

AIRWAY OBSTRUCTION IN PATIENTS WITH TREATED PULMONARY TUBERCULOSIS

By S. C. Poh

SYNOPSIS

A study was made to assess the prevalence of airway obstruction in adult patients with pulmonary tuberculosis who had completed two years of anti-tuberculous chemotherapy. A total of 297 patients were studied. Airway obstruction was observed in 26 percent of the men and 13 percent of the women. It is likely that this significant difference is due to the preponderance of a greater extent of disease, older age, and of smokers in the men. In both males and females there was a higher prevalence of smoking and of more extensive disease in the older patients. The factors influencing the higher prevalence of obstructive airway disease were found to be older age, more severe disease and heavy cigarette smoking.

INTRODUCTION

Respiratory function in pulmonary tuberculosis has been extensively studied ever since 1846 when Hutchinson first measured the vital capacity in tuberculous patients. (Hutchinson, 1846). Ventilatory impairment was frequently reported with the prevalence of airway obstruction varying from 11—50%, depending on the severity and duration of the disease as well as on the age of the patients. (Gaensler and Lindgren, 1959, Hallett and Martin, 1961, Martin and Hallett 1961, Lancaster and Tomaschfsky 1963, Birath *et al*, 1966, Koike *et al*, 1967, Snider *et al*, 1971).

Age distribution and other factors in the local population might act to influence the extent of pulmonary impairment in tuberculous patients in Singapore. The present investigation was undertaken to assess the prevalence of airway obstruction in adult patients with pulmonary tuberculosis who had completed two years of chemotherapy with the standard primary anti-tuberculous drugs.

MATERIAL AND METHODS

For the period July 1971 to June 1972 all tuberculous patients attending the outpatient clinic of one of the Units in Tan Tock Seng Hospital who had completed two years of chemotherapy were sent for spirometry. Of the esti-

mated 600 cases registered for the period July 1969 to June 1970 only 343 were available for the study, the rest were not studied because they were not referred to the laboratory, completed treatment before or after the period, defaulted, died or were transferred to another clinic. 46 patients were excluded from the analysis because 21 were opium addicts, 18 had pleural effusion and 7 were unable to perform the tests satisfactorily. Of the remaining 297 patients 206 were males and 91 were females. None were asthmatics.

A history of the presence or absence of cough, expectoration and dyspnoea as well as smoking habits was obtained. The forced vital capacity (FVC) and the forced expiratory volume in 1 second (FEV₁) were measured using standard equipment; the best of 3 measurements was used. Airway obstruction was defined as a decrease in the ratio of the forced expiratory volume in 1 second to the forced vital capacity of less than 70%.

The pre-treatment chest radiograph was compared with the one done at the time of completion of chemotherapy. The extent of radiological involvement was graded according to the National Tuberculosis Association classification (1950).

RESULTS

The age distribution of the patients is shown in Fig. 1. For comparison, the age specific tuberculosis notification rates for the whole of Singapore for the years 1969 and 1970 are shown in Fig. 2. The two distribution patterns are fairly comparable.

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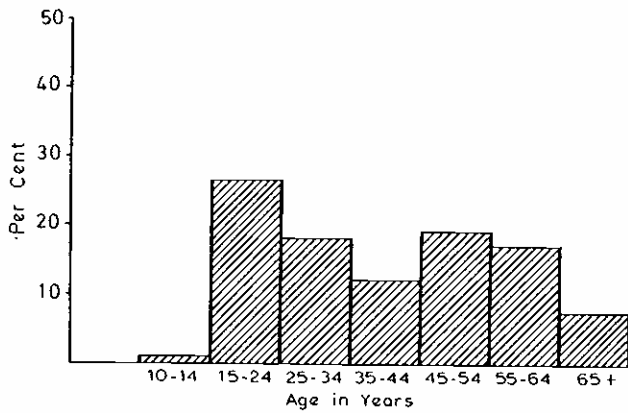


Fig. 1: Age distribution of the patients in the study.

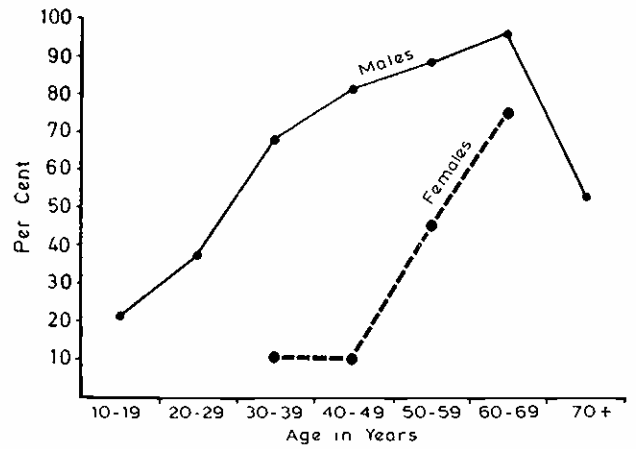


Fig. 4. Prevalence of cigarette smoking in both sexes by decades

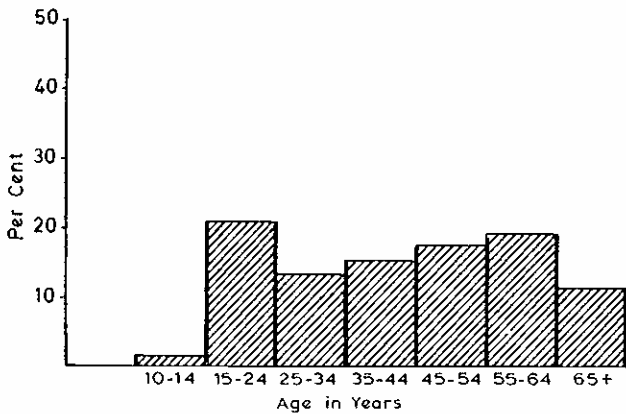


Fig. 2: Age distribution of notified cases of Pulmonary Tuberculosis in 1969-1970.

The pre-treatment chest radiographs show that 54% of the men and 57% of the women had moderately advanced and far advanced disease. At the completion of chemotherapy, there were no patients with lesions that could be regarded as far advanced and only 22% of the men and 11% of the women had radiological lesions equivalent to the moderately advanced category (Fig. 3).

It was not possible to determine duration of the disease in most of the patients.

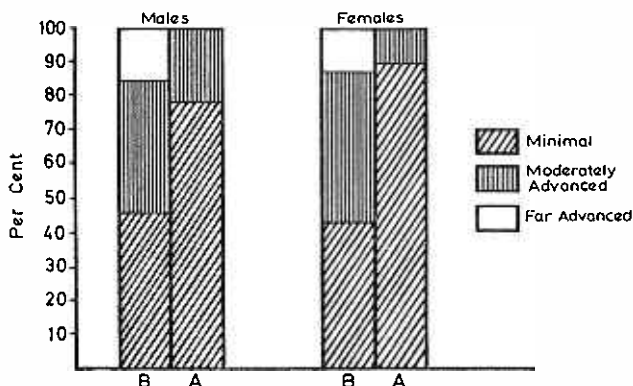


Fig. 3: Extent of Disease before (B) and after (A) chemotherapy (N.T.A. classification.)

The prevalence of cigarette smoking was much more in the men than in the women—66% of the men were regular cigarette smokers as opposed to 21% of the women. 30% of the male smokers and none of the female smokers smoked more than 20 cigarettes a day. Fig. 4 shows the age distribution of the cigarette smokers in both sexes. There is a rising prevalence with age, until the seventh decade.

Cough and sputum production was found in 55 patients and of these 40% had evidence of airway obstruction as compared with 19% in those without these symptoms. Patients with cough and sputum thus had a significantly higher prevalence of airway obstruction than did those without expectoration.

Airway obstruction was observed in 26% of the men and 13% of the women. This significant difference between males and females is associated with a preponderance of a greater extent of residual disease, older age and of smokers in the men (Table I).

On the other hand, a comparison of the extent of disease and age in smokers and non smokers in both sexes indicates old age to be associated with greater severity of disease (Table II).

It may thus be construed that old age is associated with more disease and a greater prevalence of smoking in the local tuberculous patient.

Following the method of Snider *et al* (1971), the effects of age, cigarette smoking and extent of residual disease on the prevalence of airway obstruction were evaluated by placing the patients into 8 categories according to the presence or absence of the following 3 characteristics: older age (45 yrs. or more), greater extent

TABLE I
PREVALENCE OF AIRWAY OBSTRUCTION, CIGARETTE SMOKING AND
"MODERATELY ADVANCED" CATEGORY AND MEAN AGE IN
BOTH SEXES

| | Males | % | Females | % |
|-------------------------------------|---------------|----|--------------|----|
| No. of patients | 206 | | 91 | |
| No. with FEV ₁ /FVC <70% | 55 | 26 | 12 | 13 |
| No. of smokers | 135 | 66 | 19 | 21 |
| No. with 'mod. adv.' category | 45 | 22 | 10 | 11 |
| Mean Age in years and (S.D.) | 39.92 (13.99) | | 36.2 (12.37) | |

TABLE II
DISTRIBUTION OF PRETREATMENT MODERATELY AND FAR
ADVANCED DISEASE IN PATIENTS BELOW AND ABOVE
45 YEARS OF AGE

| | | <45 years | | | >45 years | | |
|--------|-------------|-----------------|------------------------------------|----|-----------------|------------------------------------|----|
| | | No. of patients | No. with mod. and far adv. disease | % | No. of patients | No. with mod. and far adv. disease | % |
| Male | Smokers | 58 | 24 | 41 | 77 | 58 | 75 |
| | Non smokers | 61 | 24 | 39 | 10 | 6 | 60 |
| Female | Smokers | 2 | 0 | 0 | 15 | 12 | 80 |
| | Non smokers | 57 | 29 | 51 | 17 | 11 | 65 |

of residual disease (equivalent radiologically to moderately advanced category) and heavier smoking (20 cig./day or more). Fig. 5 shows that in the males, the prevalence of airway obstruction

is about 5% in the younger, less diseased and lighter cigarette smoking patients. The combination of the three factors results in a 16 fold increase in the rate of airway obstruction.

Rates of airway obstruction were not calculated for females due to the small number of patients.

DISCUSSION

It is known that of the annual number of notifications for tuberculosis in Singapore, about 75% are from the Tan Tock Seng Hospital. Within the hospital itself, registered tuberculosis cases are randomly allocated to 4 Units. This study of the cases seen in one of the Units may be regarded as representative of the total

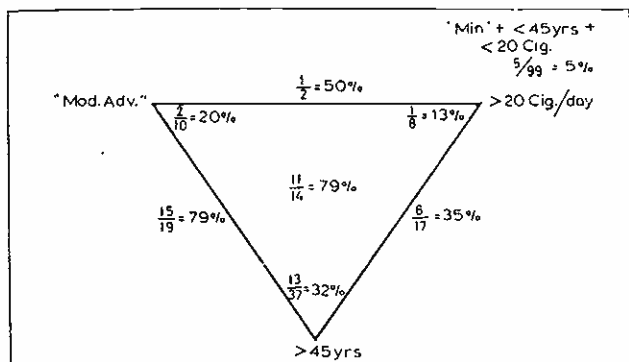


Fig. 5: Rates of airway obstruction in males. The denominator denotes the number of patients in each category. The numerator is the number with obstruction.

tuberculous population attending for treatment at the hospital.

As shown in Fig. 1 the age distribution of the patients is comparable with the cases notified for the year 1969—1970. About 60% of the patients were in the age group 15—44 years, due to the distribution pattern of the local population and perhaps better coverage in this age group.

No data are available on the prevalence of cigarette smoking in Singapore or on the prevalence of cough and sputum. As such, it is not possible to say whether the prevalence of cigarette smoking in 66% of the men and 21% of the women or the prevalence of cough and expectoration in 18% of the patients is comparable to that seen in the local non-tuberculous population.

In the reported studies of respiratory function in pulmonary tuberculosis, attempts have been made to correlate function with the extent and type of disease. Whilst the decrease in the vital capacity is attributable to the destructive process of the disease, the mechanism of airway obstruction is less obvious. Hallett and Martin, (1961), in describing the diffuse obstructive pulmonary syndrome in a tuberculous sanatorium stated that in those who have had extensive bilateral lesions for a long period of time, the frequency with which alterations of pulmonary function characterising chronic obstructive lung disease seemed uncommonly high. Lancaster, (1963), reporting similar findings concluded that tuberculosis of advanced degree and long duration is a cause of pulmonary emphysema, whilst Katz, (1964), postulated that chemotherapy reduced the number of deaths from tuberculosis and patients lived long enough to develop emphysema secondary to extensive destruction of lung tissue by the disease process. However, Martin, (1968), in an analysis of the incidence of chronic bronchitis and morphological emphysema in 36 autopsied cases of pulmonary tuberculosis reported that chronic bronchitis and emphysema occurred no more frequently in tuberculous patients than in the general population.

Bronchial mechanisms such as chronic bronchial stenosis and bronchiectatic changes have been favoured as the cause of airway obstruction. Birath, (1966), attributed the obstruction to generalised bronchial disease, as well as to a decrease in the amount of tissue with focal changes in elastic recoil leading to a check valve mechanism or airway collapse on expiration.

In this study whilst it is tempting to consider chronic obstructive lung disease as a complication due to pulmonary tuberculosis, it is entirely possible that it could have antedated the tuberculous infection or could have developed as a purely coincidental phenomenon. It can only be inferred that a very high prevalence of obstructive airway disease is to be expected in local patients who are more than 45 years old, who have a fair amount of residual tuberculous disease and who are heavy cigarette smokers.

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