

The Forced End-Expiratory Flow Rate in Chloromethyl Ether Workers

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Spirograms were made in 103 chemical workers, 72 of whom had been exposed for years to chloromethyl ethers to various degrees. The end-expiratory flow rate was below 60% of predicted in one-third of the exposed men compared to only 3% of unexposed men. Smoking was a confounding factor. In 49 current cigarette smokers consuming less than one pack per day, the data suggested a dose-response relationship between chemical exposure and the frequency of low end-expiratory flow rate.

Recently Morris et al¹ reported the normal values of the forced end-expiratory flow rate (EEFR or FEF_{75-85%}) in a large series of healthy nonsmokers. Although the degree of variation in normal people was greater for the EEFR than for the forced mid-expiratory flow rate (FEF_{25-75%}), the EEFR was a better index to the effects of smoking and these authors concluded that it was more sensitive than the FEF_{25-75%} in detecting small airway disease.

In a prospective study of workers exposed to chloromethyl ethers,² we reported that there was no demonstrable effect on ventilatory function although chronic cough was related in a dose-response fashion to chemical exposure. This conclusion was based on a study of only the forced vital capacity (FVC) and the one-second forced expiratory volume (FEV₁), the means of which did not vary among four groups of men characterized by their cumulative dosage of chloromethyl ethers. After the report of Morris and his colleagues, the spirometers of these chemical workers were reviewed and the EEFR's were measured.

Six percent of men who were unexposed to chloromethyl ethers had EEFR's below 60% of predicted normal whereas one-third of exposed men had such low values.³ The lack of a dose-response relationship was thought to be due to a confounding effect of cigarette smoking. The data have been examined in greater

detail for this report and exposure information corrected in two cases.

Material and Methods

In 1965 a group of 103 male chemical workers from a single plant had a forced expirogram during the course of a five-year periodic screening program. The screening components included a 70 mm chest photofluorogram and a questionnaire regarding age, smoking habits, and respiratory symptoms.

The ventilatory function test was done with a bellows spirometer. Volumes were recorded under ambient conditions and measurements were not corrected for temperature and barometric pressure. Results for the FVC were calculated as percent of predicted using the normal standards of Baldwin et al⁴ according to age and height. The FEV₁ was calculated as percent of observed FVC. The EEFR was measured as described by Morris et al,¹ the predicted value was obtained from their nomogram, and the observed value was calculated as percent of predicted according to age and height.

Chloromethyl methyl ether was manufactured and used to transmethyrate organic chemicals beginning in 1948 at the chemical plant from which the study population was drawn. This chemical was contaminated with small amounts of bis(chloromethyl) ether. For convenience, the abbreviation CMME will be used to indicate exposure to both substances.

Determining exposure data was difficult because CMME had been manufactured and used in three different buildings at different times, changes of employees involved in the chemical processes were frequent, and amount of exposure diminished over time as a result of process improvements.

Since suitable chemical determinations of CMME concentrations in the work environment had not been made, supervisory personnel associated with the manufacture or use of CMME during the period 1948 to 1964 were asked to rank the exposure of all job classifications retrospectively on an arbitrary scale from 0 to 6. Work histories and exposure ratings for each job at every important stage in the development of the process were used to

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