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Epidemiological insights into occupational cancers: A five-year retrospective analysis at the Tunisian institute of occupational health and safety

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Abstract

Cancer stands as the fourth leading cause of global mortality. Occupational exposures play a substantial role in the development of various types of cancer, including lung, colorectal, and breast cancer. The links between exposure to carcinogenic agents in the workplace and the subsequent development of various forms of cancer have been unequivocally established. This study aimed to analyze the epidemiological features of occupational cancers reported in the Tunisian Institute of Occupational Health and Safety during 2015−2020. This was a descriptive retrospective investigation, focusing on cases of reported occupational cancers that were documented during clinical consultations at the Institute of Occupational Health and Safety in Tunisia over the period from 2015 to 2020. Epidemiological features were analysed by year, region, industry, gender, age at diagnosis, and exposure duration to occupational hazards. A total of 7 patients sought consultation to evaluate the potential occupational origins of their cancers. The mean age of patients was 60.14 ± 10 years. All subjects had a history of smoking (7 cases), with an average of 22 pack-years. Alcohol consumption was reported in a solitary patient. In each case, a definitive occupational link was established. The patients held diverse occupational roles: miners (3 cases), construction workers (2 cases), machine operators (1 case), and maintenance agents (1 case). The average duration of occupational exposure was 27 years. Six patients had bronchopulmonary cancer. One patient had bladder cancer. Symptoms manifested, on average, 20 years after starting employment. Detailed occupational scrutiny unveiled exposure to distinct hazardous agents: silica particles (4 cases), asbestos (1 case), solvents (1 case), and nickel (1 case). Correspondingly, the reported cancer cases were classified under specific categories of the Tunisian list of compensable occupational diseases. The study underscores the significant but often overlooked role of occupational agents in the development of bronchial and bladder cancer. Urgent preventive actions, such as the implementation of protective equipment and automation of certain processes, are crucial to reducing the occurrence of occupational cancers.

Keywords: Occupational Cancer; Carcinogens; Work exposure

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1. Introduction

Occupational cancers are a significant and growing public health concern worldwide. These cancers are caused by exposure to workplace carcinogens, constituting a substantial proportion of all cancer cases. According to the International Agency for Research on Cancer (IARC), it is estimated that approximately 4% of all cancer cases globally are due to occupation [1]. Interestingly, 10 to 20% of lung cancers [2] and 21 to 27% of bladder cancers [3] are estimated to be associated with occupational exposure.

The IARC has compiled a comprehensive collection of information on carcinogens, both occupational and non-occupational, in a series of published monographs [4]. These monographs are crafted with the support of international expert working groups. The IARC has released assessments on more than 1000 substances, each review encompassing a concise portrayal of the agent's chemical and physical attributes, production methods and quantities, utilization patterns and occurrences, summaries of experimental tests for carcinogenicity, a brief overview of other pertinent biological data, synopses of case reports and epidemiological studies concerning cancer in humans, and an appraisal of its carcinogenic potential. IARC categorizes agents or exposure circumstances based on their carcinogenicity, spanning from Group 1 (carcinogenic to humans) to Group 4 (likely not carcinogenic). Notably, approximately 40% of the 100 identified definite and probable carcinogens are predominantly associated with occupational exposures [5].

Occupational cancers can affect workers in a wide range of industries, including mining, construction, manufacturing, and agriculture. The clinical features of these cancers can vary depending on the type of cancer and

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the duration and intensity of exposure to the carcinogen. Common occupational cancers include lung cancer, mesothelioma, bladder cancer, and skin cancer [6].

Identifying workplace links to occupational cancers is crucial for preventing these cancers and protecting workers' health. The acknowledgment of occupational carcinogens holds significance for primary prevention, compensation, surveillance of exposed workers, and recognizing causes [7]. Additionally, the use of tobacco has been related to an increased risk of developing work-related cancers. However, reducing or abstaining from smoking can help decrease this risk [7].

In this study, we aimed to analyze the epidemiological characteristics of reported occupational cancers at the Tunisian Institute of Occupational Health and Safety over five years from 2015 to 2020.

2. Material and methods

This study was a descriptive retrospective investigation that focused on reported cases of occupational cancers documented during clinical consultations at the Institute of Occupational Health and Safety in Tunisia spanning the years 2015 to 2020. The data were collected from medical records and occupational exposure histories of patients diagnosed with occupational cancers. The professional origin of the cancer cases selected for our study was established, considering the recognition conditions specified in the list of occupational disease tables that compensate for cancerous conditions. Cases of cancer not meeting these criteria were not included in our study.

All used data were anonymized and securely stored to protect the identities of the individuals involved. Informed consent was not required as this survey involved the analysis of pre-existing, de-identified data. Researchers followed the principles outlined in the Declaration of Helsinki throughout the study to uphold the highest standards of ethical conduct in medical research. Data were then entered and analyzed using SPSS 20.0 software. Frequencies and percentages were calculated for qualitative variables. The data were analyzed using descriptive statistics, including frequencies, percentages, and means.

The study strictly adhered to ethical guidelines, ensuring patient confidentiality and privacy. The institutional review board of the Institute of Occupational Health and Safety in Tunisia granted approval for the study. It is essential to highlight that this study maintains participant anonymity and has no conflicts of interest.

3. Results

A total of 7 patients sought consultation for the evaluation of the potential occupational origins of their cancers. The mean age of the patients was 60.14 ± 10 years, and each individual had a history of smoking (7 cases), averaging 22 pack-years. One patient reported alcohol consumption. Notably, a definitive occupational link was established in each case, shedding light on the diverse occupational roles of the patients. These roles included miners (3 cases), construction workers (2 cases), machine operators (1 case), and maintenance agents (1 case), with an average duration of occupational exposure spanning 27 years. All the participants were from public sector.

The prevalent cancer diagnoses within the cohort included bronchopulmonary cancer in six patients and bladder cancer in one patient. The primary reasons for seeking consultation were general health decline and weight loss (5 cases), along with dyspnea (2 cases). Remarkably, the onset of symptoms occurred, on average, 20 years after the initiation of employment.

Thorough occupational examination revealed exposure to distinct hazardous agents, further substantiating the occupational origin of the cancers. The identified agents included silica particles (4 cases), asbestos (1 case), solvents (1 case), and nickel (1 case). Furthermore, the reported cancer cases were systematically classified under specific categories of the Tunisian list of compensable occupational diseases. These categories encompassed Table No. 17 (Mineral dust containing free silica: 5 cases), Table No. 18 (Asbestos dust: 1 case), Table No. 33 (Aromatic amines, their hydroxyl, halogen, nitroso, nitro, and sulfonic derivatives, and 4-nitrodiphenyl: 1 case), and Table No. 6 (Nickel: 1 case).

4. Discussion

Global mortality and disability rates are significantly impacted by occupational exposure to carcinogens [8]. A cross-sectional study incorporating data from 195 countries unveiled that in 2017, the collective effect of all occupational carcinogens was linked to 319,000 cancer deaths and 6.42 million disability-adjusted life years. Asbestos, benzene, and petroleum pitch were identified as the principal risk factors for cancer burden, highlighting the substantial impact of occupational carcinogens on global health [9]. In our study population, six individuals were diagnosed with lung cancer and four cases were linked to silica exposure with medium professional exposure of 32 years. Lung cancer constitutes the most common occupational-associated cancer [9]. Being exposed to silica dust is a widely recognized risk element for the development of lung cancer. Silica particles become trapped in lung tissue, causing inflammation and scarring, which can lead to permanent lung damage and a progressive, debilitating, and sometimes fatal disease called silicosis [10]. Indeed, several studies have provided evidence of the link between silica exposure and lung cancer. A meta-analysis of 18 studies found that exposure to silica particles was associated with an increased risk of lung cancer [11]. Another study presented compelling evidence indicating that exposure to silica alone is sufficient to elevate the risk of developing lung cancer [12]. Furthermore, a meta-analysis employing dose-response analysis further affirmed that the risk of lung cancer rises in correlation with escalating levels of exposure to silica [11]. Workers in industries such as mining, construction, farming, and engineering are at a higher risk of exposure to silica dust [13].

One patient who was diagnosed with lung cancer had a 19-year Nickel professional contact with his job as a miner. Exposure to nickel, particularly water-soluble nickel compounds, has been associated with an increased risk of lung cancer. Research findings have established a dose-dependent connection between lung cancer and cumulative exposure to water-soluble nickel compounds. This suggested that heightened levels of exposure were associated with an increased risk of developing lung cancer [14]. The IARC has classified nickel compounds as carcinogenic to humans. Furthermore, based on evidence from animal and human surveys, the U.S. Department of Health and Human Services (HHS) has classified metallic nickel as reasonably anticipated to be a human carcinogen [15]. Occupational exposure to nickel occurs mostly through the inhalation of dust particles and fumes, commonly found in workplaces where nickel and nickel compounds are produced or used, such as mining, smelting, welding, casting, and grinding [15].

One patient had an 18-year professional exposure to asbestoses and developed a lung cancer. Numerous studies have established a clear link between asbestos exposure and lung cancer. The risk of developing lung cancer is seen with all forms of asbestos, and the greater the exposure to asbestos, the higher the risk of lung cancer. The majority of lung cancer cases in individuals exposed to asbestos typically manifest at least a decade after the initial exposure to asbestos [16-18]. The dominant exposure routes within our study were inhalation and dermal contact.

In the case of bladder cancer, one patient from our cohort was diagnosed following 29 years of solvent exposure. In fact, exposure to solvents has been associated with an increased risk of bladder cancer, as supported by various studies. Evidence from a population-based case-control study conducted in Nordic countries indicated an association between occupational exposure to specific solvents and an increased risk of bladder cancer. The study revealed that exposure to solvents such as trichloroethylene, perchloroethylene, aromatic hydrocarbon solvents, benzene, and toluene was associated with an increased risk of bladder cancer [19]. Moreover, a recent study published by Xie et al. highlighted the link between occupational exposure to organic solvents and the risk of bladder cancer. The researchers emphasized that certain occupations involving the use of solvents may pose an increased risk of bladder cancer [20].

The results of our study underscore the significant impact of occupational carcinogens on the health of workers. Our findings revealed a clear occupational link to the observed cancers in the cohort, with detailed scrutiny identifying exposure to hazardous agents such as silica particles, asbestos, solvents, and nickel.

The Tunisian professional risk mapping CaRiPt study found that19,64% of the studied workers population were exposed to carcinogenic products, and the majority of them (89.9%) were exposed to CIRC 1 products, and 71% of the population held intermediate professions, with 67.9% having more than 20 years of seniority [21].

Regarding the declaration of work-related diseases, a recent Tunisian study published in 2022 cancer represents 5.6% (12 cases) of the pathologies recognized as occupational diseases in Tunisia during the study period from 2012 to 2019 [22]. Our study's results align with previous research, indicating that occupational exposure to carcinogens imposes a substantial disease burden at the global, regional, and national levels [9]. The study's findings also align with the past and current history of occupational cancer epidemiology, emphasizing the importance of exposure assessment and risk assessment for workplace regulations [1]. Furthermore, the study's results highlight the need for comprehensive assessment methods for exposure to cancer risk factors and the importance of identifying new causes or promoters of cancer to prevent occupational cancer risks effectively.

The results of the study are consistent with endeavors to pinpoint occupational carcinogens, emphasizing their importance for primary prevention, compensation, and surveillance of exposed workers. Additionally, they contribute to the identification of the causes of cancer in the workplace. The classification of the reported cancer cases under specific categories of the Tunisian list of compensable occupational diseases further emphasizes the need for effective prevention measures and policies, ensuring safe workplaces and protecting workers from occupational carcinogens.

Overall, our study's results contribute to the growing body of evidence on the impact of occupational carcinogens on workers' health and the importance of implementing preventive measures to reduce the burden of occupational cancers. The findings underscore the need for continued research and action to address occupational cancer risks and ensure the safety and well-being of workers in various industries. Due to the infrequency of occupational cancers, all the examined studies disclosed a relatively low count of cancer deaths or registrations attributable to occupational factors. This data limitation affects the reliability of the obtained estimates. Indeed, the substantiation of an agent as an occupational carcinogen is most convincing when there is a demonstrated exposure-response relationship. This relationship can be assessed in the entire cohort or through a nested case-control study when it is more efficient to evaluate exposure in a subset of the cohort. Such data are valuable in risk assessments for estimating the reduction in risk associated with a decrease in exposure. Despite significant strides in pinpointing occupational carcinogens, there is an ongoing necessity for research into the causes of work-related cancer. Numerous workplace exposures have not been thoroughly assessed for their carcinogenic potential due to insufficient epidemiological evidence and a shortage of quantitative exposure data.

Occupational carcinogens contribute to a significant burden of disease worldwide. The challenge ahead for the next decade lies in identifying interventions earlier in the causal pathway. This involves implementing toxicological testing, applying biomarkers to detect exposure or precancerous changes, and establishing engineering and good industrial hygiene practices to effectively decrease occupational exposure levels. Essential measures include the provision and proper use of personal protective gear, implementing workplace controls, and educating workers to prevent their exposure to these carcinogens.

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Conflict of Interest Disclosures

All authors declare that they have no conflict of interest.

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