Occupational lung cancer*

Câncer de pulmão ocupacional

Eduardo Algranti, José Tarcísio Penteado Buschinelli, Eduardo Mello De Capitani

Abstract

Lung cancer is a multifactorial disease. Hereditary, genetic, and environmental factors interact in its genesis. The principal risk factor for lung cancer is smoking. However, the workplace provides an environment in which there is a risk of exposure to carcinogens. The International Agency for Research on Cancer currently lists 19 substances/work situations/occupations that have been proven to be associated with lung cancer (group 1). Thorough occupational history taking is not widely practiced in patients with lung cancer, which has a negative impact on the investigation of causality and, consequently, on the identification of cases of occupational cancer. The objectives of this review were to list the agents that are recognized as causes of lung cancer, to discuss the contribution of occupation to the development of the disease, to cite national studies on the subject, and to propose a list of procedures that are essential to the appropriate investigation of causality between lung cancer and occupation.

Keywords: Lung neoplasms; Occupational diseases; Occupations; Carcinogens.

Resumo

O câncer de pulmão é multicausal. Fatores hereditários, genéticos e ambientais interagem na sua gênese. O principal fator de risco é o tabagismo. Entretanto, o ambiente de trabalho é um local de possível exposição a agentes cancerígenos. Atualmente, a *International Agency for Research on Cancer* lista 19 substâncias/situações de trabalho/ocupações comprovadamente associadas ao câncer de pulmão (grupo 1). A abordagem da ocupação em pacientes portadores de câncer de pulmão é fraca, impactando negativamente na busca da causalidade e, consequentemente, no desvelamento de casos de câncer ocupacional. Os objetivos desta revisão foram elencar os agentes reconhecidamente indutores de câncer de pulmão, discutir a contribuição da ocupação no desenvolvimento da doença, citar as publicações nacionais sobre o tema e sugerir uma lista de procedimentos que são essenciais para uma adequada investigação da relação de causalidade entre câncer de pulmão e ocupação.

Descritores: Neoplasias pulmonares; Doenças ocupacionais; Ocupações; Carcinógenos.

Introduction

Carcinogens are often found in the workplace. Until the 1970s, most of the known human carcinogens were encountered in the workplace. The work environment remains a significant source of carcinogens.[1]

Carcinogenesis is a multifactorial process in which there is interaction among hereditary, genetic, and environmental factors that lead to uncontrolled cell growth. From this standpoint, occupational cancer is not considered a typical occupational disease, but rather a disease in which work, as an environmental factor, plays a decisive pathogenic role, by Schilling's criteria, which will be discussed below.[2]

The principal risk factor for lung cancer is smoking, which is largely responsible for the development of the disease in men and women. It is estimated that 10-15% of all deaths from lung cancer in the USA are caused by risk factors other than smoking. In isolation, these would account for 16,000-24,000 deaths per year, which would still place lung cancer among the ten most deadly forms of cancer.[3] Occupational carcinogens can act alone or in synergy with smoking. A review of lung cancer in Brazil discussed the principal risk factors, notably smoking, and the economic sectors where carcinogens are strongly present. The economic sectors listed included

* Study carried out at the *Fundação Jorge Duprat Figueiredo de Segurança e Medicina do Trabalho* – FUNDACENTRO, Jorge Duprat Figueiredo Foundation for Occupational Safety and Medicine – São Paulo, Brazil.

Correspondence to: Eduardo Algranti. Serviço de Medicina, FUNDACENTRO, Rua Capote Valente, 710, CEP 05409-002, São Paulo, SP, Brasil.
Tel 55 11 3666-2202. E-mail: eduardo@fundacentro.gov.br

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mining, mineral processing, metal processing, the chemical industry, and the construction industry, including the manufacture of building materials.[4]

Studies on the relationship between lung cancer and occupation, regardless of the type, depend on thorough occupational history taking and on the proper classification of cases and controls (when applicable) within exposure groups. Typically, exposure is divided into the so-called lists A and B.[5] List A comprises the types of occupations and industries that have been classified as being definitely associated with lung cancer, whereas list B involves the types of occupations and industries that are suspected of being associated with this form of cancer. Lung cancer, leukemia, and mesothelioma account for most forms of occupational cancer.[6] Exposure to asbestos, alone, is estimated to be responsible for at least half of the cases of lung cancer attributable to occupation.[7,8]

Recently, the Brazilian National Ministry of Health issued a decree making it mandatory that cases of occupational lung cancer be reported.[9] The Social Security Regulation—Decree 3048/99, amended by Decree no. 6,957 of September 9, 2009—presents a list of work-related cancers, among which is occupational lung cancer, that are recognized for disability payment purposes.[10] Due to the importance of the subject, as well as to the fact that thorough occupational history taking is not widely practiced in patients with lung cancer and that the subject is infrequently addressed in the Brazilian literature, it is relevant that the matter be discussed by specialists who deal with respiratory diseases in their routine. The objective of this review was to provide pulmonologists with information that will contribute to a more thorough investigation of the etiology of cases of lung cancer, furthering the understanding of the epidemiology of the disease in Brazil.

Classification of carcinogenic agents

The International Agency for Research on Cancer (IARC) was established in 1965 as a member institution of the World Health Organization. For more than 30 years, the IARC has produced publications on carcinogenic agents, and such publications have evolved into a program of monographs.[11,12]

The term "agent" refers to chemicals (substances, compounds, elements), groups of chemicals, complex mixtures, environmental or occupational exposure, behavioral or cultural aspects, biological agents, and physical agents. Therefore, "agents" refer to substances, occupations, or situations that affect cancer risk. This term will be used throughout the text.

The IARC monographs are structured into sections:

- Introduction
- Exposure data
- Studies of cancer in humans
- Studies of cancer in experimental animals
- Mechanistic studies
- Summary
- Final evaluation

Each section has specific guidelines and methods to be analyzed. For instance, the evaluation of studies of cancer in humans includes epidemiological cohort studies, epidemiological case-control studies, ecological studies, and intervention studies. Occasionally, studies of biological markers are included. Studies are considered based on their quality, on the existence of temporal relationships between exposure and effects and on causality criteria. Meta-analyses and combined analyses are also admitted. In the final evaluation, the agent is classified, in accordance with the sections above, as belonging to one of four groups (Chart 1).

Occupational agents related to lung cancer

Always using the reputable reference of the IARC, with its criteria and classifications, we present a list of agents that are undoubtedly carcinogenic to humans—classified as Group 1.[13]

This classification is routinely reviewed, and, according to its last update (16/01/2009), Group 1 comprises 108 items, among which there are pure substances, mixtures, exposure circumstances (several of which are occupational), and habits. Although the classification does not specify the form of cancer caused, this can be found in the IARC monographs,[14] which indicate that lung cancer is one of the major forms of cancer on the list.

The IARC studies show that lung cancer, in addition to its various occupation-related causes, is related to habits, such as smoking, or to exposure circumstances, such as emissions from domestic coal burning. There are 20 agents among the substances, mixtures, or occupations related to lung cancer. In addition, there are several other agents listed in Group 2A, that is, agents that are probably carcinogenic to humans, and many of them might be included in Group 1 in the coming years. The present review article will address only the agents classified as Group 1, a group that leaves no room for speculation, and related to lung cancer, thereby making it possible to establish a more objective relationship between the disease and the agent. Chart 2 lists the 20 agents mentioned.

In order to facilitate the task of obtaining information on carcinogenic agents with which a patient might have had contact, a list of some activities and occupations that are common in Brazil and can involve exposure to agents classified as IARC Group 1 (Chart 3) was drawn up, in addition to the occupations, per se, classified as carcinogenic to the lung (Chart 2).

Occupational burden of lung cancer

The occupational risks of lung cancer are quantitatively estimated by calculating the Population Attributable Risk (PAR). The PAR measures the burden of disease attributable to a given risk and estimates its confidence interval.[15] The methods for calculating the PAR depend on knowing the proportion of the population exposed to the risk.

The PAR is calculated based on risk measures (relative risk or odds ratio). Since the occupational risks of lung cancer vary according to the socioeconomic profile of the population, it is admissible that the calculation varies in studies conducted in different regions. One group of authors, using a mean PAR of 9%, estimated that, in 2000, there were 102,000 deaths from occupational lung cancer worldwide.[6] In two recent studies, the PAR was calculated to be 11.6% and 4.9%, respectively.[8,16] In an estimate made in the USA and derived from relative risks described in the literature, PAR was calculated to be 9%.[7] Although the fraction of workers exposed to occupational carcinogens in developing countries might be similar to that found in developed countries, it should be borne in mind that the exposure conditions are much worse in the former.

The significance of the exposure to occupational carcinogens also varies according to smoking status. A multicenter case-control study conducted in Europe concluded that the odds ratio for lung cancer in nonsmoking females was 1.75 (range: 0.63-4.85), although no increased risk was detected for males.[17] Another cohort study did not detect excess risk in nonsmoking females exposed to agents on list A or B, except in specific situations for some groups of occupations or industries that presented excess risk (painting activities, the rubber industry, the footwear industry, the wood industry, and the paper industry).[18]

Occupational exposure to welding fumes and dusts was associated with a higher relative risk of epidermoid carcinomas than that of other histological types.[19] In one study, there was excess risk of small cell carcinoma and epidermoid carcinoma in comparison with that of adenocarcinoma.[16] Therefore, it is possible that there is an association between a given type of exposure and certain cell types of lung cancer.

Despite the knowledge that has been accumulated for decades, establishing occupational causality in cases of cancer remains extremely uncommon. In a study conducted in Great Britain, it was calculated that, in 2004, approximately 7,300 deaths would be attributable to cases of occupational cancer, in contrast with the statistical records of 223 deaths from occupational diseases in the same year.[8]

In Brazil, data on cancer and occupation are scarce. One study involving 316 cases and 536 controls at 14 hospitals in the city of São Paulo, Brazil, calculated that the risk of cancer doubled (OR = 1.97; 95% CI: 1.52-2.55) when groups at higher and lower risk of exposure to carcinogens were compared.[20] These results were similar to those reported in a large population-based study conducted in Denmark, in which the risk of lung cancer in workers with technical-level training was found to be twice that observed in workers with a college education.[21] A second case-control study of occupational risks and lung cancer revealed a significantly increased risk for workers engaged in the production of industrial machinery, workers in the ceramics industry, and workers in the textile industry, the last ones being at excess risk only after performing the activity for more than 10 years.[22] Two case-control studies involving 1,793 and 1,004 cases of lung cancer and conducted in the USA and Germany, respectively, revealed a significantly increased risk of lung cancer in workers engaged in the production of sheet metal, workers in the metallurgical industry, and workers engaged in the production and installation of industrial machinery, as well as in workers engaged in other occupations.[23,24] We emphasize that published studies can be compared only if the number of cases involved is representative, detailed occupational data has been collected, and a similar classification of occupations has been used. Cases of lung cancer associated with exposure to asbestos and silica have been reported in the Brazilian literature.[25,26]

Due to the multifactorial character of cancer, it is complicated to estimate the disease burden attributable to risk factors. Although the contribution of occupational exposure is small, in comparison with that of smoking, it is much superior to that of other risks associated with lung cancer.[27] Based on the evolution of the literature in recent decades, it is absolutely clear that environmental factors, together with increased life expectancy, have contributed to the higher rates of cancer in the population.[28]

How is a nexus established? Information gathering and a practical guide to history taking

The approach to the relationship between occupation and lung cancer is complicated by two factors. First, the latency period (the time elapsed between the initiation of exposure and the recognition of the disease) is long. That results in what is known as recall bias, which occurs due to the long latency period between exposure and diagnosis. Second, there are confounding factors, notably smoking.

In Brazil, the social security system adopts Schilling's classification for the recognition of occupational diseases.[29] This classification divides the "strength" of the relationship between exposure and disease into three levels (groups)[2]:

- The group designated Schilling I comprises diagnosed diseases that are directly and almost exclusively related to occupational exposure, such as silicosis

Chart 1 - Classification of carcinogenicity used by the International Agency for Research on Cancer.

Group	Classification	Parameter
1	Carcinogenic to humans	Sufficient evidence of carcinogenicity in humans and in experimental animals[a]
2A	Probably carcinogenic to humans	Limited evidence of carcinogenicity in humans and sufficient evidence of carcinogenicity in experimental animals[b]
2B	Possibly carcinogenic to humans	Limited evidence of carcinogenicity in humans and less than sufficient evidence of carcinogenicity in experimental animals[c]
3	The agent is not classifiable as to its carcinogenicity to humans.	Inadequate evidence of carcinogenicity in humans and in experimental animals[d]
4	The agent is probably not carcinogenic to humans.	Evidence suggesting lack of carcinogenicity in humans and in experimental animals.

Source: International Agency for Research on Cancer.[12] [a]Exceptionally, an agent can be included in Group 1 when evidence of carcinogenicity in humans is less than sufficient but there is sufficient evidence of carcinogenicity in experimental animals and strong evidence that the agent acts through a relevant mechanism of carcinogenicity in humans. Also exceptionally, an agent for which there is sufficient evidence of carcinogenicity in humans but for which there is only limited evidence of carcinogenicity in experimental animals can be included in this category, as in the case of arsenic. [b]Exceptionally, an agent can be included in Group 2A solely on the basis of limited evidence of carcinogenicity in humans if it belongs to a class of agents that have mechanisms of action similar to that of those classified as Group 1 or 2A. [c]Exceptionally, an agent can be included in Group 2B solely on the basis of limited evidence of carcinogenicity in humans and in experimental models if it belongs to a class of agents that have mechanisms of action similar to that of those classified as Group 1 or 2A. [d]Exceptionally, an agent for which the evidence of carcinogenicity is inadequate in humans but sufficient in experimental animals can be included in Group 3 when there is strong evidence that the mechanism of carcinogenicity in experimental animals does not operate in humans.

Chart 2 - Carcinogenic agents causally linked to lung cancer and included in Group 1 of the classification of carcinogenicity of the International Agency for Research on Cancer, as well as exposure conditions and observations.[a]

Substances, circumstances of exposure, or occupations	Main activities in which exposure can occur	Observation
Tars, pitch, soot, schist, and bitumen	Fumes and dusts of these compounds generated by processes such as street paving, waterproofing of roofs, oil extraction (schist and bituminous sand), and charcoal production (charcoal plants)	These agents consist of mixtures of polycyclic aromatic hydrocarbons, such as benzopyrene.
Arsenic	Respiratory exposure during the production and use of arsenical pesticides, as well as during the smelting of copper ore or other contaminated ores, such as non-ferrous metals (e.g., bronze and brass)	
Asbestos	Manufacture of artifacts of asbestos cement; mining; handling of artifacts of asbestos cement, such as during the installation of tiles and water tanks; manufacture and installation of brake pads, brake disks, and clutch disks; weaving of flame-retardant fabrics; use of asbestos as a protective barrier against heat or fire in industries that use furnaces; and the activity of lining furnaces or even the activity of cleaning these environments	In addition to causing lung cancer, asbestos causes pleural mesothelioma.
Beryllium	Beryllium production; and the manufacture and use of special high-hardness grinding wheels, alloys containing beryllium, and beryllium salts	Beryllium can also cause a chronic lung disease known as berylliosis.
Bis(chloromethyl) ether and chloromethyl methyl ether	Chemical synthesis in general (various chemical industries), as an intermediate substance in the production of resins, pesticides, polymers, etc.	
Cadmium	Respiratory exposure during cadmium mining and refining; manufacture of nickel-cadmium batteries and pigments for paints; galvanizing processes (dispersion via electroplating procedures, such as chrome plating and nickel plating); production of stabilizers for plastics; and cadmium alloy production.	Occupational exposure to cadmium fumes is causally associated with the development of pulmonary emphysema.
Hexavalent chromium (Cr[VI])	Exposure to stainless steel welding fumes (which contain high chromium concentrations); exposure to chromic acid mists during electroplating (chrome plating); production of dichromate-based pigments; and zinc production	Chromium in metallic form or in the form of trivalent compounds is not considered carcinogenic.
Occupational exposure to mists and vapors from strong acids containing sulfuric acid	Sulfuric acid mists generated from battery charging, acid vapors emanating from metal cleaning processes (pickling), production of fertilizers, and chemical/petrochemical industry processes	It is noteworthy that in the history of workers exposed to strong acids, there are complaints of burning of the eyes and upper airways, temporally associated with the exposure.
Occupation of painter	House painting, vehicle painting, etc.	There are a number of risks involved, such as exposure to dusts and fumes (through pyrolysis) in the preparation of surfaces, exposure to metals used in paint pigments or as anti-rust agents, exposure to resins (e.g., epoxy), and exposure to asbestos used in construction.

[a]Adapted from Siemiatycki et al.[1] and from the International Agency for Research on Cancer.[13]

Chart 2 - Continued...

Substances, circumstances of exposure, or occupations	Main activities in which exposure can occur	Observation
Manufacture and repair of footwear (leather industries)	There is an association between these activities and cancer of the lung, larynx, and nasal cavity.	The exact cause is unknown, but it is speculated that the cause is leather dust, dust from chemicals used in the preparation of leather (tanning), or a combination of the two.
Coke production	The preparation of coal coke (in "coke ovens") for use in the production of steel in large iron and steel metallurgical plants is related to lung cancer.	The process generates a large quantity of fumes rich in polycyclic aromatic hydrocarbons.
Aluminum production	The industrial process exposes workers to tar fumes.	Aluminum itself is not carcinogenic, but exposure to polycyclic aromatic hydrocarbons generated in primary aluminum production is.
Iron and steel production	The industrial process exposes workers to tar fumes, and stainless steel production exposes workers to Cr(VI) and to nickel.	Iron itself is not carcinogenic, but exposure to associated metals and polycyclic aromatic hydrocarbons generated during the smelting process is.
Mustard gas	An extremely toxic, irritating, carcinogenic gas used as a chemical weapon.	
Coal gasification	The production of gas from charcoal in retorts produces fumes containing tar.	The work and the type of exposure are very similar to those of the production of coke for iron and steel metallurgical plants.
Nickel	The nickel compounds generated especially by the nickel refining process, probably the oxides and sulfites, as well as the compounds generated by the stainless steel welding process.	
Radon	Underground mining of gold, iron (hematite), and uranium.	Radon is a radioactive gas formed from the isotopic decay of uranium and radium and is naturally found in volcanic rock.
Free crystal silica	All situations leading to risk of chronic silicosis.	The chronic inflammatory process of silicosis is likely to be associated with the development of lung cancer.
Passive smoking	Several occupational situations, such as working in bars, restaurants, offices, etc.	
Talc with asbestiform fibers	Mining and industrial or crafted handling of silicate, talc, and soapstone geologically contaminated with asbestos fibers.	Exposure to talc dust (silicate) contaminated with asbestos fibers causes the same effects as does exposure to asbestos. The contamination is natural and depends on the mine the talc comes from. Because of the geological origin of talc deposits, often there is contamination with amphibole asbestos.

[a]Adapted from Siemiatycki et al.[1] and from the International Agency for Research on Cancer.[13]

Chart 3 - Principal activities that might be related to lung cancer in Brazil.

Activity	Agent
Welding	The emission of welding fumes is always a potential risk, especially if the worker welds stainless steel, which contains high levels of chromium and nickel.
Metal smelting and refining	A large number of activities can expose workers to the emission of fumes with high concentrations of polycyclic aromatic hydrocarbons, as well as to metal fumes and silica.
Charcoal kiln operation	Exposure to charcoal kiln smoke containing polycyclic aromatic hydrocarbons
Street paving and waterproofing of roofs	Emission of polycyclic aromatic hydrocarbon vapors
Battery charging	There is exposure to sulfuric acid mists during the charging of batteries in factories and in repair shops.
Cleaning of metallic surfaces in metallurgical industries	There is exposure to vapors of strong acids (e.g., hydrochloric acid and nitric acid) used in the process known as pickling.
Asbestos mining and production of asbestos cement products	Exposure to asbestos (any type of fiber)
Construction and maintenance of furnaces in the metallurgical, ceramics, glass, and smelting industries	Occasionally, furnaces are lined with asbestos.
Construction	Installation and renovation of roofing and water tanks made from asbestos cement, especially the drilling process for setting tiles. Demolitions in general.
Use of asbestos-contaminated talc	In mining and talc grinding, in the rubber industry (tires, rubber mats, etc), where talc is used to prevent the pieces from adhering to each other, in the production of putty adhesives, and in sanding of this type of adhesive in workshops. The risk occurs if the talc contains asbestos.

and lead poisoning. These are the classical occupational diseases.

- The group designated Schilling II includes diseases that can be found in the entire population, but to which work was a contributing factor in those cases. Some examples are work-related musculoskeletal diseases (repetitive strain injuries or others) and coronary diseases, in which stress plays an important role. Work-related cancer is included in this group, since tumors of occupational origin might have causes other than those of the same tumors when non-work-related.
- The group designated Schilling III includes diseases in which work triggers a latent disorder or aggravates a previously established disease. Allergic contact dermatitis, asthma, and mental disorders, for example, fit into this group.

In practice, the relationship between work and many of the diseases in the Schilling III group can be definitively confirmed or ruled out, such as in cases of allergic dermatitis after contact tests, or even in cases of asthma after specific bronchial provocation tests, or when peak flow curves are obtained in periods of work and of leave from work. However, the same is not true for the diseases in the Schilling II group, in which cases there is always room for doubt, even when the investigation is thorough.

Chart 4 - Basic content for a screening type of occupational history taking.

Self-reported occupational history:
Current occupation and exposure
Description of the workplace (presence of gases, dusts, vapors, or other inhaled agents)
Previous occupation and exposure
Temporal relationship between lung cancer and any of the occupations reported (pay attention to the latency period)
Diagnosis of or death from lung cancer among other workers in the workplaces described

Chart 5 - Suggested generic form for occupational history taking.

Name: ______________________________Registration: __________ Date: ___/____/____		
Record, in chronological order, only the occupations associated with inhalation risk.		
Workplace Name and type of company	Detailed description of the occupation/function [adopt the terms used by the patients and ask them to explain the unusual situations]	Substances involved
1) AGRICULTURAL PRODUCTION[a]	YES [ ] NO [ ] Until the age of: _____	
2)	From ___ to ____ Total: _____	
3)	From ___ to ____ Total: _____	
4)	From ___ to ____ Total: _____	
5)	From ___ to ____ Total: _____	

[a]In rural areas, working in agricultural production is a common first job, hence the suggestion of beginning history taking by inquiring about this activity.

Lung cancer is not always etiologically related to occupational exposure. Therefore, occupational history taking can be conducted at two levels of depth: a general inquiry, that is, a type of basic screening for occupations and substances; and a detailing of the history, after the detection of something suspicious in the initial screening.[30-33]

Pulmonologists can easily perform the general enquiry, but it should be borne in mind that they might need aid in detailing the history, since it is not possible for a single professional to retain and understand all of the information related to the complex world of work. If no occupational suspicion is raised in the initial approach, a more in-depth investigation will not be conducted. It is understood, therefore, that the basic occupational history plays a fundamental role in routine history taking.

All routine occupational history taking should include the initial and brief but no less comprehensive overview inquiry of present occupations, previous occupations, and specific types of exposure recognized as posing the greatest occupational risk for lung cancer, such as that to fumes, gases, dusts, and other aerosols (see Chart 4 for a suggestion of a guide).

After the first voluntary statement, there should be specific inquiries, preferably using a standard list of agents and types of exposure recognized as causing lung cancer (Charts 2 and 3). If the screening does not indicate occupations or environments with suspected agents, further history taking can be dispensed with.

When the etiology is hypothesized to be occupational and a suspected exposure is identified in the screening, the workplaces where the patients have been employed and the occupations they have had in their professional life should be detailed.[32] To that end, an appropriate amount of time should be allocated in the medical appointment. It is not possible to obtain quality information in a hasty manner. This detailing should follow a script covering from first to current job, preferably using a standard pre-approved data collection worksheet (Chart 5). This step should include the following:

- Detailed information on workplace production processes (e.g., grinding, separation, loading, mixture, chemical reactions, etc.); presence of aerosols, gases, vapors; exhaust conditions, etc.
- Designations used for basic raw materials, processing substances (e.g., catalysts), and end-products
- Complete description of the occupations performed (direct or indirect exposure, use of personal protective equipment, mean number of work hours, inhalation risk in neighboring sectors, etc.)

Some occupations, such as that of welder, foundry caster, part trimmer, toolmaker, tool sharpener, emery grinder, jackhammer operator, crusher operator, enameller, etc, are difficult to understand for pulmonologists who have never witnessed these activities. The nomenclature used by the patients to designate their occupations should be faithfully recorded and should not deter physicians from searching for more detailed explanations about what these designations mean in practice. In the absence of visits to the workplaces, other sources of information should be consulted (Chart 6).

Chart 6 - Basic available sources of information on toxic substances, work processes, and specific occupations.

Institutional
1. IARC - International Agency for Research on Cancer
http://monographs.iarc.fr/
2. Toxicological Information Centers
A list of internal reports of work-related accidents and respective telephone numbers can be found on the ANVISA website: www.anvisa.gov.br National telephone number: 0800-722-6001
3. Brazilian Ministry of Labor and Employment through the *Fundação Jorge Duprat Figueiredo de Segurança e Medicina do Trabalho* (FUNDACENTRO, Jorge Duprat Figueiredo Foundation for Occupational Safety and Medicine)
www.fundacentro.gov.br click on *Fale Conosco and then on Consultas Técnicas.*
Specialized databases
TOXNET: www.toxnet.nlm.nih.gov/
• Free-access toxicological database of information on hundreds of chemicals that are present in workplaces. From this site, it is possible to access other databases, such as:
HSDB: Hazardous Substance Database
Toxline: search of literature on toxic substances
Chemical Synonyms
Haz-Map: Occupational Exposure to Hazardous Agents: www.hazmap.nlm.nih.gov/
User-friendly database of occupations, chemical agents, and work processes of the National Institute of Health, in which information can be searched by substance, occupation, or work process
BVS Toxicologia Brasil: www.tox.bvs.br/html/pt/home.html
• With access to several toxicological databases and to literature in Portuguese
Basic textbooks
1. Sullivan Jr JB, Krieger GR, editors. Hazardous Materials Toxicology - Clinical Principles of Environmental Health. Baltimore: Williams & Wilkins; 1992.
2. Parmeggiani L, editor. Encyclopaedia of Occupational Health and Safety, 3rd ed. Geneva: International Labor Office; 1983.
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A common situation that merits attention is that of when the principal occupation of the patient seems not to include suspected agents but is performed in contaminated environments. For instance, furnace operators in the steel, foundry, or ceramics industry, in addition to the possibility of being exposed to polycyclic aromatic hydrocarbons, can be intermittently exposed to asbestos during operations for the maintenance and renovation of furnaces, which are performed by specific professionals but can pollute the environment with asbestos.[34] Another important situation that should be addressed in history taking is the possibility that the patients have lived, for long periods of time, with family members who are exposed to carcinogens in the workplace and bring industrial dust home on their contaminated clothes.[34-37]

If necessary, pulmonologists can resort to an occupational physician or hygienist, or even visit the workplace of the patient.

Final considerations

In medical practice, making any diagnosis requires recalling that a certain disease exists. In addition, most diseases have known causes.

Tumors of occupational origin are not recognized as such in Brazil. Consequently, the affected workers are not entitled to their labor and welfare benefits. The few studies on the relationship between occupation and cancer that have been published in Brazil are restricted to academic public health[20,22] or to clinics specializing in occupational pulmonology.[25,26,35] The subject is alien to most pulmonology clinics in Brazil.

In Brazil, there are still no epidemiological records of occupational tumors that allow, in the mid- and short-term, the detection of occupational hazards and, therefore, their effective prevention. If we are “paralyzed” by the lack of scientific proof of a nexus, there is no way that we can perform primary prevention of occupational cancer. In 1965, Sir Austin Bradford Hill, known primarily for the establishing the criteria of disease causality, alerted us to the fact that scientific work is, by nature, incomplete and subject to change due to advances in knowledge. However, that does not give us the right to postpone preventive measures that ignore or reject current knowledge.[38]

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About the authors

Eduardo Algranti
Medical Researcher. Department of Internal Medicine, *Fundação Jorge Duprat Figueiredo de Segurança e Medicina do Trabalho* – FUNDACENTRO, Jorge Duprat Figueiredo Foundation for Occupational Safety and Medicine – São Paulo, Brazil.

José Tarcísio Penteado Buschinelli
Medical Researcher. Department of Internal Medicine, *Fundação Jorge Duprat Figueiredo de Segurança e Medicina do Trabalho* – FUNDACENTRO, Jorge Duprat Figueiredo Foundation for Occupational Safety and Medicine – São Paulo, Brazil.

Eduardo Mello De Capitani
Associate Professor. State University at Campinas School of Medical Sciences, Campinas, Brazil.