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EDITORIALS

Screening for Occupational Cancer of the Lung

An increased incidence of cancer of the lung has been noted in certain occupational groups, including coke-oven workers, miners of uranium and hematite, those working with and around asbestos, and some chemical workers.¹ In nonsmokers, occupational exposure plays a strictly limited role in the etiology of pulmonary cancer, but the combined insult from smoking cigarettes and the occupational exposure may, in certain instances, lead to a substantial increase in the relative risk of developing this condition. It goes without saying that industry, government, the medical profession, and the worker himself all have an obligation to do everything possible to limit the increased risk in those exposed; however, for the most part, the best way to accomplish this remains uncertain.

Prevention clearly represents the single most effective approach and, as such, can be achieved in a number of different ways. Thus, complete avoidance of exposure to the carcinogen is the ultimate goal, but in some instances, this may not be possible. Where practicable, a noncarcinogenic or less carcinogenic agent should be substituted (for example, fiberglass for asbestos), but in many instances, no suitable replacement is available, and it is therefore necessary to control exposure by limiting the concentrations of the carcinogen in the working environment. This can often be achieved through control of dust or similar measures. Such environmental control can be brought about through modification of equipment so that less dust is generated, by the wearing of respirators, and by improving ventilation. The control of airborne hazards is a problem for engineers and dust physicists, and in certain areas, their efforts have been extraordinarily successful. This is certainly true of the pneumoconioses, and there is sufficient evidence available to show that the incidence of both asbestosis and coal workers' pneumoconiosis can be reduced by lowering the airborne concentration of fibers and coal dust in the working place. Indeed, in the case of coal dust, there is some

evidence to suggest that there is a threshold (about 2 mg/cu mm) below which no subject will develop coal workers' pneumoconiosis.² Unfortunately, there has been a tendency to infer that both the present standard for asbestos (two fibers per cubic centimeter) and the proposed more stringent standard will be equally effective in reducing the incidence of pulmonary cancer and mesothelioma. That both of these conditions are dose-related is now evident,³ but the relationship between cumulative exposure to asbestos and the development of cancer of the lung and mesothelioma is far from clear. At present, it is not possible to predict the effect of any proposed standard for asbestos on the incidence of either condition in exposed populations.

Since it has been established that smoking cigarettes vastly increases the risk of cancer of the lung in exposed occupational groups, an alternative approach is possible. Thus, were it possible to dissuade workers from smoking cigarettes, this would be a most effective preventive measure, but the publicity already given to the relationship of smoking cigarettes to the development of pulmonary cancer, emphysema, chronic bronchitis, coronary artery disease, and cancer of the bladder so far has not acted as a significant deterrent. More effective would be the hiring of only nonsmokers in those occupations in which there is an increased risk of cancer of the lung, but it is doubtful whether the unions would cooperate with such a practice.

Alternatively, if it is accepted that the majority of persons will continue to smoke, it may be possible to lessen the effects of pulmonary cancer by attempting to diagnose the condition early in its course, thereby possibly improving the rate of cure. To achieve this end, various governmental agencies, including the National Institute for Occupational Safety and Health and the Occupational Safety and Health Administration, are recommending the monitoring of exposed populations by means of serial chest x-ray films and cytologic studies of sputum.⁴ While there are specious arguments in favor of health monitoring for pulmonary cancer, critical examination reveals numerous flaws in this approach. Implicit in this approach is the assumption that early diagnosis improves the prognosis in



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cancer of the lung. While there is irrefutable evidence that early diagnosis improves the outlook in many acute and chronic infections and some non-infective acute emergencies, this is not true, for the part, for most forms of cancer and least of all cancer of the lung. Most studies to date have shown that the detection of asymptomatic cancer of the lung by serial chest x-ray films has had little effect on prognosis.^{5,7} Moreover, little thought has been given to the added hazards from the radiation associated with the use of serial x-ray films. There is ample evidence to show that the genetic load from diagnostic irradiation will double the incidence of congenital abnormalities by 1990.⁸ At the present time, both the Mayo Clinic and the Johns Hopkins Hospital are involved in studies to ascertain whether early diagnosis has anything to offer in improving the prognosis in cancer of the lung. So far, the results of the Mayo Clinic's project suggest that there may be some slight improvement in life expectancy, but it is far too early to draw definite conclusions.⁹ To date, serial chest x-ray films have proved more useful in the detection of cancer of the lung than cytologic studies of sputum.

The usefulness of cytologic studies of sputum as an aid in the diagnosis of pulmonary cancer in symptomatic patients is established. Nonetheless, many subjects who are subsequently shown to have cancer of the lung have multiple normal results on examination of samples of sputum prior to surgery, and this is especially true of peripheral lesions. Whether cytologic studies of sputum will prove useful in monitoring industrial populations is as yet unknown, but there are compelling reasons for remaining skeptical. Before any screening test is used in a population, it is mandatory to determine the test's sensitivity, specificity, validity, and cost. Thus, it is necessary to know how many false-positive and false-negative results the test yields and how the test compares to other standard methods of establishing the diagnosis. Moreover, once the diagnosis has been established, it is important to know whether the prognosis can in any way be affected by early treatment. If it proves impossible either to alter the course of the disease or to relieve symptoms, the whole effort to achieve early diagnosis has been futile. To date, the sensitivity, specificity, and validity of cytologic studies of sputum in monitoring large populations have not been assessed, although it is hoped that the studies from the Mayo Clinic and the Johns Hopkins Hospital will answer some of these questions.

Many other problems are coming to light as a result of the studies at the Mayo Clinic and the Johns Hopkins Hospital. First, one has to consider the subject who is found to have abnormal results

on examination of sputum but who has no radiographic abnormality. Presumably, the next step is fiberoptic bronchoscopic examination, but even so, in many instances the cancer, if present, cannot be located. Multiple mucosal biopsies will occasionally identify the site of the lesion, but frequently this technique is to no avail, and in yet other subjects, multiple carcinomata are found. And how far does one go in the subject with doubtful or equivocal findings on cytologic studies of sputum? At what intervals does one repeat the bronchoscopic procedure? Secondly, while there is no trouble ensuring quality control in the interpretation of specimens of sputum in institutions such as the Johns Hopkins Hospital and the Mayo Clinic, it is unlikely that there are sufficient numbers of trained cytologic technicians and cytologists in the laboratories of community hospitals and private pathologic laboratories to provide the proper service necessary to monitor industrial populations. The demand for cytologic studies of sputum as a means of monitoring industrial populations is likely to spawn a series of substandard private cytologic laboratories. Should the studies from the Mayo Clinic and the Johns Hopkins Hospital make it clear that the yield from cytologic studies of sputum is poor and the prognosis unchanged, an insistence that industry should supply these services is both unethical and harmful to the exposed worker, in that a proportion will undergo a series of unpleasant and invasive procedures to no purpose. Although it is intended that industry should be compelled to absorb the cost of health monitoring, it is imperative to bear in mind that the expenses incurred are ultimately handed on to the consumer. The annual cost of performing chest x-ray films and cytologic studies of sputum at six-month intervals would amount to at least \$60 per subject, and this does not include interpretation. If the population exposed is measured in hundreds or thousands, the financial burden becomes appreciable. Finally, whenever the role of health monitoring for cancer of the lung is discussed, it is difficult not to notice that those governmental officials who are most evangelic are invariably wreathed in cigarette smoke. To advocate unproven procedures while ignoring the main cause of the problem shows an unwillingness to face the facts. The trouble with evangelists is that in convincing others, they convince themselves.

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