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THE ROLE OF SPUTUM CYTOLOGY IN OCCUPATIONAL MEDICINE

SUPPLEMENTARY REPORT

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In 1972, a report was prepared describing the current state of sputum cytology as a method for studying individuals with certain types of occupational exposure. It was concluded that for screening purposes in asymptomatic populations, the method should be restricted to high risk groups, such as men over 40, those who were heavy cigarette smokers, and individuals working in occupations having a known cancer risk, such as asbestos workers, uranium miners, and chromium workers. It was emphasized that the method should be used only with full recognition of the problem of follow-up in case of positive findings, and that only the prompt use of exhaustive methods of localization would be expected to reduce mortality. It was also pointed out that the effect of excluding individuals with marked atpical metaplasia from employment in industries with a high cancer risk was still under evaluation.

In the report mentioned above, reference was made to several studies that were underway or unreported which might answer questions as to the management of positive cases and the advisability of excluding marked atypical metaplasia from high risk industries. During the last two years, there have also been reports of studies of other high risk groups. The appropriate use of sputum cytology has become an urgent question, with increasing requirements for periodic medical surveillance in the criteria documents and OSHA standards.

The report by Saccamanno et al (1) which appeared in January 1974 describes the most comprehensive application to date of sputum cytology in a high-risk occupational group. It is derived from a study of over 50,000 sputum samples from nearly 6,000 men from 1957 to 1973. Most of those examined were underground uranium miners. The emphasis in this report is upon the serial changes in 34 individuals who developed carcinoma in situ (CIS) and in 17 individuals who developed invasive carcinoma of th lung. The authors demonstrate in these selected cases a progression in the development of abnormal squamous cell metaplasia, with a large proportion showing marked atypia prior to CIS or invasive carcinoma. This was true for 4 of 5 cases of invasive oat cell carcinoma, all of whom however had evidence of epidermoid CIS, and 3 of whom were subsequently shown to have both epidermoid and oat cell malignancies.

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The authors postulate that there is an orderly morphological progression to malignancy, and that there is an average period of 4 or 5 years during which individuals exfoliate cells that are markedly atypical or represent carcinoma in situ before developing carcinoma of the lung. They therefore recommend periodic sputum surveillance of occupational groups and others at high risks, using this period for early detection and treatment.

Unfortunately the foregoing report does not adequately describe the serial changes that occurred in the total population of miners and controls under observation. From published tables it appears that 2,588 uranium miners had either mild, moderate or marked atypia which had not progressed to carcinoma (based on their highest sputum classification). Analysis of such information, with emphasis upon the course of individuals with marked atypia, and comparing the effects of cessation of smoking, removal from harmful exposures, etc. with non-intervention is needed before one can make a balanced judgement as to the practical application of sputum cytology as a screening method, even in high risk groups. Nevertheless in the absence of such evidence, prudence would dictate that individuals with marked atypia not be employed in high risk industries, or allowed to continue work with exposures to known pulmonary carcinogens.

Another recent application of sputum cytology to the study of workers exposed has been in individuals working with chloromethyl methyl ether and exposed to bis (chloromethyl) ether. Figueroa et al (2), described 14 lung cancers in a single plant diagnosed between 1962 and 1971; 12 of 13 histologically confirmed cases were of the oat-cell type. The foregoing authors did not include sputum cytologic studies in their investigation, but studies in a West Coast plant by NIOSH did. Archer et al (3) studied sputum in 138 current employees and 7 former employees of a plant where exposures to bis (chloromethyl) ether presumably occurred. Moderate and marked atypia was described in 34.1% of 44 present workers judged most heavily exposed to BCME over 5 years, and 42.9% of 7 former workers, but in only 14.3% of 14 minimally exposed current workers and 15% of 80 workers employed for less than 5 years. A group of 44 above-ground or open pit miners was used as a control, and these showed only 11.4% moderate or marked atypia. The authors concluded that sputum cytology appeared to be a sensitive and rapid method of assessing the status of bronchial epithelium in a population, and by correlating such results with subsequent cancer incidence studies, might permit a quantitative lung cancer predictions.

Frost et al (4) have reported preliminary findings along the same lines, comparing the prevalence of non-negative cellular findings (slight atypical metaplasia, moderate atypical metaplasia, grave atypical metaplasia and carcinoma) in several groups. In 401 apparently healthy cigarette smokers in a low risk respiratory environment, 32% had non-negative findings. In 112 asbestos workers (smokers and non-smokers)

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40% were non-negative. In 605 smokers and non-smokers working in what was regarded as a high lung cancer risk environment i.e. bis (chloromethyl) ether, there were 67% with non-negative findings. After repeat examinations to remove those with incidental and non-significant atypia, the respective percentages were 13%, 30% and 58%. In the published report the proportions of different grades of atypia are not given, so direct comparison with the result of Archer et al is not possible. Again, however, the potential value of sputum cytology as an epidemiologic tool is shown.

There are several unpublished studies now under way in which sputum is being used to study populations regarded as having a potential lung cancer risk from their occupations. These include hairdressers exposed to aerosols, aluminum pot line workers, painters, and vinyl chloride workers. Results of these are looked for with interest.

Sputum cytology has been suggested as an obligatory portion of the periodic examinations of workers in at least one recent criteria document that for coke oven emissions (4). Here, it is stated that any workers with a Papanicolaou grade 3, 4 or 5 sputum should be "referred immediately to an appropriate specialist for thorough medical evaluation. The return of such a worker to his former work will be based upon the judgement of the responsible physician." Current application of such a program would present tremendous difficulties as medical criteria for appropriate action do not exist. This might lead to the unnecessary loss of jobs if criteria were too restrictive or rigid.

The proposed arsenic standard is more realistic; it includes sputum cytological analysis as a recommended supplementary procedure: "Sputum cytological analysis is a recommended procedure for early detection of lung cancer."

It is our conclusion that sputum cytologic examination continues to be a highly promising method for the early detection of lung cancer and for the epidemiologic study of groups exposed to substances thought to be pulmonary carcinogens. The limitations continue to be:

1. There are relatively few laboratories which can prepare and interpret sputum samples properly, so as to yield consistent, reproducible results.

2. Automated techniques have not yet been demonstrated to be sufficiently sensitive, specific, and reproducible to use for preliminary screening.

3. Relatively few medical facilities are prepared to carry out the highly sophisticated studies needed to localize tumors in sputum-positive, radiologically negative patients.

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4. Long-term epidemiologic follow-up of serially studied individuals in high-risk industries is needed to develop appropriate criteria as to the proper management of cases in which moderate or marked atypia is diagnosed.

Until further work is done, it is recommended that sputum cytological examination continue to be applied selectively, rather than as an obligatory procedure in regulations and standards.

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