

CHRONIC BRONCHITIS EMPHYSEMA AND COR PULMONALE

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PREFACE

THE subjects dealt with in this monograph are common ailments known to clinicians for centuries. They represent a considerable proportion of the diseases of the chest met with in general practice and in the medical work of hospitals in all parts of Great Britain. The acute illnesses prone to occur in winter in those afflicted with chronic bronchitis form a large proportion of the total morbidity. They cause inability to work, economic hardship, and a loss of productivity in industry from their effect on the middle-aged and elderly. Ultimately, the chronic process ends fatally, but only after a long and protracted struggle which may last for decades, and whose vicissitudes are glimpsed imperfectly by doctors. The precise causative factors concerned in the origin and perpetuation of chronic bronchitis are imperfectly understood and the natural history of the disease process is still largely unknown.

The establishment in 1946 of the first whole-time clinical department of the University of Sheffield within the hospitals of Sheffield brought the staff into close contact with common disorders reaching the wards as medical emergencies or as diagnostic problems. Among the patients seen from the earliest days of the department were many with chronic bronchitis in all its various stages. The starting-point of the research interest acquired by the staff in these patients was the fascinating problem of pulmonary heart failure. The application to patients with this condition of the modern techniques of investigation of the circulation led on to studies on the effect of the administration of oxygen, on the changes in the renal circulation found by clearance techniques, and on the use of various diuretics and antibiotics in the treatment of heart failure. Gradually members of the department acquired an interest in the

pulmonary function in health and disease and also in the clinical condition of chronic bronchitis and emphysema found in most of the patients with pulmonary heart failure.

Studies of the nature of the infection of the respiratory tract in chronic bronchitis necessitated a better insight into the relationship between minor illness and the acute relapse of patients with bronchitis and pulmonary heart failure. In order to study illnesses in the family and in persons who were less incapacitated than those in hospital, field work was begun which led to an attempt to discern the earliest stages of chronic bronchitis. The tenuous nature of the line of demarcation between health and disease was realized for the first time in 1950 when clinical examinations and medical histories were obtained in volunteer workers in industry of all ages. After this pilot study, symptomatic inquiries were made in further industrial and rural communities in an attempt to define possible factors related to the pathogenesis of bronchitis. The department has thus traversed the natural history of bronchitis in its successive researches. If these have failed to yield new discoveries of great significance they have at least educated those engaged in the work and have given them inspiration and insight into their daily task. The fortitude and willing co-operation of the many patients has been a constant spur to fresh effort, but it is perhaps inevitable in work upon so complex a subject that little seems to have been accomplished.

The wisdom of attempting to draw together the results of such diverse studies into a monograph primarily written for clinicians is in doubt. Yet the illumination of separate portions of the field of study has seemed constantly to bear upon the clinical problem. Perhaps those who read this work may find something of interest in the account of solved and unsolved problems. In the case of those who bear the brunt of ill-health associated with these diseases—the family doctors—it is only possible to hope that the familiar story may be seen in its wider perspective and read without boredom.

We thank all those who have lent material or illustrations for inclusion in this book. We thank our radiological colleagues, Dr. T. Lodge and Dr. E. K. Abbott, for permission to reproduce the various radiographs in Chapters II and VIII. We particularly acknowledge the help of the sisters, nurses, house-physicians, and former members of the University Department of Medicine who have assisted in the collection of the clinical records on which much of our text is based. Among the staff of the department who have given technical assistance we wish to thank particularly Miss M. S. Greaves, B.Sc. (Sheffield), Mrs. D. Warrender, Mrs. S. Bradford, A. B. Kesteven, D. Woolhouse, and R. Saynor, A.I.M.L.T.

The research which we have described would not have been possible without generous financial support received from the Endowment Fund of the Board of Governors of the United Sheffield Hospitals. One of us (M. M. Platts) has been in receipt of an expenses grant from the Medical Research Council. The field work depended upon co-operation with the directors, managers, and workers at the industrial firm where the first survey was made, and with the medical officers of the Health Department of the West Riding of Yorkshire. We wish to thank Professor Fraser Brockington of the University of Manchester, and Dr. Wood Wilson and Dr. Main Russell of the West Riding of Yorkshire. Two health visitors, Miss J. Cheetham and Mrs. D. Simpson, paid many visits to the homes of patients during the field survey. Dr. W. Pickles and Dr. and Mrs. J. B. Coltman of Aysgarth, Wensleydale, gave much help during the survey of a rural community. To these and all others who have contributed in any way, we extend our best thanks. Finally, we wish to thank Mrs. G. M. Osborne for unfailing secretarial assistance and Sister J. Hutchinson of the Royal Hospital for her warm regard for the welfare of our patients.

C. H. S.-H.

T. H.

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CHRONIC BRONCHITIS, EMPHYSEMA, AND COR PULMONALE

CHAPTER I

THE DEFINITION OF CHRONIC BRONCHITIS

THE full significance of the first symptoms or illness which will later be recognized as the beginning of chronic bronchitis is very rarely appreciated at the time of the occurrence. So when patients come to the surgery or to the out-patients department with the story that they have had a cough or a cough with the raising of sputum for months or years, the manner in which the symptoms developed has usually become a past memory and the early stages of the disability have been forgotten. If only the patient could be seen and investigated in the first stages of chronic bronchitis, it might then be possible to discern the factors which are important as causes of the pathological changes in the respiratory tract in bronchitis, and further development of the process might be prevented.

Unfortunately, all but the later stages of the morbid process of chronic bronchitis are poorly understood, and though it is clear that the early stages are manifested by symptoms there is no single physical sign, except possibly the wheeze, which can be used to distinguish such 'bronchitic' subjects from healthy persons. Consequently almost all available descriptions of the clinical picture of chronic bronchitis are based upon patients who have already travelled far along the road and for whom there is no possible return to normality of the respiratory tract. Such patients usually complain of three symptoms—cough, expectoration, and dyspnoea. The cough and expectoration are usually experienced daily, thus giving rise to such expressions as, "I've always got a cough", or, "I cough up phlegm every

morning". The cough is worse in winter though it may still be present in the summer. The dyspnoea is experienced on exertion and is also distressing at certain other times such as after exposure to fog. Often it is accompanied by wheezing, but this is not invariably noticed by the patient. To these symptoms there must be added the characteristic winter breakdown in health lasting three or more weeks and described by most as an exacerbation of the symptoms of bronchitis.

At first sight, it would not seem to be a difficult task to discern such patients with established chronic bronchitis among the general public. But patients in an earlier phase of their illness, and especially those who are not breathless, are difficult to distinguish from their fellows. Many healthy persons experience cough and may even raise sputum particularly during or after attacks of influenza, common cold, or other acute respiratory infections. The cold "that fled to the chest" is often regarded as a feature of the early stage of chronic bronchitis but it is not confined to such persons.

In 1951, during clinical examinations of an industrial population in Sheffield it was found to be difficult to draw the line between healthy men and those with disease of the respiratory tract. In this study full clinical and radiological examination of the chest and simple pulmonary function tests were performed. The subjects were volunteers from workers at a mixed engineering and chemical industrial plant. They were asked to volunteer particularly if they considered that they suffered from bronchitis or other chest disease, but others who considered themselves fit were also invited to take part. Four hundred and six men were examined and interviewed by ordinary medical history-taking procedures and their answers were recorded on a standard card. When their replies were sorted it was at once obvious that the frequency of respiratory symptoms was related to age. *Table I* shows the symptoms arranged in two columns—cough and sputum, and cough, sputum, and dyspnoea. Column 1 consists of those with a productive cough which was intermittent, as when experienced

only during colds, and also those with a persistent daily cough. Column 2 includes only those with a productive cough which was persistent and which was also accompanied by dyspnoea. The latter was defined as breathlessness

Table I.—FIELD SURVEY. SYMPTOMS OF BRONCHITIS
IN A VOLUNTEER INDUSTRIAL POPULATION. (MALES ONLY)

AGES	NUMBER EXAMINED	COLUMN 1 ALL THOSE WITH COUGH AND SPUTUM		COLUMN 2 PERSISTENT COUGH, SPUTUM, AND EXERTIONAL DYSPNOEA		COLUMN 3 COLUMN 1 EXCLUDING THOSE IN COLUMN 2	
		No.	Per cent	No.	Per cent	No.	Per cent
Under 30	112	22	19.6	1	0.9	21	18.7
30-39	112	44	39.2	12	10.7	32	28.5
40-49	91	33	36.2	20	21.9	13	14.3
50-59	65	36	55.3	23	35.5	13	19.8
60 and over	26	15	57.6	11	42.3	4	15.3
	406	150	36.9	67	17.2	83	19.7

THE RESULT OF PHYSICAL EXAMINATION

CLINICAL CATEGORY	NUMBER	ALL THOSE WITH COUGH AND SPUTUM		PERSISTENT COUGH, SPUTUM, AND EXERTIONAL DYSPNOEA	
		No.	Per cent	No.	Per cent
Selected (171)					
Organic disease	90	70	77.7	48	53.4
Healthiest (over 30)	81	22	27.1	2	2.5
Unselected (235)					
Under 30 years of age	108	19	17.6	0	—
Over 30	127	39	30.7	17	7.2

noticed on exertion, such as on walking uphill, and which had been experienced for three or more years, or which was of a more extreme degree and experienced for any duration of time. Column 3 shows the residue of these from Column 2 who either had no breathlessness, or dyspnoea less severe than the definition above. It is clear that the

number of those in Column 2 is strikingly correlated with age. There were fewer persons aged 60 or over than in the other decades, but the percentage with cough, sputum, and dyspnoea in these was higher than in those aged 50 to 59. The apparent correlation of the symptoms of Column 1 with age is also shown by the table to be the result of the inclusion in Column 1 of the persons segregated in Column 2, for the numbers in Column 3 are not related to age. The results of clinical and radiological examination and of the pulmonary function tests were next used to assess the entire group of the 406 volunteers. Ninety men were selected because they showed evidence of organic disease of the heart or lungs. All but 4 were more than 30 years of age, and from the remaining persons aged 30 and over, 81 men were selected as being the healthiest. These two groups of men were chosen for further study of their respiratory illnesses over several years. The history of respiratory symptoms given by them is shown in *Table I*, which also gives figures for 235 men not selected for this purpose. The 90 men with organic disease had a high incidence of symptoms and included most of those with cough, sputum, and dyspnoea from the original 406 men who were examined. The 81 healthy men had a much lower percentage of symptoms, but the proportion with cough and sputum all the year round or occasionally was similar to that in the unselected persons. The latter group of 235 men included 108 under 30 years of age who were healthy and 127 others aged 30 and over who were difficult to assess. Probably most of the men were healthy but others had minor abnormalities on clinical examination or else their pulmonary function was below the value predicted for normal persons of the same age and sex. Some were probably in the early stage of chronic bronchitis, but there was no way of establishing this by clinical examination on one occasion. On the other hand the 90 men with organic disease segregated by examination should have included a high proportion of men with established chronic bronchitis in a more advanced stage. The clinical diagnoses finally reached in these 90 men are shown in *Table II* arranged in

4 groups. Their symptoms and the results of ventilatory function tests are also summarized in the table. Apart from pneumoconiosis, bronchiectasis, asthma, and a few miscellaneous cases, the majority of those with either cough

Table II.—FIELD SURVEY. CLINICAL FINDINGS
AND SYMPTOMS IN 90 MEN WITH ORGANIC DISEASE

CLINICAL DIAGNOSIS	NUMBER	ALL THOSE WITH COUGH AND SPUTUM	PERSISTENT COUGH, SPUTUM, AND DYSPNŒA	DEPRESSED VENTILATORY FUNCTION* 80 PER CENT OR LESS
Hypertension				
Cardiac enlargement	13	11	8	7
No cardiac enlarge- ment	14	11	7	10
Pneumoconiosis				
Definite X-ray change	9†	6	6	3
Minimal X-ray change	6‡	6	4	2
Miscellaneous				
Asthma	4	2	1	3
Unexplained cardio- megaly	3	1	1	2
Coronary heart	1	1	0	—
Rheumatic heart	1	1	0	0
Post-lobectomy (bronchiectasis)	1	1	1	1
Pulmonary tubercu- losis (inactive)	1	1	0	0
Remainder 'Bronchitis and emphysema'	43	35	25	28
Totals	90	70	48	55

* Expressed in terms of predicted normal values.

† 3 also had cardiac enlargement and hypertension.

‡ 3 also had hypertension, 2 with, 1 without cardiac enlargement.

and sputum or with cough, sputum, and dyspnœa showed either the clinical findings generally described as 'bronchitis and emphysema' or these findings together with hypertension. It seemed unlikely that the hypertension contributed materially to the symptoms, particularly as the heart

was of normal size in half the patients. The ventilatory function was depressed in two-thirds of those labelled 'bronchitis and emphysema' but was also depressed in men with other diagnoses. Thus although physical examination revealed diseases such as pneumoconiosis which might have caused the symptoms, it did not indicate which persons should be labelled as having chronic bronchitis any more clearly than did the study of the symptoms or the function tests alone. However, by combining together the symptoms, the signs, and the results of radiographs and function tests, one could select a group of persons in whom all diseases other than chronic bronchitis had been excluded. Such 'pure' chronic bronchitics would form, however, an artificially selected group and might not be fully representative of the whole population of persons with chronic bronchitis.

Observations of those persons labelled healthy or with organic disease was therefore begun in order to record their respiratory illnesses over a period of years. A regular visit was paid by a health visitor to the homes of 163 persons and a record was kept of all illnesses leading to respiratory symptoms and particularly of those necessitating time away from work. Sometimes medical examinations were made during the more severe illnesses.

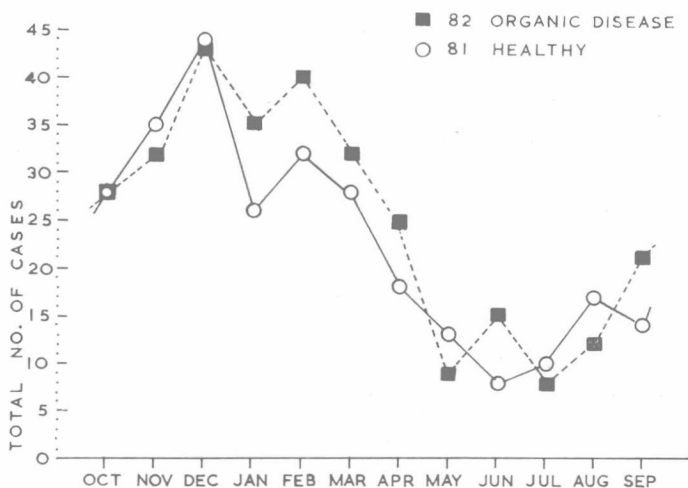
Table III shows the total number of all respiratory infections and of common colds, tonsillitis, influenza, bronchitis,

Table III.—NUMBERS OF RESPIRATORY INFECTIONS
IN 81 HEALTHY PERSONS AND 82 WITH ORGANIC DISEASE
(OCTOBER 1951 TO SEPTEMBER 1954)

	HEALTHY	ORGANIC DISEASE
Common cold Tonsillitis Influenza	215	137
Colds affecting the chest	48	119
Acute bronchitis and pneumonia	10	44
Total	273	300

and pneumonia in 82 volunteers with organic disease and 81 healthy men for the years 1951 to 1954. *Fig. 1* shows the seasonal incidence both for total infections and for acute

ALL TYPES OF RESPIRATORY INFECTION IN TWO GROUPS.
3 YEARS: OCT. 1951 TO SEPT. 1954 INCL.



ACUTE BRONCHITIS & PNEUMONIA IN TWO GROUPS.
3 YEARS: OCT. 1951 TO SEPT. 1954 INCL.

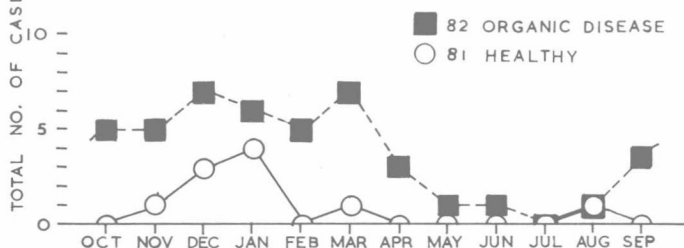


Fig. 1.—Shows the total number of acute respiratory infections and of bronchitis and pneumonia in groups of healthy workers and of those suffering from organic disease. The period of study was from October, 1951 to September, 1954.

bronchitis and pneumonia in the same years. It is clear that bronchitis and pneumonia were far commoner in the volunteers with organic disease than in the healthy persons.

Table III also shows that those with organic disease suffered fewer attacks of upper respiratory infections but more chest colds than did the healthy persons. Attacks of acute bronchitis in the winter, which are one of the main disabilities of chronic bronchitics, were actually four times more frequent in the group with chest disease than in the healthy persons.

To sum up the results of this study of an industrial population, it is difficult first of all to define the border-line between health and sickness; and secondly, diagnosis is confused by the occurrence in the same person of different conditions which may each contribute to the symptoms. For the purpose of recent field studies, some workers have accepted a definition of chronic bronchitis based on the presence of chronic cough and expectoration, at least during the winter, for not less than three years, and of the occurrence during this time of at least one chest illness with increased cough and sputum severe enough to confine the subject to his bed or house. Gross localized disease of the bronchi or lung such as bronchiectasis, tuberculosis, lung abscess, or carcinoma must have been excluded. The present authors favour a definition of chronic bronchitis which includes a reference to breathlessness. Insistence upon dyspnoea as already defined, as well as upon persistent cough and sputum, may of course exclude some patients in the early stages of chronic bronchitis. But a definition including breathlessness is preferred because of the doubt which is felt about the ability of clinical examination to distinguish with certainty healthy persons from those with early chronic bronchitis. The value of such a definition in connexion with further field studies made by one of us (M. Clifton) will be apparent by reference to Chapter XI. There it will be shown that among those persons complaining of a persistent cough and sputum, only those with coexisting breathlessness are prone to regular attacks of bronchitis. Among the others with a persistent cough and sputum, who are not breathless, there may be some who are in the earliest phase of chronic bronchitis but who cannot certainly be distinguished from their neighbours who will never develop

chronic disease. The family doctor who is able to follow the health of his patients over a number of years is the only person who can decide this point. For the sufferers from chronic bronchitis become clearly distinguishable from the healthy population as the seasons change and as the years pass.

CHAPTER II

THE CLINICAL PICTURE OF CHRONIC BRONCHITIS

OBSERVATIONS on the natural history of chronic bronchitis have been baulked by the very slow development of the disease. No single observer can chart the course of the disease from start to finish in a representative group of patients, and current descriptions are mostly based upon patients with irreversible changes. The account which follows is also based upon such patients with established chronic bronchitis. They were selected from a much larger group of patients with chronic chest disease, firstly because conditions such as pneumoconiosis, asthma, active tuberculosis, and gross bronchiectasis had been excluded, and secondly because of the completeness with which they were investigated for emphysema by the performance of pulmonary function tests.

THE MODE OF ONSET OF SYMPTOMS

It is obvious that chronic bronchitis is an extremely protracted illness and that there is much obscurity concerning its early phases. It is therefore difficult to obtain precise details concerning the mode of onset and duration of symptoms by the time that patients reach hospital. Oswald, Harold, and Martin (1953) analysed the case-histories of a thousand patients seen at the Brompton and other London hospitals during a 2-year period and used a special questionnaire for the collection of data. They found that 524 patients had an insidious, and 476 an acute, onset of symptoms. Those with an insidious onset said that they had slowly become 'chesty' over some months or years. Those with an acute onset blamed various episodes including acute bronchitis (in 342 patients) and pneumonia