BRONCHIECTASIS: A STUDY CENTRED ON BEDFORD AND ITS ENVIRONS*

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Bronchiectasis is usually regarded as a serious disease, commonly causing much disability, needing surgical intervention if at all possible, and leading to an early death. This investigation was planned to obtain some idea of its incidence within the specified area of Bedford and its environs, to analyse the severity of its symptoms, to observe the effects of treatment, and then to consider whether the gloomy prognosis and the hasty recourse to surgery often advised are justified in more than a small percentage of patients.

The first description of bronchial dilatation was written by Laennec in 1819—the term "bronchiectasis" was introduced later in Swaine's translation of Hasse (1846). The next century saw the publication of many articles discussing it from various aspects; the most complete was that of Clark, Hadley, and Chaplin (1894). Over this period the disease became known in its classical form, and only after the introduction of bronchography was it appreciated that less severe examples arose. Attention was drawn to this by Bezançon and his colleagues (1924) and by Wall and Hoyle (1933). During the last war the opportunity was taken to prove that it was relatively common among those who had been passed as fit for military service—in England by Martin and Berridge (1942), and in America by Fine and Steinhausen (1946). It is clear, therefore, that bronchiectasis may exist either as a serious handicap or in very much slighter degree; the former type of case has tended to gravitate to the teaching or other large hospitals for diagnosis and treatment, whereas the latter has been described principally in groups of selected material. Descriptions of the disease have come mainly from these hospitals, and information about bronchiectasis as it occurs among a given population of all ages is incomplete and scanty.

In this paper a general study of the subject has been made, and the findings have been discussed and contrasted with those reported elsewhere. A number of differences have been found, and, though little that is new has been added, the general picture of the disease which emerges is certainly unlike that most often described.

Material and Criteria of Diagnosis

The investigation was conducted over a period of five years (1947–51) from a chest clinic responsible for a population of approximately 150,000, centred on the borough and suburbs of Bedford, which contain over 60,000 inhabitants and are surrounded by small urban and rural communities. Most patients were referred for diagnosis or found in the course of routine radiography, but 25 adults and 5 children were sent for observation and treatment with the diagnosis already confirmed. No case of bronchiectasis arising in the course of a disease of more consequence to the patient than the dilatation itself has been included—and hence no bronchiectasis associated with conditions such as carcinoma of the bronchus or post-primary tuberculosis.

In the past, criteria of diagnosis have varied greatly. For instance, Farrell (1936) diagnosed bronchiectasis on a plain radiograph even if iodized oil showed no dilatation, and others have done likewise whenever the alveoli failed to fill. Bradshaw, Putney, and Clerf (1941) and others have been satisfied with the evidence obtained on bronchoscopic examination. Only a few authors, among whom Ogilvie (1941) may be mentioned, have drawn attention to any difficulty in interpreting dilatation on bronchograms. In this investigation some uncertainty in deciding whether bronchiectasis was present has been experienced in a small proportion, and no bronchi that have tapered towards the periphery or any that were partially filled, unless also grossly dilated, have been judged ectatic. A number of borderline cases have been omitted, and those included have been viewed by two or more observers, all of whom have diagnosed bronchial dilatation independently.

Incidence, Distribution, and Aetiology

Unequivocal bronchiectasis, proved by bronchogram, was found in 166 patients (137 adults and 29 children); 87 were male and 79 female. A further 48 cases of undoubted bronchiectasis were discovered, though not confirmed by bronchograms because of age, small respiratory reserve, or refusal to consent to the procedure. In addition to these two groups 75 cases possibly had bronchiectasis, but lacked abnormal physical signs, a positive radiograph, or a history of an aetiological condition from which symptoms could be traced. Therefore, although some of these, if subjected to a bronchogram, would undoubtedly have been shown to have bronchial dilatation, they must be excluded from any calculation. With these reservations it would seem fair to include the proved cases and the strongly suspected but not confirmed cases (214 in all) as an estimate of the approximate number discovered in this selected population of 150,000 during the period of five years. When 14 cases are subtracted for deaths, removals from the district, and inability to trace, 200 persons with bronchiectasis were living in the area at the end of 1951—an incidence of 1.3 per 1,000. Here it should be noted that further calculations shown in this paper relate only to the 166 cases confirmed by bronchograms unless it is stated otherwise.

The distribution of the ectasis was right-sided in 40, left-sided in 39, and bilateral in 87. Bronchographic filling was complete on both sides to the tertiary or quaternary branches in just over one-half, in 23 there was unilateral filling alone, in 3 only reports were available, and in the rest there was some imperfection, usually a small one, in the bronchogram. The type of dilatation was observed in 163 patients, and was found to be cylindrical or fusiform in 100, saccular or cystic in 4, and a combination of the two or mixed in 59. The number of lobes known to be implicated averaged 2.6 over the whole series, but some of them were damaged in part only. Involvement of the left lower lobe was accompanied by dilatation in the lingula in 87 out of 109 patients. The latter was complete in 55 and partial in 32; the inferior branch of the lingula was most often affected, and the axillary branch of the superior division most often escaped. Out of 129 lower lobes which were completely filled and visualized, the apical branch escaped dilatation on 62 occasions when the rest of the lobe was ectatic. The right lower lobe was bronchiectatic on 84 occasions, and the extent of the disease was in many instances less than on the left side.

Bronchiectasis of an area or areas totalling less than the size of the right middle lobe has been described as segmental in this paper, although it was often much less in degree. Such dilatation was present in 32 patients, being unilateral in 29 and bilateral in 3.

The aetiological factors thought to be responsible for the development of bronchiectasis were investigated; great care was taken to obtain an accurate history from the patient or,

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where necessary, from relations. A definite illness from which symptoms started was recorded by the majority, but in a few without regular symptoms the history of a specific respiratory illness or a radiograph typical of calcified primary tuberculosis has been accepted as evidence of the antecedent factor. Because of the difficulties of exact diagnosis the term "pneumonia" has been used throughout this paper without further qualification to include all acute respiratory infections. Chronic or recurrent bronchitis and cough since infancy have been assigned as factors rather than classed as of unknown aetiology, for it is felt that this group of chronic respiratory catarrh, whatever its real origin, is important enough to be acknowledged. No mention has been made of the congenital anomaly as a cause, for the reason that it is not susceptible of proof, and not even admitted by F. P. L. Lander (1947, personal communication) and by other authorities. Pneumonia was judged to be responsible for 43%, pertussis and the infectious fevers for 16%, recurrent bronchitis and cough since infancy for 21%, primary tuberculosis for 7%, and mustard gas for 5%. A number of miscellaneous causes made up the total.

Symptoms, Signs, and Complications

The symptoms and clinical aspects of the disease are analysed in considerable detail in order that they may be contrasted with those which have been described by others. Particular importance has been attached to this, as most of the well-known studies on which opinion largely rests were published before the arrival of the antibiotics—later reviews have concerned themselves mainly with the results of treatment.

In 73 patients symptoms started before the age of 10; in each succeeding decade the number was smaller, being five in the sixth decade. The age at which patients came under observation was spread over an even longer period and was most common in the fourth decade. The length of time that symptoms had been present averaged 17.9 years. The individual duration of symptoms varied from two weeks to 48 years, but in only 15 patients was it over 34 years. Twenty-two adults and 12 children were seen in whom the history of symptoms was less than one year. Forty-seven patients had been radiographed previously and not diagnosed as having bronchiectasis; 21 of them had been in hospitals with a respiratory affection, and 6 had been in sanatoria though non-tuberculous.

The reasons why these patients came under observation were noted: 34 were referred as possible cases of pulmonary tuberculosis, 23 for haemoptysis, 28 for chronic cough or bronchitis, and 19 following pneumonia; in only 12 was bronchiectasis suspected, but 30 were sent with the diagnosis already established (in 4 this had been done locally); 6 were regularly attending the clinic and were thought to have phthisis, and 12 were found when examined as contacts of this disease; only 2 had been diagnosed previously by mass miniature fluorography.

Cough was always present in 134, intermittent in 20, and absent in 12. The daily amount of sputum, however, was often hard to determine. Those who had been in hospital on 24-hourly sputum measurements were capable of estimating the quantity accurately, but many others were found on trial to exaggerate the amount considerably. It is also likely that some erred in the opposite direction for aesthetic reasons. The figure taken in this paper is the amount which was judged to be the patient's average throughout the year, apart from exacerbations. More than 50 have had actual sputum measurements performed over periods up to several weeks, and in the others careful and repeated inquiry was made. The average volume of sputum in the 122 patients who reported it as continuously present was 1½ oz. (43 ml.) each 24 hours, the highest reading being 8 oz. (230 ml.), and the lowest being a trace, estimated as ¼ oz. (7 ml.). It was intermittent in 22 patients, and a further 22, of whom 12 were children, stated that they had no sputum. It was noted as fetid in 17 patients (16 adults and 1 child), but in only 2 was the fetor sufficient to taint the air of a room.

Very varying percentages for the occurrence of haemoptysis have been given by different authors, many of whom have not defined their use of the term. Among these patients 46 had suffered from stained sputum and 34 others had haemoptysis of at least two teaspoonfuls of blood on one or more occasions; in only seven was ½ pint (235 ml.) exceeded. There was no obvious relationship between the type of bronchiectasis and the liability to bleeding, but with one exception the larger haemorrhages took place in bronchiectasis of considerable extent.

Dyspnoea on exertion has been described as a constant symptom in many of the earlier studies. In this series the patient's own opinion has been accepted regarding the degree of disability present: 26 had dyspnoea on slight exertion, 77 on moderate exertion, 33 on severe exertion, and 30 did not suffer from dyspnoea.

Abnormal physical signs in the chest are present in a high proportion of those with bronchiectasis, the most typical being persistent moist sounds localized to the damaged area. Obvious signs were always present on examination in 123 of these patients, but they accompanied segmental bronchiectasis in only 7 cases out of 32. It is difficult to differentiate the early stages of clubbing of the fingers from variations of the normal nail-bed and its overlying skin. Among these patients 47 were judged to have early clubbing, 25 well-developed clubbing, and 3 marked clubbing. In 3 children it arose or increased during observation, and in 2 adults it was observed to diminish after effective treatment.

As in about half these patients the onset occurred during the first decade it might be expected that many would have been of poor physique; 8 children and 13 adults were of this type. The ability to work has been stated to be much diminished. All the children in this series were able to attend school, though 9 of them lost time, especially during the winter months, with symptoms not of bronchiectasis but of recurrent bronchitis. Out of the 130 adults under the age of 60, 5 were unable to work or to conduct their household duties; one of them was incapacitated by myocardial ischaemia. The social implications of the disease were slight. No divorces or suicides occurred; neither did there appear to be any undue difficulties in marriage.

Sinusitis was not especially searched for, though all who had suggestive symptoms were investigated; definite infection was found in 39 adults and 14 children. Asthma was present in nine of the whole number. Pneumonia arising, apart from the causal illness, was reported in 67 patients, but special attention was paid to a history of this complication. During the observation period it was known to have occurred in 16 patients—in 6 on more than one occasion, and in 3 for the first time. Seven had frank haemoptysis, the largest being 2 pints (1,140 ml.); all had had haemoptysis previously. One patient developed a pulmonary abscess, and another a spontaneous pneumothorax. Otherwise there were no serious complications except those to be mentioned in the patients who died.

Bearing in mind the 166 patients as a whole, it is instructive to contrast the extent of the disease and the severity of symptoms in different groups. Short comparisons are drawn between the children and adults, between the cases diagnosed by teaching or large hospitals and the remainder, and between the segmental bronchiectatics and those more extensively affected.

Among the children, cough without sputum, due to its being swallowed, was noticeable, but fetor was uncommon. Haemoptysis was also less frequent and smaller in amount, the largest being 2 oz. (57 ml.). Dyspnoea on exertion was less obvious even with extensive disease, and localizing physical signs were more often obscured by generalized bronchitis. The presence of the saccular type of dilatation was much less common, and there were no cases of the thin-walled cystic type. On the other hand, poor general development and symptoms of sinus infection were more pronounced than among the adults.

Twenty-six cases were diagnosed in teaching hospitals, and when compared with the remainder they were found to be

TABLE I.—*Numbers and Percentages of Various Symptoms and Physical Signs Contrasted in Cases of Bronchiectasis Diagnosed in Teaching Hospitals and the Remainder*

Symptom, Sign, or Condition	26 Cases of Bronchiectasis Diagnosed in Teaching Hospitals (21 Adults, 5 Children)				Remaining 140 Cases of Bronchiectasis (116 Adults, 24 Children)			
	Adults	Children	Total No.	Total %	Adults	Children	Total No.	Total %
Regular cough	21	5	26	*100·0*	93	15	108	*77·1*
Regular sputum	21	5	26	*100·0*	90	6	96	*68·6*
Fetid sputum	8	1	9	*34·6*	8	—	8	*5·5*
Developed clubbing	6	1	7	*26·9*	16	2	18	*12·9*
Pronounced clubbing	1	—	1	*3·8*	2	—	2	*1·5*
Constant abnormal chest signs	21	5	26	*100·0*	81	16	97	*69·2*
Haemoptysis (½ oz. or more)	7	2	9	*34·6*	24	1	25	*17·8*
Recurrent pneumonia	13	3	16	*61·5*	45	6	51	*36·4*
Presence of sinusitis	14	4	18	*69·2*	25	10	35	*25·0*
Segmental bronchiectasis	1	—	1	*3·8*	26	5	31	*22·1*
Average age in years on diagnosis	20·4	5·0	17·4	—	38·4	7·6	33·1	—
Average amount of sputum (in oz.)	2·5	2·5	2·5	—	1·0	0·1	0·8	—
Average number of lobes affected	3·1	4·2	3·3	—	2·4	2·0	2·4	—

TABLE II.—*Numbers and Percentages of Various Symptoms and Physical Signs Contrasted in Cases of Segmental Bronchiectasis and the Remainder*

Symptom, Sign, or Condition	32 Cases of Segmental Bronchiectasis (27 Adults, 5 Children)				Remaining 134 Cases of Bronchiectasis (110 Adults, 24 Children)			
	Adults	Chi'dren	Total No.	Total %	Adults	Children	Total No.	Total %
Regular cough	20	2	22	*68·8*	94	18	112	*83·6*
Regular sputum	19	—	19	*59·4*	92	11	103	*76·9*
Fetid sputum	1	—	1	*3·1*	15	1	16	*11·9*
Clubbing of all degrees	9	—	9	*28·1*	56	10	66	*49·3*
Constant abnormal chest signs	7	—	7	*21·8*	95	21	116	*86·5*
Haemoptysis (½ oz. or more)	6	—	6	*18·8*	25	3	28	*20·9*
Recurrent pneumonia	7	1	8	*25·0*	51	8	59	*44·0*
No symptoms	6	3	9	*28·1*	17	6	23	*17·2*
Average amount of sputum (in oz.)	0·5	—	0·4	—	1·5	0·7	1·3	—

of a much severer type (Table I). Cough, sputum, and abnormal physical signs were universal. Fetid sputum, advanced degrees of clubbing of the fingers, large haemoptyses, and recurrent pneumonia were much commoner, as were symptoms of sinusitis. More lobes were bronchiectatic, and there was only one with ectasis of segmental extent.

As regards segmental bronchiectasis, with the exception of haemoptysis all symptoms and signs were less severe than in the patients with more extensive disease (Table II). There were no regular symptoms in 28% of them as against 17% of the remainder.

Diagnosis

The diagnosis of bronchiectasis has rightly been held to depend on the triad of a relevant history of illness from which symptoms started, the presence of abnormal physical signs, and a radiological abnormality. Ogilvie (1941) and others have stated that these three factors are present in a very high percentage of bronchiectatics; and among the patients who were diagnosed at teaching hospitals this triad was present in all. However, when the whole group is analysed 32 had no regular symptoms, 43 had no constant localizing abnormal physical signs, but only 3 had normal postero-anterior radiographs. This latter finding might be due to the fact that those with normal radiographs were not subjected to bronchograms, but actually over 50 were done during this survey with negative results in the absence of radiological abnormalities when symptoms or history were suggestive of bronchiectasis. All radiographs were taken with a modern apparatus at 6 ft. (1.8 metres) distance; in some instances they showed changes which were difficult or impossible to see in earlier films of poorer definition. For reasons of space only brief comment on the radiological changes found among these patients can be given.

The well-marked abnormalities which have often been described, such as opacities suggestive of pneumonia, circular or ring shadows, and the obvious triangular shadows associated with lobar collapse, were noted many times. However, a number of changes of a minor character must be emphasized, particularly as quite often it is only by close attention to them that bronchiectasis may be suspected. Slight lateral shift of the heart or mediastinum and alteration in the position or shape of the interlobar septa may be mentioned. A change in the position or shape of the hemi-diaphragm, localized bulging or "tenting" of the diaphragm, and reduction in size or obliteration of the costophrenic angles are further signs. The shape and position of the hilar shadows and the presence of hilar calcifications may be of consequence. Diminution of the pulmonary markings in compensatory emphysema and increase of these markings, due to crowding or to actual broadening of them with absence of tapering, are most important abnormalities. Finally, the shadows caused by the collapse of segments or subsegments of the lung may be small, not dense, and consist only of a few crowded but usually thickened pulmonary markings, often, but not always, of roughly triangular shape. The constancy of the radiographic changes in this series was noteworthy, except for such alterations as arise with superadded pneumonia or the temporary retention of sputum. In only one patient, a boy of 13, was an abnormality due to a collapsed middle lobe seen to disappear gradually, leaving a normal radiograph, though bronchial dilatation still persisted.

Prognosis

It is impossible to judge the prognosis of a chronic disease in a series of patients observed for only a few years, but, while acknowledging their statistical inadequacy, some conclusions may be drawn. The group of 166 patients was followed for a total of 498 person-years—an average of three years each. The largest number of cases came under observation during the first two years, but 23 were diagnosed in 1951. During this time six patients died and three were lost sight of. In the youngest patient who died death was certified as occurring from exhaustion; she was a girl of 14 who had extensive bilateral bronchiectasis. Her death may have been complicated by pneumonia, and she never had the benefit of any adequate treatment or of penicillin. The remaining patients who died were all over the age of 40: one died of the late effects of deep radiation following a mastectomy for carcinoma, which had caused bilateral bronchiectasis; the other deaths were due to cor pulmonale complicating bilateral disease, a coronary thrombosis, status asthmaticus, and heart failure following chronic bronchitis and asthma (Table III). The average length of symptoms in those dying was 14.5 years, and the average time from diagnosis was 4.75 years. None of these patients could have been treated surgically because of the extent of the disease or other reasons.

Among the 48 cases unconfirmed by bronchograms there were two deaths; one which was certified as due to asthma in a girl of 9; the other from cardiac failure complicated by hypertension in a woman aged 75. Both these patients gave radiological evidence of extensive bilateral bronchiectasis.

Apart from its mortality, the morbidity of bronchial dilatation has been regarded as of essential consequence. In the relatively short period of the survey very little change was observed in the general condition of these patients. One who had had no sputum developed a trace after a respiratory

TABLE III.—*Details of Bronchiectasis Patients Dying During the Observation Period*

Case	Sex	Age at Death	Cause of Death	Period in Years Before Death		
				Symptoms Present	Disease Proved	Under Observation
Confirmed by Bronchogram						
A	F	14	Exhaustion	8	2	1
B	F	42	Pulmonary radiation disease	2½	1½	1
C	M	47	Cardiac failure plus chronic bronchitis and asthma ..	11	4	2
D	M	53	Status asthmaticus ..	20	1/12	1/12
E	F	62	Cor pulmonale ..	38½	21	2½
F	M	62	Coronary thrombosis	8	1	1
Average		48		14½	4¾	1½
Not Confirmed by Bronchogram						
Y	F	9	Asthma	9	—	6/12
Z	F	75	Cardiac failure and hypertension ..	75	—	2
Average		42		42	—	1½

infection. Three patients, on the other hand, reported a reduction in sputum, apart from the use of any antibiotics and any initial improvement noted from medical treatment. No positive evidence of increase in the extent of the condition was obtained, but a second bronchogram was done in only 15 patients.

Treatment

The treatment of bronchiectasis may be medical or surgical, the latter to-day being almost synonymous with pulmonary resection. The measures described as medical require further elaboration. Postural drainage, either by intermittent "tipping" or raising the foot of the bed on blocks, was advised in every case in which this caused expectoration. Physiotherapy, including breathing exercises and instruction in postural coughing, was also ordered. The way in which the antibiotics were given varied during the period, but, broadly speaking, the methods described by Kay and Meade (1945) and Olsen (1948) were used for penicillin and streptomycin, and that reported by Wynn-Williams and Moyes (1951) for chloramphenicol.

There were 86 patients with ½ oz. (14 ml.) or less of sputum daily who were not thought to be in need of treatment, apart from those who found early morning "tipping" helpful. Patients with more than this amount of sputum were always given instruction in postural drainage and breathing exercises. This simple treatment rendered fetid sputum odourless in every case in which it was tried. Moreover, whenever posture resulted in the coughing up of sputum, it always reduced the total quantity when diligently carried out, and also decreased any toxaemia present. Chemotherapy* was given in addition if there was an exacerbation of symptoms, an upper respiratory infection accompanied by fever, bronchitis, pneumonia, or persistent toxaemia.

Twenty-six patients were admitted to hospital and given penicillin, in 10 of whom it was supported by streptomycin; 23 others were treated with chloramphenicol, and in 2 aureomycin was used. The results obtained from these antibiotics were excellent, the reduction in sputum obtained being in the nature of 50% with penicillin, and 60% if streptomycin was added. Chloramphenicol was even more effective. Unfortunately, this improvement was not maintained, and a gradual increase in sputum occurred in most patients after an interval which varied from a few days to several months. It was found that the majority had a basic level of sputum which could be lowered by antibiotics but which gradually reappeared. Prolonging the course of treatment was not found to lengthen the period of improvement, and, latterly, treatment was given for only a few days after maximum benefit was obtained. The complications arising in this series were treated medically with the exception of a pulmonary abscess, which, failing to respond, was successfully drained. Chemotherapy was particularly valuable in controlling the attacks of recurrent pneumonia, and the tendency for each succeeding infection to cause deterioration either by increase of sputum or by toxaemia appeared by clinical estimates to be removed.

Surgery was considered whenever patients had 2 oz. (57 ml.) or more of sputum daily and were inconvenienced by it. Frequently recurrent pneumonia, and haemoptysis of considerable size or if often repeated, were adjudged to be additional indications for resection. Surgery was not advised for prophylactic purposes nor for underlying toxaemia, as this was not found to be persistent in any who were suitable for surgery. There were 51 patients who had at least 2 oz. (57 ml.) of sputum, but in only 10 of them was the condition unilateral; 17 other cases had bilateral disease not affecting more than three lobes. Of the first group two were operated on and four were quite unsuitable for surgery because of advanced age, concurrent bronchitis, or asthma. Of the second group two were also operated on and three were unsuitable for various reasons. There were left, therefore, 4 patients with unilateral and 12 with bilateral disease who had 2 oz. (57 ml.) or more of sputum and were fit for operation should they consent to it.

Resection of one or more lobes was carried out on six patients, the operations being done in thoracic centres of repute. Two were much improved though left with a trace of sputum each day; one, although left with 2 oz. (57 ml.) of sputum, was permanently improved from 6 oz. (170 ml.) and one was unchanged. The remaining two developed broncho-pleural fistulae and empyemata after operation; of these, one is much worse functionally than before operation, with an unchanged amount of sputum, and the other has much less sputum but is more dyspnoeic. Two further patients had had surgical treatment many years previously—one a phrenic crush with no improvement, the other an artificial pneumothorax with permanent reduction of the sputum by almost a half.

Apart from the treatment detailed above, a number of these patients were treated by their general practitioners with one of the sulphonamides or penicillin for exacerbations of respiratory infection with satisfactory results.

Discussion

While little information is available regarding the true incidence of bronchiectasis among the general population, there are statistics which show the number of bronchiectatics admitted to hospital compared with other diseases. The results of post-mortem examinations on similar material are also available. Out-patient figures might be expected to be of greater value, but they show much the same results as those on in-patients. More recently, information has been obtained from surveys by mass miniature fluorography, although proof of the disease by bronchogram is lacking in most cases. N. Smith (1952, personal communication) found nearly 1 per 1,000 among 6,888,127 persons fluorographed. These figures and that (1.3 per 1,000) found here do not support the statements of Ochsner (1930) and Holinger (1943) that bronchiectasis is commoner than tuberculosis. However, it is certain that neither this review nor any other has discovered every case of bronchiectasis in an area. A survey somewhat similar but perhaps more comprehensive than the one described here is that of Mackenzie (1950), who investigated children of school age suspected of this disease in Leicester and found an incidence of 2.9 per 1,000 among those examined. This is probably the highest incidence yet reported in an unselected group, but unfortunately his criteria of diagnosis are unpublished. Certainly in Bedford, where excellent co-operation exists with the school medical authorities, no such figure could be obtained, only 29 cases being confirmed among about 33,000 children.

The distribution of the bronchial dilatation found in this survey is rather different from that in most others, as the left

*The terms "chemotherapy" and "antibiotics" are used as synonymous throughout this paper.

side was not found to be affected more often than the right, although the area involved was greater. A little over half the cases were bilateral, but this figure is not as high as that of Walsh and Meyer (1938), who reported 68% ; any differences in this respect are probably related to the completeness of the filling of the bronchi.

Despite the large numbers of reviews consulted for comparative purposes, that of Martin and Berridge (1942) contained the sole description of bronchiectasis of less than lobar extent arising among patients with wider-spread disease, though cases of segmental bronchiectasis have been recorded by Hall (1938), Chapman and Wiggins (1941), and others. It is therefore impossible to decide whether the finding of 32 patients with segmental bronchiectasis among 166 is unusual. From the evidence of this survey it would not appear to be common in the material attending the teaching hospitals, as it was encountered only once among the 26 who had been diagnosed in this way. Little need be said about the type of dilatation disclosed except that in a large proportion it was mixed and could not be described accurately as of one shape.

The causal factors found responsible were in the main similar to those reported previously. Mustard gas and primary pulmonary tuberculosis figured in larger numbers than in any other general series. The first was responsible for eight cases, whereas hitherto only isolated instances have been recorded except by Bonnamour, Badolle, and Gaillard (1929), who devoted part of a monograph to the subject, and Carr, Denman, and Skinner (1947), who investigated a number of individuals accidentally exposed to mustard gas. Primary tuberculosis was the responsible cause in 12, the highest number reported previously being 2 out of 33 children by Raia (1938). One reason for past omissions may be that such children are treated, and described, as tuberculous ; another that bronchiectasis due to primary tuberculosis causes so little disability that it is not often referred for an opinion. The latter statement may appear open to argument, especially in the light of the work of Brock (1950) ; but in the present series symptoms were noticeably few, and the only complication that arose in this group was a single attack of pneumonia. It is, however, freely admitted that if pathological examination were always possible primary tuberculosis might well turn out to be a relatively common cause of bronchiectasis, and under such conditions there might be little difference in symptoms between dilatations due to this cause and other aetiological factors.

Special importance must attach to the symptoms of bronchiectasis, as much discomfort, unhappiness, and disability has been attributed to them. Churchill (1938) stated that many patients found employment difficult or impossible, and that suicide and divorce were commoner than among the normal public. In this series the cough and quantity of sputum were much less than usually recorded, often approaching more nearly to selected cases of " dry " or " haemorrhagic " bronchiectasis, and persistent fetid sputum was not encountered. Dyspnoea on exertion and abnormal physical signs have been reported, especially in the earlier accounts, as almost constant, but were less severe here. It should be particularly noted that only five patients under the age of 60, one of whom was incapacitated by a coronary thrombosis, were unable to work or conduct their household duties. The general physical development of any group is difficult to estimate, but poor physique appeared to be less obvious than is often described. No special difficulty in social adjustment was observed.

On the other hand the age of onset and duration of symptoms were very similar to those recorded elsewhere, although in 34 cases which were diagnosed the symptoms had lasted less than one year. Haemoptysis occurred as often as in most series and pneumonia was also very common, although the results of treatment were so satisfactory that this complication may now be rated as a relatively minor one.

The diagnosis of bronchiectasis should have been made much easier through the advances of radiography, and yet 47 of these patients had been radiographed in the past and the diagnosis not established. In every instance there was a definite abnormality, although in some this was of small extent. Indifferent apparatus may be a partial explanation, but as a number had attended large hospitals this cannot be the only cause. In view of the widespread belief that bronchiectasis is often present with a normal postero-anterior radiograph, it is interesting that in only three patients was this view normal. This finding was not the result of the investigation only of patients with abnormal radiographs, as 91 bronchograms were done with negative results, and in over half these patients the plain film was normal but the history or physical signs suggested the possibility of the disease. It has been observed by a number of writers that if the triad of history, physical signs, and abnormal radiograph are present, bronchiectasis may be diagnosed with great confidence even in the absence of a bronchogram. No case was found in which this triad was present, and yet a bronchogram was normal. The use of iodized oil is really only necessary for diagnosis in the absence of one of these indications.

The prognosis of bronchial dilatation has been considered gloomy by most authorities. The basis of this opinion was laid by Clark and his colleagues (1894), and the papers of Perry and King (1940) and Bradshaw, Putney, and Clerf (1941) provided further evidence of the serious outlook of those with bronchiectasis when medically treated. In the present series six patients died during the period of observation. The duration of their symptoms was nearly as long (14.5 years) as that of the whole group, and they had been diagnosed for an average of 4.75 years before death. These results are different from those of Perry and King (1940), who found that among their patients the average length of symptoms before death was only five years, and also from the findings of Bradshaw and his co-workers (1941), who recorded that the average duration of life was only 1.8 years after diagnosis. It should be noted that over half the deaths in both series were caused by complications of the disease which are now amenable to chemotherapy, that the average age at death was much younger, and that heart failure, which accounted for half the deaths in this series, was a relatively infrequent cause in theirs. Less pessimistic figures were given by Wall and Hoyle (1933), who, over a short period, observed no deaths among 18 cases of " dry " bronchiectasis.

Practically all authorities have found that the prognosis of the surgically treated case is better than that of those which have only medical treatment, but I have failed to find a study in which the surgically treated have been compared with those who were recommended surgery but refused it. Moreover, the time during which the antibiotics have been in extensive use permits only a brief appreciation of their value. The evidence gathered during this survey suggests that the one-time common causes of death—pneumonia and other pyogenic complications—have now ceased to be important, and that a far higher proportion of patients in the future will die of unconnected diseases and of cor pulmonale secondary to extensive bronchiectasis. None of the six who died could at any period of their illness have been considered for operation, either because of the large areas involved or because of other factors. Furthermore, the disease was not observed to progress in extent or severity of symptoms, apart from those caused by diminished respiratory reserve in patients unsuitable for surgery.

The treatment of bronchiectasis is overshadowed by the pessimism shared by most physicians regarding medical measures. Alexander (1944), a surgeon, is one of the few who have drawn attention to the considerable benefits of non-surgical treatment, and to the fact that half the cases are unsuitable for surgery because of the widespread nature of their disease. This pessimism is due to a number of considerations, the most valid of which is the irreversibility of the underlying lesion. Of great importance, however, has been the almost universal belief in a bad prognosis—the opinion that symptomless areas are likely to become infected and also that the condition is steadily progressive. Further reasons lie in the difficulty with which some patients

can be persuaded to continue the most valuable exercise of postural drainage, and in the unwarranted assumption that the patient's life is usually a burden. Most writers think that the treatment of bronchiectasis is surgical in every case in which this is feasible. This bias was apparent even before the development of the modern technique of pulmonary resection, and has been greatly strengthened by its success. The advances of chemotherapy have been judged largely on their ability to render surgery safer. Seldom has it been stressed that their influence on medical treatment has been even more pronounced. It is admitted by some that small and relatively uninfected areas of bronchiectasis may not require excision, but this is by no means generally agreed.

Surgery was advised in this series for certain definite reasons, and not for every case in which it was technically possible. Some justification of this attitude must be sustained. Operation is usually recommended because of the severity of symptoms or because the prognosis of the disease is poor. On the first count it must be noted that very few patients who came into the operable class were bothered by their symptoms; only one actively desired operation, and he had never been treated by antibiotics. As regards prognosis, the evidence of this survey points to a great change in mortality trends, although the time of observation is too short for strict confirmation. In no operable case did the patient die during this period, no extension of the disease was seen, and deterioration in the general or symptomatic condition did not take place. It is not maintained that these misfortunes will cease to occur henceforth, but it is thought that there is enough evidence to suggest that they will not be common. As against this must be placed the definite if small mortality of lobectomy, and the greater one of multiple resections and pneumonectomy. Also, the complication rate of operation cannot be overlooked, nor is improvement inevitable. It seems, therefore, that resection for the purpose of avoiding future catastrophe is difficult to vindicate.

Although the points set out above are necessarily too brief to form a conclusive argument for limiting the number of bronchiectatics that are submitted to a major operation, it is doubted whether a large percentage of the total number are more suitable for resection than for modern medical treatment, which, if adequately advised and carried out, greatly limits the disability arising from the disease. Unfortunately, the cases that are most in need of help are those least amenable to surgery, and unless all the diseased areas can be removed the patient is still liable to complications. Moreover, in attempting the eradication of such a patchy disease, considerable portions of healthy lung are often sacrificed, in spite of the development of segmental resection. The social status and co-operation of the patient or parents in treatment may well be one of the decisive factors in deciding for or against intervention.

Summary

During a survey upon a population of nearly 150,000 lasting for five years 166 patients were found with bronchiectasis confirmed by bronchograms; a further 48 had undoubted bronchiectasis, but in the absence of confirmatory bronchograms they have been ignored in the detailed analysis. By combining these figures with certain deductions it is shown that bronchiectasis was present in at least 1.3 per thousand. The distribution and type of bronchiectasis found showed no great differences from those previously reported, but the aetiological factors responsible for its development showed an unusually large number of cases due to primary tuberculosis and mustard gas. The symptoms complained of were less severe and universal than those reported in most general series, and approached those found in selected groups who had been passed as fit for military service; only five patients under the age of 60 were incapacitated from work. Attention is drawn to the fact that in only three patients were postero-anterior radiographs normal. Comparisons are drawn between cases which had been diagnosed in teaching or large hospitals and the remainder, and prove conclusively that those diagnosed in such hospitals had more extensive disease and also severer symptoms. Those patients with disease of less than lobar extent proved, on the contrary, to have fewer symptoms than the rest.

The period under observation averaged three years, during which time there were six deaths, which all occurred in bilateral cases or from complications not due to bronchiectasis. There were no deaths from pneumonia or other pyogenic complications. The condition of the rest remained little changed. The treatment given was mainly medical, but six patients were treated by resection.

Reasons are given for postulating that the prognosis of the medically treated case is not so bad as has been stated previously, and that this is largely due to the advent of chemotherapy. Arguments are also brought forward to show that it may not be justifiable to advocate surgery whenever this is possible; that a high proportion of bronchiectatics are likely to remain well and little inconvenienced by their disease if competently treated by postural drainage and antibiotics; and that the latter statement applies particularly to the operable group.

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