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OCCUPATIONAL AND ENVIRONMENTAL MEDICINE

APPROACH TO THE PATIENT WITH AN OCCUPATIONAL OR ENVIRONMENTAL ILLNESS

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In 1700, an Italian physician, Bernadino Ramazzini, first published a compendium of diseases that could afflict workers.[10] In *De Morbis Artificum Diatriba* (Disease of Workers) he gave dozens of examples of illness caused by exposures ranging from bad eyesight among those doing fine work to breast infections among wet nurses. He made a significant contribution to the manner in which histories were obtained from patients, adding to the approach first outlined by Hippocrates centuries earlier. Ramazzini recommended physicians ask their patients what they did for a living. Given the blurring lines between traditional occupational exposures and hazards now found in the general environment, the complete approach to a patient today includes asking about exposures in both occupational and environmental settings.

As students are traditionally taught in medical school, the history is the most important interaction with a patient; physical examination findings and laboratory assessment generally confirm suspected diagnoses, rather than being the primary source of information. Although students are generally well taught how to obtain histories about common diseases, traditionally there is less emphasis on obtaining information about occupational or environmental exposures. Even today many medical schools do not have any required curriculum time in this area, and Levy has documented the paucity of training in traditional medical education.[6]

This article reviews an approach useful to primary caregivers in ascertaining whether there is an occupational or environmental aspect to a patient's problem, although virtually all medical practitioners in some way would benefit from ascertaining such information about their patients. Exposure information is relevant over the broad spectrum of life, from reproductive hazards and risks in utero, to old age and some diseases that most often appear late in life.

OCCUPATIONAL AND ENVIRONMENTAL HISTORY

The importance of asking a few relevant questions is illustrated by the following case study.

On a rainy Sunday evening, a young man in his mid-20s comes to the emergency room complaining that over the past several hours he has had the onset of a severe headache. He is accompanied by his pregnant wife, and relates that he had spent the day refinishing baby furniture in a closed garage. He had no prior history of neurologic difficulty or any significant medical history.

While waiting to be fully evaluated, he was given two acetaminophen, and when seen by the neurologist several hours after the initial history he noted that the pain had essentially resolved. Nevertheless, without much additional history, an overnight admission, including a spinal tap and CT scan, generating a several thousand-dollar hospital bill, led to little useful information and the patient was discharged the following day. A subsequent call from the resident in the emergency room who had first seen the patient to an occupational medicine physician led to a fuller understanding of this case.

A furniture stripping compound he had used contained methylene chloride, and, in retrospect, it was believed the patient had generated large quantities of methemoglobin over the course of the day, leading to his headache, which resolved as he sat waiting in the emergency room. The patient had been asked no questions regarding the nature of the chemicals he was working with on the day of his illness.

Physicians generally learn a standardized format of obtaining history and additional information about their patients. The usual order is (1) chief complaint, (2) history of present illness, (3) past medical history, (4) family history, (5) social history, which often includes rudimentary information about work, (6) review of systems, (7) the findings on physical examination, and (8) relevant laboratory test results. Recognizing the enormous productivity and time pressures on physicians, it should be noted that obtaining a rather complete occupational and environmental

history can generally be done in less than 5 minutes. Only then, should there be something relevant to an exposure at the workplace or in the individual's general environment, would there be a need to obtain a detailed evaluation of environmental or workplace exposures, which might take considerably longer, and require additional specialists. Physicians specialized in occupational medicine are often first trained in a primary care field, and then obtain credentials as board certified specialists in occupational medicine, one of the branches of the broader field of preventive medicine. Such individuals are trained to more fully and in greater detail evaluate the possible relationships between exposures and disease.

Figure 1 is a relatively simple occupational and environmental exposure history format that can be useful in obtaining more detailed information about relevant exposures. Asking these questions serves several useful functions. First, it may be the key to identifying the patient's current illness. Second, many individuals find interactions with physicians intimidating, but when relating basic facts about themselves, such as explaining how they make a living, or how they spend their free time, they can develop good rapport with their primary caregiver, or specialist. Last, in an ongoing primary care relationship, such information is useful to the medical practitioner, allowing for future-focused evaluation of organ systems that may be at particular risk because of prior exposures.

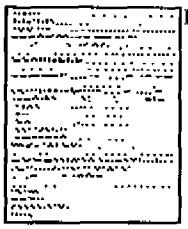

Figure 1. Occupational and environmental history.

Figure 1 outlines a simple approach to ascertaining relevant information about occupational and environmental exposures. Although this review begins with the question of the patient's current work, it should be appreciated that the latency period between the exposure and the onset of disease can vary from minutes to decades, and the current occupational setting may not necessarily be relevant.

The primary care provider should ascertain their patient's current job and how long the individual has worked in this setting. Unless self-evident, the primary care provider should ask the individual to describe the nature of the work, explain any jargon that might have been used, and even comment on the industry involved. An axiom of the workplace is that the setting is more important than the trade, so a security guard, for example, might develop an asbestos-related disease if their workplace is a shipyard.

Next, one can ask about the general matter of exposures at work to dusts, fumes, chemicals, physical agents, or other factors. One can ask about such exposures away from the workplace as well. The patient should be asked to describe any adverse effects they think may be related to such exposures.

A classic public health question would be inquiring whether any fellow workers or those who share their ambient environment are similarly ill or have complaints related to similar exposures. This often serves as a useful clue to the specific nature of a patient's disease, and, if others are involved, proper authorities can be notified to investigate the situation. Additionally, a question about the use of protective equipment will elicit, in a general way, the perceived hazards of a workplace. If the individual is required to use steel-toed shoes, a hardhat, safety goggles, hearing protection, or other safety equipment, then one may infer that specific hazards have been recognized.

The next useful step might well be to inquire in a systematic fashion regarding all previous employment. As a rule, to impress upon patients that each and every prior job may have some relevance, it may be useful to push the patient's recollection back to their childhood, when they may have had part-time employment after school or during summer vacations. Then one can go into regular employment at the completion of schooling and get a chronologic list of places of work and potential exposures. It is also relevant to ask about other part-time, temporary, or summer vacation employment for those who may have had extended schooling. A 2 to 3 month employment as a construction worker at the age of 18 led to the development of a mesothelioma in his late thirties of an athlete who became a football coach, who had had no other exposure to **asbestos**.

Another area of relevant inquiry is military service or similar exposure. Given the recent concerns over "Gulf War Syndrome" and, earlier, the concerns about Agent Orange, or even earlier, nuclear weapons testing, military service--albeit short in duration for some individuals--may have led to serious exposures. Alternative service may have been relevant as well. There is the case of a man in his late 50s with a mesothelioma for whom no known **asbestos** exposure could be identified until a question regarding World War II military service was asked. The response was "Oh, I was lucky. I got a job in a shipyard." This 2-year war-time employment was sufficient exposure to cause disease decades later.

Exposures in the workplace are not the only source of potentially hazardous materials. Environmental exposures through air, soil, water, or even food products can result from materials that escape industrial sites and, in some industries, contaminated clothing can contaminate a household.

An area rarely asked about and, admittedly, rarely the source of useful information but relevant in some cases, is hobbies. A case study can illustrate this.

An environmental scientist at a government-run laboratory, thoroughly knowledgeable about potential health effects of toxic materials and working on an emergency response team, had as a hobby competitive pistol shooting. He noted he used hearing protection while at the firing range, but discussion revealed that he manufactured his own bullets in an unventilated basement using a heated pot to melt lead. Although he had no clinical symptoms, measurements of blood lead revealed a remarkably elevated value of fifty mug/dL. On follow-up after he stopped

manufacturing his bullets, his blood lead levels returned to normal.

Other hobby-related exposures may include lapidary work, welding exposures, and a variety of other hazards.

In addition, although relevant for all cases, a good smoking, alcohol, and drug use history is most relevant because of potential interactions with workplace or environmental hazards.

THE PHYSICAL EXAMINATION

The signs and symptoms on physical examination associated with occupational or environmental exposures may be specific but most often are general and nonspecific in nature. Diffuse symptoms such as nausea, vomiting, headache, parathesias, or chronic cough may be the first sign of an occupationally or environmentally induced illness, although they are often associated with many other medical conditions. A primary caregiver must always be sensitive to the possibility of a specific problem related to such nonspecific symptoms.

When conducting a physical examination, the primary caregiver should be sensitive for certain changes that may point to occupational or environmental exposures. Listed are several findings that may possibly be connected to occupational or environmental exposures:

Skin: areas of depigmentation, Mees' lines on fingernails or toenails, discoloration of the gingiva, multiple small burns, areas of cellulitis

Head, eyes, ears, nose, and throat: area of alopecia, perforated ear drums, hearing loss, cataracts, perforated nasal septum, inflamed vocal cords

Chest and heart: gynecomastia, crepitant rales, increased anteroposterior diameter, abnormal cardiac rhythms, enlarged heart, hypertension

Abdomen: dysphasia, diffuse discomfort, rectal mass, enlarged liver

Musculoskeletal system: decreased range of motion, back spasms or back pain, muscle atrophy, swollen joints, altered gait

Nervous system: central or peripheral manifestations of neurologic alterations

These are a few examples of findings that may be related to exposures of a specific nature and should be considered by the evaluator of the patient.

ROLE OF LABORATORY TESTING

Few laboratory tests are specific for exposures, other than those that target specific chemicals or their metabolites. These might include various solvents or heavy metals. Generally, laboratory tests are nonspecific but can be extremely useful in the full assessment of potential problems associated with hazardous exposures.

PULMONARY ASSESSMENT

Occupational lung diseases are among the more common problems associated with workplace exposures. Diseases of an obstructive or restrictive nature can be found, and the usual tools of pulmonary assessment can be employed.

The most commonly used modality is the chest radiograph, but it should be noted that screening chest radiographs are rarely indicated, with the possible exception of an individual who is at particularly high risk of developing pulmonary pathology, such as a worker with longstanding exposure to asbestos, or uranium miners. There is little value in the routine use of chest radiographs among the general population, even with a history of exposure to many agents.

Pulmonary function testing, often using only simple spirometry, is useful in the full assessment of a patient. Workplace or environmental diseases, such as asthma, or restrictive changes caused by the various pneumoconiosis-producing dusts can be assessed by this method. Only rarely is it necessary to proceed further with blood gases, exercise testing, or challenge testing. All these modalities are available and can be useful in individual cases, however.

Blood and urine evaluation serve as routine screening tests for liver, kidney, or hematologic diseases but are of little value and generally detect disease at a relatively advanced stage. A developing area that will receive much attention in the future is that of genetic testing, but it is beyond the scope of this article.

It should also be recognized that although certain screening tests have little definitive value,[9] they may be mandated by federal or other requirements, and primary practitioners are often asked to complete physical assessments for employment or job placement.

RELATED SCIENTIFIC DISCIPLINES

There are a number of scientific disciplines related to the issues of occupational and environmental exposure. Remembering that this field comes from the broader field of preventive medicine, principles of epidemiology are often used by specialists in this area. The ultimate evaluation of the cause-and-effect relationship between exposure and disease is made using such investigations. It therefore is useful to have some basic appreciation of some of the principles of epidemiology, as well as other areas of science.

Epidemiologic principles are used to establish the relationship between exposure and disease, and much of what is applied to individual patients comes from studies of groups of individuals. Traditionally, disease was studied among groups of workers who usually had high levels of exposure and were therefore more likely to develop disease. It is now appreciated that in some cases environmental exposures can rival, or even exceed, occupational levels and more attention is being paid to issues such as community assessment. Also, increasingly lower levels of exposure to some agents are recognized as having potential hazard.

Basic principles of toxicology are also useful in understanding the nature and development of occupational and environmental disease.[3] Classic concepts such as dose-response and latency should be understood. With regard to dose-response, the basic principle is that, as the dose rises, the likelihood of some biologic alteration increases. This can certainly be modified by genetic factors, immune status, nutrition, and synergistic or antagonistic exposures. It should be remembered that not all factors are understood with regard to why some individuals develop disease following certain types of exposures and others do not.

As noted earlier, the latency for the development of occupational or environmental disease can vary greatly. If a valve breaks and spews a noxious chemical on an individual, symptoms may begin immediately. In the case of something such as metal fume fever--that is, the inhalation of zinc or other fumes from welding and related operations--the symptoms of fever and chills do not begin for several hours, and mimic influenza. Diseases such as lead poisoning may take months of exposure to develop, and, generally, with some exceptions, cancers only begin to develop after two decades have elapsed from first exposure. It is not necessary to have continuous exposure over that period of time. Some problems, such as clear cell carcinoma of the vagina, even can skip generations, as was learned by prospective mothers who took diethylstilbestrol. Disease did not develop until their offspring reached the end of their second or into their third decade of life. With such ays possible, primary care providers should always be vigilant for prior exposures producing disease after considerable intervals.

Another discipline that has much bearing on understanding exposure and, perhaps, ultimately ameliorating hazardous conditions, is that of industrial hygiene.[2] At workplaces, industrial hygienists measure exposure hazards and recommend methods to safeguard workers. They deal with basic issues such as measurement of amounts of toxins in the workplace, measurements of hazards in the workplace, and ventilation and lighting, and, along with safety professionals, may get into areas such as machine guarding. They are in a position to recommend less hazardous substitutes or look for alternate ways of producing materials. They also can investigate the enclosure of particular hazardous processes, or, as a last resort, can make appropriate recommendations for individual personal protective equipment for workers in dangerous environments. Personal protective equipment is recognized as the least satisfactory method of worker protection.

Other ancillary health professionals include audiologists, who can assess hearing loss, ergonomists, who can assess the interactions of workers and their equipment, and toxicologists, who can make specialized measurements of body tissues and fluids.

MAJOR CLASSES OF HAZARDS

It would literally take an encyclopedia of hazards, as does exist, to review most hazards that can arise with workplace or environmental exposure. In this section the author highlights some of the major classes of hazards with representative and illustrative case examples.

avy Metals

A wide variety of heavy metals can cause illness, both in occupational and environmental settings.[4] Among the better appreciated of these problems are lead poisoning in young children from pica, the eating of lead paint chips (or other foreign substances). Industrial lead poisoning is rarely a problem, although it is still occasionally seen in burners dismantling old elevated structures that in the past were often painted with leaded paints.

An underappreciated problem is that of a Parkinsonian-like picture induced in some welders by the manganese found in welding rods. With latencies as short as several months or as long as several decades, workers as young as their mid-30s have been noted to have tremor, impotence, softened speech patterns, and other findings characteristic of a Parkinsonian state. The first cases in welders were reported in the 1930s,[1] and more subsequently.

An interesting case study is that of a 42-year-old man referred for evaluation of arsenic poisoning. He had been ill over a 5-month period and a treating physician, following appreciation of Mees' lines (white lines in the fingernail beds) ran a heavy metal screen and detected large quantities of arsenic in the urine. An occupational history documented that the man worked as the manager of a convenience store that also sold gasoline. He had recently moved into a new doublewide mobile home with his family and had built an outdoor deck with arsenic-treated wood, and had applied arsenic-containing pesticides to his lawn. He had also begun using a new ceramic coffee cup from Mexico, given him by a family member. The diagnosis of arsenic poisoning was confirmed and he had classic findings, including stocking/glove parathesias. In reviewing his exposure history, it was noted that the excess arsenic wood had been burned outdoors; however, the patient did not do the burning and did not handle the ashes. The coffee cup was tested (ceramic glazes can contain lead and other heavy metals), but was not found to contain arsenic. The cause of his intermittent problem appeared to be the use of a juice glass taken from a kitchen cupboard to measure the arsenic-containing herbicide, with the glass not being washed prior to being put back in the cabinet, and subsequently being used by the individual. He was also questioned about the relations with his wife since spousal poisoning should always be suspected with arsenic intoxication in a nonoccupational setting, given that many cases still are found this way.

Another recent example of an unusual source of heavy metal poisoning was the case of dozens of people with elevated mercury levels in Arizona, with other cases noted in Texas, following the use of a Mexican beauty cream heavily contaminated with mercury. Although none of the individuals had overt nervous system damage, many had early symptoms of mercury poisoning, including headaches, weakness, mood changes, and dizziness. Up to 10% of the cream was composed of a mercury-containing compound, and could be easily be absorbed through the skin, especially with heat and sunlight.

Chemicals

A wide variety of chemicals, in many classes, can lead to occupational or environmental illness. Solvents are especially well known for their hazard[7] and can cause a wide range of diseases affecting the hematopoietic system, the nervous system, the biliary system, the renal system, and other organs. The following case illustrates how short-term employment can lead to illness.

A white man in his late 20s presented with biochemical evidence of liver damage. He had been a journalism major and had worked in radio and television but had recently been laid off from a radio announcing position. He had taken a job at a construction site in New York city, where his job was to "paint" the inside of wooden forms prior to concrete being poured, so the molds could be easily removed after the concrete had hardened. He carried this material around in a 5-gallon bucket and used a large paintbrush to swab the inside of the forms. During the course of the day, much of this material would spill over onto him. He was not a user of alcohol.

When seen, his liver function tests were elevated, with no physical stigmata. The compound involved was a complex mixture of solvents, many of the components known to have the ability to cause liver function abnormalities. When last seen, his liver function tests were returning to normal following cessation of work, and he was lost to follow-up because he moved to another community to resume his broadcasting career. He was told that it would be beneficial to inform all his future physicians of this short-term intense exposure causing liver function abnormalities, which might never return to baseline levels.

Sometimes, unusual outcomes lead to the rapid pinpointing of specific chemical hazards. A case in point is that of exposure to vinyl chloride, a gaseous substance used to make polyvinylchloride resin in the manufacture of vinyl plastics. Exposure to vinyl chloride leads, in some individuals, to a rare malignancy affecting the vascular system, particularly within the liver, known as *hemangiosarcoma.* The identification of several cases in one manufacturing facility in a short period of time led to the identification of this specific hazard. When such exposures are exquisitely related to certain disease outcomes such as vinyl chloride and hemangiosarcomas, asbestos exposure and mesotheliomas, and radium salts and bone sarcomas, these are called *sentinel tumors.*

Another class of agents increasingly being recognized as causing disease in both workers and in household settings are pesticides. Not surprisingly, many cases are reported each year among farm workers who are inadvertently sprayed, or who return to recently sprayed fields too soon. Less obvious cases are illustrated by the case study below.

A middle-aged art gallery owner in New York city usually lived in a small apartment near the gallery but also used a large home in Connecticut. She developed lower back pain after playing tennis in early spring, and to save walking up the steps in the Connecticut house moved into a daughter's bedroom on the first floor. Some 10 days later, while still having back pain, she also experienced a severe case of dizziness. She then returned to New York city and, upon being examined by her physician, was told to continue to rest her back and take a nonsteroidal anti-inflammatory drug. The following weekend she again returned to the Connecticut house for bed rest. She developed diarrhea, which was blamed on the anti-inflammatory, which was discontinued. She stayed at the country home and 1 week later experienced additional severe diarrhea, stomach cramps, and generalized weakness. The symptoms persisted and progressed, with weakness and transient pain in her hands and feet. She began to lose weight and had some difficulty in walking or standing.

Upon consulting her internist again, a chest radiograph revealed no abnormality and because of the continued weight loss she was referred to a gastroenterologist who found only rapid motility. She continued with neurologic abnormalities in her legs, associated with twitching and pain. She began to experience diplopia, memory loss, and speech difficulties. Additional visits to her physician revealed no abnormal laboratory test results. She was then referred to a psychiatrist who believed that although depressed, her symptoms were of a physical nature. She then underwent a series of further medical assessments by a gynecologist, endocrinologist, and infectious disease specialist. These visits ruled out diabetes, multiple sclerosis, and a possible parasitic infection.

During the summer, the patient spent a month on the West Coast, during which time her symptoms disappeared. On return to New York, she lived in her apartment and continued to feel well. She was shown an article in a literary magazine about pesticide poisoning.

On calling her exterminator, she found that the house in Connecticut had, on two occasions, been heavily sprayed with organophosphates prior to her onset of symptoms, especially in the bedroom where she had stayed, to combat fleas. Spraying had occurred on the carpet, drapes, bed, and other furniture. At a later time, when her symptoms worsened, this had been, in retrospect, associated with additional episodes of spraying in the house and additional use of organophosphates on the lawn.

At this time, her physician correctly diagnosed her illness as hypersensitivity to organophosphates.

This sort of problem is not uncommon because primary care practitioners often have a low index of suspicion that the source of a patient's problem may be in their environment or a workplace exposure. Such multiple referrals, without resolution of the problem, are not unknown because each specialist tends to focus on his or her area of expertise and does not always step back and assess the patient more broadly.

The resolution of some medical conundrums occurs more quickly when larger numbers of individuals are involved. There is the case, for example, of a group of 20 work colleagues who shared a lunch together. In less than 1 hour, and over the next several hours, 16 of the 20 individuals became ill, with a wide variety of symptoms and, upon medical evaluation, some were noted to have extremely slow pulses, as slow as 20 beats per minute. Although this would seem an obvious situation in which to consider food poisoning, this finding of severe

bradycardia should steer one away from such a consideration.

The lunch had been simple, a roasted meat dish, cabbage salad, dessert, rolls, and tea. The cabbage salad had been made by opening precut bags of cabbage to which vinegar, salt, and spice from a pepper can were added. The pepper can used by the individual making the salad had been retrieved from a recently deceased relative's automobile trunk. That relative had been a crayfish farmer in Louisiana. It turned out that what was thought to be black pepper was instead aldecarb, a potent pesticide that had been used in connection with crayfish farming, and its use as black pepper was sufficient to cause this severe outbreak of illness.

DUST AND FIBERS

A wide variety of respiratory hazards can cause many obstructive or restrictive diseases. It is now better appreciated that there are significant environmental factors leading to exacerbations in asthmatics, including dust mites, animal dander, and other exposures in the home, along with less well appreciated hazards such as flour dust or aerosolized plastic wrap in supermarket butcher shop areas. Increasingly, materials that cause asthma exacerbations are being better appreciated as the number of cases of asthma continues to rise in the United States.

A whole range of dusts produce pneumoconiosis, or scarring of the lung. First reported by Zenker,[12] many occupational settings expose workers to dusts such as silica, **asbestos**, coal, and a variety of other particulate materials. It recently has been appreciated that silica can cause lung cancer, although the mechanism and details of this relationship are not yet well understood. Much better appreciated, and known for some 60 years, is the relationship between **asbestos** exposure and the development of cancer, especially lung cancer and the otherwise rare cancer of the pleura, mesothelioma.[11] Mesotheliomas of other structures (peritoneum, pericardium, and others) have also been reported. The scarring of the lung caused by most of the pneumoconiosis-producing dusts is one of restrictive change, although obstructive change has been noted as well. **Asbestos**, in particular, has been appreciated as a substance that represents a significant workplace hazard to virtually any group of workers who may have some exposure to it, whether they handle it or not, but it is also known to produce what is sometimes called "neighborhood disease."

A 28-year-old accountant presented to his physician with a dull chest pain that was more fully evaluated after several months. A thoracotomy revealed a malignant mesothelioma. Lung tissue analyzed for **asbestos** content showed two forms of **asbestos** present in the lung. A detailed occupational and environmental history at first failed to reveal any potential source of **asbestos** exposure. The young man had been a college student, and neither he nor any family member had ever worked in an environment with known **asbestos** exposure and he had always worked as an accountant. Given that he was under 30 years of age, the development of mesothelioma seemed particularly unusual, given the usual latency period for this disease.

A further review of a map locating his two places of residence during his lifetime revealed that both homes were within three blocks of a naval shipyard, and one of the forms of **asbestos** found in his lung was of the type most commonly used aboard US Naval vessels. Ultimately, his exposure was determined to have been environmental, during his childhood, and his 28-year latency period seemed appropriate.

PHYSICAL AGENTS

A wide variety of physical hazards can cause disease. Some apply to the workplace, some to environmental situations, but most apply to both.

Temperature Extremes

Both temperature extremes can be hazardous to health. From a public health perspective, one of only two well-recognized causes of mortality that leads to mortality patterns outside long historical norms is hyperthermia during extremely hot summer weather. (The other is influenza outbreaks, usually during winter.) The workplace hazard of heat stress and heat stroke are generally well recognized and dealt with by appropriate means, the best defenses being proper hydration and limitation of exposure. In fact, the role of adequate hydration was well documented with recent troop deployments in the Persian Gulf, where no fatalities occurred from heat stroke because of strict rehydration orders.

Hypothermia is much less commonly associated with difficulty except for individuals inadvertently stranded out of doors. A synergistic effect of the combination of alcohol use, used by some to "keep warm," combined with hypothermia, leads to increased likelihood of mortality.

Noise

Hearing loss is probably the most frequent injury caused by exposure in the working environment.[8] Because hearing loss is common even without workplace noise, however, a specific cause is rarely sought. Also, there are numerous other high-noise exposures associated with nonoccupational activities, including the use of chainsaws, hunting, snowmobiling, and protracted use of lawn mowers and other such equipment. Even military exposures to artillery may be responsible in some cases but are rarely elicited in the history. There is a growing body of evidence that high levels of noise may lead to elevated blood pressure.

Ionizing and Nonionizing Radiation

The hazards of ionizing radiation have been appreciated for about 100 years and range from dermatitis to a variety of malignancies. Certain occupational settings put individuals at much increased risk, such as uranium miners and other hard rock mine operators. Only relatively recently has the same problem--radon gas--been appreciated as a hazard in the home environment. Increasingly, evidence has been accumulating that points to the environmental hazards of radon as a cause of lung cancer in the general population.

Traditionally, little thought had been given to other forms of electromagnetic radiation, especially those below the ionizing level. Increasingly, concern about skin cancer as a result of the ultraviolet component of sunlight has been noted, and, in special settings, infrared radiation was known to be associated with specialized problems such as glass-blowers' cataracts. There is also an increasing appreciation of the potential health hazards of other forms of nonionizing radiation, including microwave and radio frequency radiation, along with extremely low frequency electromagnetic radiation. A wide variety of diseases have been associated with such exposure and many studies are underway to further elucidate this problem. Among the diseases that have been associated with nonionizing radiation and, in some specific cases, causally linked, are leukemias, breast cancer, and brain cancer, with some consideration being given to other diseases as well.

WORKERS' COMPENSATION

No article on the approach to a patient with occupational illness would be complete without some mention of workers' compensation, a subject with which most physicians wish to have little interaction. Increasingly, however, primary care physicians are being asked for their judgment regarding the role of workplace exposures with regard to illnesses and certain injuries. Although many physicians find it unpleasant to deal with aspects of the legal system, they are doing their patients a disservice if they do not continue their traditional advocacy role in this area. If a physician thinks that an injury or illness was caused by some occupational exposure, it is incumbent upon him or her to inform the patient, along with the admonition that although a doctor can give no legal advice, the injured individual might well seek appropriate counsel from others, including union shop stewards, family attorneys, or other individuals knowledgeable about such matters. It is inappropriate to not fully serve the patient in this manner if the physician has knowledge that could ultimately be beneficial to the patient in his or her role as an employee. Physicians also often do not appreciate that their view is not ultimately the judgmental one; they do not make a judgment about disability, which is a quasi-judicial determination. Rather, they are asked to rate someone's medical impairment, a subject within their realm of competence. Others are then left to take this information and turn it into a judicial ruling.

SOURCES OF INFORMATION

A primary caregiver not trained in occupational and environmental medicine, or only minimally so, is often faced with a dilemma of where to obtain additional information regarding a particular case. It might well be suggested that the first source of good information are patients themselves, who often know a great deal about the workplace, and if the questions suggested earlier are asked, significant information can be obtained. If the caregiver is then presented with information about which he has no first-hand knowledge, several avenues are available to obtain additional information.

Material Safety Data Sheets

Current legal requirements, which are relatively new, require that every employer maintain a list of material safety data sheets (MSDS) regarding every substance used at the workplace. Every manufacturer of a product supplied to a work setting must have these documents available, and workplaces are to have them readily available to workers and their medical care providers. Under law, medical care providers can obtain a copy of a MSDS by telephone or written request. If a trade secret with regard to a process or product is involved, the individual requesting the information may be required to sign a confidentiality agreement, but, under the law, these documents must be made available to most health care personnel. In addition to the individual worker's workplace, many of these documents can be obtained through other sources, such as the Chemical Manufacturers Association, the Canadian Centre for Occupational Health and Safety, or through the Internet.

Sources of Technical Information

Additional resources are available to a practitioner to obtain information.[5] Poison control centers, county or state health departments, or regional offices of federal agencies such as the National Institute of Occupational Safety and Health (NIOSH), or the Occupational Safety and Health Administration (OSHA) can all be accessed. In addition, there may be local academic institutions with appropriate departments of occupational and environmental medicine, toxicology, industrial hygiene, safety, or related disciplines. An additional source of information would be workers' compensation insurance carriers who are often glad to provide information in the hopes of ultimately preventing a claim. Finally, there are numerous written resources available at academic and local hospitals, as well as on the Internet.

Internet Resources

Perhaps the most widely used Internet database is through the National Institutes of Health National Library of Medicine, which has a site called *Grateful Med.*

Other federal contacts with resources available to the public as well as healthcare personnel include those of NIOSH, OSHA, Centers for Disease Control, Agency for Toxic Substances and Disease Registry, and Environmental Protection Agency (EPA). All of these have Web sites that can be accessed.

In Canada, but readily accessible to Americans, is the Canadian Centre for Occupational Health and Safety which offers expanded databases in English and French.

Specific Databases

There are more than a dozen databases, all of which can be reached through the National Library of Medicine. Some are very specific and some are essentially all inclusive of the indexed scientific literature. The MEDLINE database, for example, has some 7 million references in biomedical journals dating back to the 1960s. Other, more specific, databases include CHEMLINE, TOXLINE, TOXLIT, RTECS (Registry of

Toxic Effects of Chemical Substances), GEN-TOX (an EPA database of genetic toxicology), and the TRI (Toxic Chemical Release Inventory).

Private Organizations

There are a variety of nongovernmental entities that also serve as potential resources of information. These include the American College of Occupational and Environmental Medicine, as well as their many statewide and regional affiliates. Information can also be obtained through the American Public Health Association, Association of Occupational and Environmental Clinics, the Society for Occupational and Environmental Health, and, on the international level, the International Labor Office or the International Commission on Occupational Health. Other organizations servicing individuals in related fields also exist, such as the American Association of Occupational Health Nurses, the American Conference of Governmental Industrial Hygienists, and the American Industrial Hygiene Association. Safety information can be obtained from the National Safety Council and the American Society of Safety Engineers.

CONCLUSION

The single most important aspect of the approach to patients with potential occupational or environmental disease is to have a high index of suspicion and to follow through on that suspicion. Although many practitioners have had little training or formal experience with occupational and environmental health matters, and they are rarely reinforced in medical training, there are numerous resources available to the practitioner willing to spend the time and effort needed to better understand certain medical dilemmas. As with many other aspects of care, a comfort level develops with repeated attempts at working to obtain an appropriate occupational and environmental history. Given that medicine is a field with the expectation for lifelong learning, it is not too late, even as a practicing professional, to bolster what may have been limited and inadequate training at an earlier time.

The role of occupational and environmental factors is becoming increasingly more important, especially as other diseases--such as infectious diseases and chronic diseases such as heart disease and hypertension--are more effectively dealt with, and ultimately the goal of good medical care is to practice more and more preventive medicine. This requires caregivers to be more knowledgeable about workplace and environmental exposures.

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