consecutive years, (Medical Research Council, 1965). Sixteen patients (19%) in the group did not have chronic bronchitis and were called Group I and 69 (81%) had chronic bronchitis as well (Group II).

Age: A breakdown of the age distribution of the patients showed 2 patients (2%) between 30-39 years, 11 (13%); between 40-49 years, 17 (20%); between 70-79 years and 1 patient (1%) over 80 years of age.

Sex: Eleven of the total (13%) were female, and the male to female ratio was 6.7:1 in the group.

Smoking: Eighty were smokers (94%) and the rest denied this habit. The former were mostly individuals with a long history of heavy smoking.

Race: The racial breakdown of the group is shown in Figure 1 and contrasted with that of the general hospital attendances during this period. There were 3.5 times as many Chinese as the other races within the group.

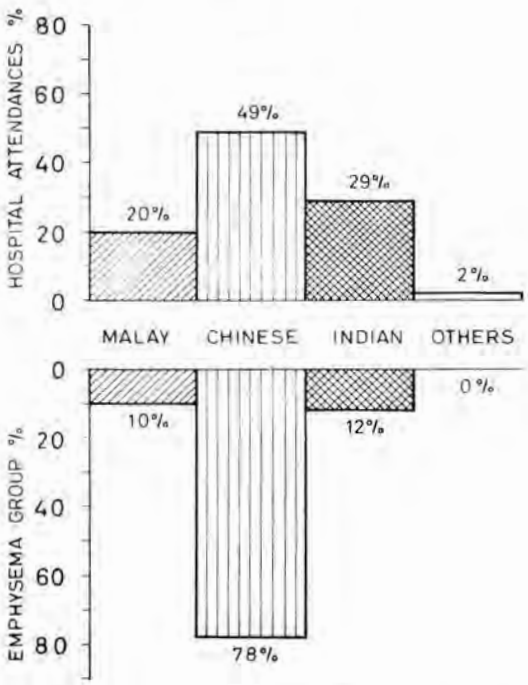

Fig. 1. Ethnic Distribution: in the study group and in the general hospital attendances.

Clinical features: Cough (88%) and dyspnoea (99%) were the most common symptoms experienced by the patients as a whole, the former being seen only in 6 patients (38%) in group I. Of these, 4 patients had a dry cough and 2 a productive one which did not however fulfill the criteria for chronic bronchitis. Wheeze was noticed or complained of by 20 of all 85 patients (24%). Only 2 of 16 patients (12.5%) in group I had wheeze, of whom one had bronchial asthma in addition, while in Group II, 18 patients (26%) had this feature. Of these 18, 3 patients had asthma in addition to chronic bronchitis. Wheeze therefore was seen almost exclusively in patients with coexistent chronic bronchitis and/or bronchial asthma. Seventy seven patients (91%) had diminished breath sounds on auscultation and 94% of patients had an increased antero-posterior diameter. Heart failure resulting from cor pulmonale had occurred at some time in 18 patients (21%) and all of these patients belonged to group II.

Radiological features: Eighty two patients (96%) had evidence of hyperinflation. In terms of the distribution of radiological changes, the commonest pattern was diffuse disease (42%). Thirty one per cent had predominantly upper zone disease and 27% lower zone disease. Bullae were visible in 26% and 22% had changes representing old tuberculous lesions. Pneumothorax had been sustained at some time by 9 patients including 4 with bullae, 3 with tuberculous scars, 1 with both bullae and scars and 1 with no other obvious cause.

Respiratory function data: Ninety per cent of all the patients studied had a RV/TLC value greater than 50%, and 86% a D_LCO below the predicted value. Elevation of TLC levels were seen in 37%. This is likely be an underestimate since this measurement was made by spirometry and not body plethysmography which also shows up the volume of poorly ventilated areas and bullae. A comparison was made between patients in Group I and II with respect to some important indices of lung function and the results are shown in Table I. A statistical analysis showed no significant differences at the 5% level in lung function as reflected by these variables between groups I and II. However, a greater proportion of patients in group II (71%) had a prolonged helium dilution time indicative of abnormal distribution

Table I

Lung Function indices in Group I & II Patients

	Mean	SD	Mean	SD
FeV_1 as % of predicted	48.2	+ 20.2	39.6	+ 14.3
TLC % predicted	116.3	+ 24.7	112.3	+ 23.4
RV/TLC %	60.1	+ 15.7	62.3	+ 9.4
D_LCO % predicted	64.6	+ 35.4	52.5	+ 32.6
Helium Dilution Time (mins.)	4.9	+ 1.5	5.2	+ 1.5

of ventilation, when compared to Group I (51%). Carbon dioxide retention was present at some time in 12 out of the 56 patients in whom this information was available and of these 10 were group II patients.

Polycythemia was considered to be present when the packed cell volume exceeded 55%, and was seen in four (5%), all of whom were group II patients. Elevated haemoglobin levels (taken as 15 Grams % and above) were seen in 25 patients, of whom 24 were from group II. Electrocardiographic changes indicative of right atrial hypertrophy, right ventribular hypertrophy and right bundle branch block were seen in 29 of 74 patients. The latter figure comprised 11 patients from group I and 63 from group II. Abnormal cardiograms were seen in 2 (18%) and 27 (43%) patients from the two groups respectively. However, the most severe changes were observed in patients in group II.

DISCUSSION

Emphysema is a morbid anatomical condition by definition, and is ubiquitous. Even where it exists during life, clinical expression in the form of respiratory disability, abnormal lung function or radiological changes may or may not be evident. Clinical emphysema generally represents severe disease of centrilobular or panlobular types which are believed to be distinct pathological entities (Anderson and Foraker, 1973). The centrilobular variety is more common but lungs with widespread emphysema often show the coexistence of various grades of centrilobular and panlobular emphysema (Thurlbeck, 1963). How often it causes clinical disease is unknown, and hence so is the prevalence of emphysema (Oldham, 1976).

The findings in our group of patients are generally in agreement with features found in patients with emphysema as described elsewhere. Forty four per cent were in their sixth decade of life. Hernandez *et al.*, (1966) found a rise in incidence and extent of involvement in adult lungs up to the sixth decade after which there was a levelling off as in our patients. The disease tends to predominantly affect men in whom it is found two to ten times (6.7 times in our group) as frequently as in women (Anderson and Foraker, 1976). The latter generally have milder disease, and an increase of frequency of emphysema with aging, whereas in men, this increase applies both to frequency and to severity (Thurlbeck *et al.*, 1974). The effect of age and smoking are difficult to separate as the total consumption of tobacco is related to the former, but emphysema seldom affects non-smokers, (6% of our group), in whom the prevalence of the condition is much lower (Dysinger *et al.*, 1963 and Dunnill, 1976). It appears that emphysema is more closely related to smoking than to age or sex (Anderson *et al.*, 1966); severe emphysema in smokers is almost always of the centrilobular variety whereas in non-smokers severe emphysema, though very uncommon, is invariably of the panlobular type (Dunnill, 1976).

The prevalence of emphysema has also been related to environmental factors like industrialisation (Isnikawa *et al.*, 1969) and to ethnic factors (Murphy *et al.*, 1962) and obviously the two factors may be inter-related. Though the total number of patients is not large, an impressive majority within the group (78%) were Chinese who also tend to be concentrated more in urban areas in this country.

The clinical diagnosis of emphysema is known to be unreliable and Fletcher *et al.*, (1963) cautioned against making a diagnosis clinically unsupported by physiological and radiological changes. However in severe and symptomatic emphysema, clinical findings may be helpful, and the most consistent findings are a hyperinflated chest with poor breath sounds, and prolonged expiration especially audible over the larynx (Hugh-Jones and Whimster, 1978). Hyperinflation and poor breath sounds were present in 94 and 91% respecitvely of our patients, while wheeze was uncommon in emphysema per se, indicating when present, coexistent chronic obstructive bronchitis or asthma. Radiology is a practical and useful

method of detecting emphysema though mild to moderate disease may be missed (Laws and Heard, 1962 and Reid & Millard, 1964). The presence of radiological emphysema on the other hand is always accompanied by changes at autopsy (Laws and Heard, 1962; Reid and Millard, 1964). Bullae, which have been cited as an additional important feature, (Simon, 1964) were seen in 26% of our patients. An interesting finding was the commonness of radiographic evidence of old tuberculous scars (22%). The increased frequency of emphysema in patients from tuberculosis Sanatoria has been noted and documented by several workers (Lancaster and Tomaschefski, 1963; Katz and Kunofski, 1964 and Gaensler & Lindgren, 1959). Of the lung function tests commonly used in assessing emphysema the following have came to be regarded as beign the most useful in practice, though not specific: a low FeV_1/FVC % (Burrows *et al.*, 1965), high RV/TLC % (Sweet *et al.*, 1960) and a low D CO (Thurlbeck *et al.*, 1970). While a low FeV_1 % was taken as a supportive diagnostic criterion in our patients, a high RV/TLC % and $D_L CO$ below the predicted value were found in the majority (90 and 86% respectively).

Our patients were grouped in an attempt to study the differential features of primary emphysema (Group I) as opposed to emphysema and chronic bronchitis (Group II). Burrows *et al.*, (1964, 1965 and 1966) classified their patients with chronic obstructive lung disease into two main groups A and B. Patients in Group A (corresponding to our group I) presented with radiological evidence of emphysema, increased total lung capacity, and a reduced diffusing capacity but without significant expectoration, cyanosis, polycythemia or cor pulmonale. In type B, chest films did not suggest emphysema and there was no significant change in the total lung capacity or diffusing capacity; these patients presented chiefly with evidence of obstructive bronchitis, with marked ventilation/perfusion mismatching as shown by hypoxia and carbon dioxide retention and a tendency to cyanosis, polycythemia, and cor pulmonale. There were also a number in whom there were mixed features (corresponding to our group II). Thurlbeck *et al.*, (1970) found a strong association between chronic bronchitis and emphysema which seldom occurred independantly without chronic bronchitis, and the two conditions have been thought to represent two ends of the spectrum of a single disorder. Hutchison and Menon (1975) analysed 46 British patients with emphysema and found that the presence of chronic bronchitis had no significant effect on a number of relevant lung function variables. They suggested the association merely indicated the simultaneous occurrence of two common conditions, both related to smoking.

Fletcher *et al.* (1976) have published an account of a detailed eight year follow-up of over a thousand individuals, and from their observations, it seems likely that there are three forms of lung disease resulting from cigarette smoking: mucous hypersecretion from the large bronchi (chronic simple bronchitis), changes in the small airways leading to diffuse airway obstruction (chronic obstructive bronchitis) and emphysema, affecting the acini. Coexistence of these conditions may occur without necessarily implying that one leads to the other, resulting in an overlap of features. Greater disturbances of ventilation perfusion matching have been found in emphysematous patients with chronic bronchitis than in those without (Fletcher *et al.*, 1963), and Millard and Reid (1974) and Semmens and Reid (1974) have shown tht cardiovascular changes are related to the presence of chronic bronchitis and not to emphysema.

In this study we have found results similar in several indices to those of Hutchison and Menon (1975) in a group of Malaysian patients of whom only 19% had emphysema without chronic bronchitis. However, there were some differences between groups I and II in that there was a higher incidence of ventilation/perfusion inequality (prolonged helium dilution time, CO_2 retention and polycythemia reflecting significant hypoxemia) and of cor pulmonale (E.C.G. changes and heart failure) in group II patients probably due to the effect of coexistent chronic bronchitis.

SUMMARY

A survey over five years of patients attending our Chest clinic revealed 85 patients with emphysema, of whom 66 (78%) were Chinese. The largest numbers (44%) were in their sixth decades of life, and the male to female ratio was 6.7:1. A history of smoking was obtained in 94%. The disease appeared diffuse radiologically in 42% and signs of old tuberculosis were seen in 22%. Only 19% presented solely with emphysema, while 81%

had chronic bronchitis, in which group there was more evidence of ventilation/perfusion abnormalities and of cor pulmonale.

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