthrax induced by the road asphalt exposure is not commonly aborbed in the literature.

More considerations should be given to targeted occupational prevention. Actually, occupational skin cancer can be prevented by avoiding some risky practices



FIGURE 1 Cutaneous squamous cell carcinoma of the lower lip

and using the suitable cutaneous protective equipment (gloves and barrier cream). Respiratory protective devices, such as filtering and isolating masks, are indicated to limit the inhalation of particles, gases, and fumes. A special medical surveillance is necessary for some worker's categories in order to detect novice lesions. Affected patients should avoid further exposure to the offending agents. It is also important to improve the identification and diagnosis of occupational cancers by practitioners in various specialties to enable their recognition as an occupational disease.¹¹

4 | CONCLUSION

Both skin cancer and pneumoconiosis are a major health problem with a high prevalence and incidence. This case has given us the opportunity to highlight the importance of a careful assessment of risk factors, especially by detailing the occupational history. More attention should be accorded to suitable preventive measures in order to reduce their incidence. An early diagnosis and an effective treatment guarantee a better prognosis in terms of health condition, but also a social and professional life quality. The avoidance of the exposure should be indicated at the opportune time. Workers exposed to coal dust should undergo regular medical surveillance because of the risk for disease progression.

AUTHOR CONTRIBUTIONS

Hakim Z, Kotti N, Ben Younes K, and Turki H contributed to the medical study and case exploration. Dhoub F helped with the redaction style and the presentation of this case report. Hajjaji M, Jmal Hammami K, and Masmoudi ML supervised the case study and its report.

ACKNOWLEDGMENTS

We are grateful to all the people that contributed to this study, as well as the patient who agreed to report his medical case.

CONFLICT OF INTEREST

None.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are openly available in [repository name, e.g., "figshare"] at [http://doi.org/\[doi\]](http://doi.org/[doi]), reference number [reference number]

CONSENT

Written informed consent was obtained from the patient to publish this report in accordance with the journal's patient consent policy.

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REFERENCES

1. Bauer A. Hautkrebs als Berufserkrankung. *Hautarzt*. 2016;67(11):884-890.
2. Alfonso JH, Sandvik A, John SM. Occupational skin cancer: sweeping the path to prevention. *Occup Med*. 2017;67(5):328-330.
3. Moorthy B, Chu C, Carlin DJ. Polycyclic aromatic hydrocarbons: from metabolism to lung cancer. *Toxicol Sci*. 2015;145(1):5-15.
4. Classification du CIRC par localisations cancéreuses. Cancer et environnement [En ligne]. Disponible sur: <https://www.cancer-environnement.fr/479-Classification-par-localisations-canceruses.ce.aspx#os>
5. Partanen T, Boffetta P. Cancer risk in asphalt workers and roofers: review and meta-analysis of epidemiologic studies. *Am J Ind Med*. 1994;26(6):721-740.
6. GBD 2013 Mortality and Causes of Death Collaborators. Global, regional, and national age-sex specific all-cause and cause-specific mortality for 240 causes of death, 1990-2013: a systematic analysis for the Global Burden of Disease Study 2013. *Lancet*. 2015;385(9963):117-171. doi:10.1016/S0140-6736(14)61682-2
7. Hong W-J, Jia H, Yang M, Li Y-F. Distribution, seasonal trends, and lung cancer risk of atmospheric polycyclic aromatic hydrocarbons in North China: a three-year case study in Dalian city. *Ecotoxicol Environ Saf*. 2020;196:110526.
8. Leonard R, Zulfikar R, Stansbury R. Coal mining and lung disease in the 21st century. *Curr Opin Pulm Med*. 2020;26(2):135-141.
9. Almberg KS, Friedman LS, Rose CS, Go LHT, Cohen RA. Progression of coal workers' pneumoconiosis absent further exposure. *Occup Environ Med*. 2020;77(11):748-751.
10. Williams JL, Noviello SS, Griffith KS, et al. Anthrax postexposure prophylaxis in postal workers, Connecticut, 2001. *Emerg Infect Dis*. 2002;8(10):1133-1137.
11. INRS. Cancers professionnels. Prévention du risque de cancers - Risques. [En ligne]. Disponible sur: <http://www.inrs.fr/risques/cancers-professionnels/prevention-risque-cancers.html>

How to cite this article: Hakim Z, Kotti N, Ben Younes K, et al. Occupational exposure to coal and risk of multiple health outcomes: A case report. *Clin Case Rep*. 2022;10:e06138. doi: [10.1002/ccr3.6138](https://doi.org/10.1002/ccr3.6138)