

Bronchiectasis: results of surgical and conservative management

A review of 393 cases

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Sanderson, J. M., Kennedy, M. C. S., Johnson, M. F., and Manley, D. C. E. (1974). *Thorax*, 29, 407–416. **Bronchiectasis: results of surgical and conservative management. A review of 393 cases.** A consecutive series of 393 cases of bronchiectasis referred to a thoracic surgical unit has been followed up for one to 15 years. About two-thirds were managed surgically and one-third conservatively. The progress of the patients is analysed and the results of treatment are evaluated. The role of associated bronchitis is considered and indications for surgery are defined. It is our opinion that the current bias towards conservative management is unjustified.

The management of bronchiectasis has been discussed in leading articles in the *Lancet* (1955, 1958a, 1958b). Surgical treatment reached its zenith soon after the second world war. Since the advent of potent chemotherapy and with the recognition that many patients with bronchiectasis have only trifling symptoms there are now more advocates for conservative measures. Controlled trials proved impracticable and enthusiastic reports of surgeons were necessarily reviewed with some scepticism. Furthermore, the incidence of the problem has now been reduced owing to the progressive decline of tuberculosis and the avoidance of pulmonary collapse during respiratory infections by more efficient treatment. Excessive zeal for complete resection of bronchiectasis was criticized on the grounds that the patient is left breathless or even a respiratory cripple. Surgery was considered to be advisable for localized disease, preferably with no evidence of bronchitis in adjacent segments, and for 'dry' bronchiectasis complicated by haemoptysis—perhaps relatively more often in children because the residual lung could still grow to fill the space left in the chest after resection. Until more information was forthcoming about the long-term results of conservative therapy it was considered impossible to define the scope of surgery.

Postural drainage and chemotherapy in the life-long management of the severe case of bronchiec-

tasis clearly have their drawbacks, difficulties, and inadequacies. If the severe case could be converted to the mild the further management should be easier and safer.

The present report is a study of 393 bronchiectatic patients first seen between 1952 and 1967. The patients came from a population of about 650,000 in north and mid Staffordshire. In another paper (Sanderson, Kennedy, Johnson, and Manley, in preparation) the anatomical and clinical features of the cases will be described and discussed.

METHODS

Selection of cases for treatment was based on the severity of the symptoms rather than on the bronchographic picture. Physiological assessment was limited to simple open spirometry before and after treatment.

Operation was usually performed after a trial period of up to two years of conservative treatment, including postural drainage, and was preceded by a short course of antibiotics chosen after bacteriological examination of the sputum and continued for a few days postoperatively.

CONSERVATIVE MANAGEMENT One hundred and fifty-one patients were treated conservatively for one or more of the following reasons: (1) mild disease, 72; (2) associated bronchitis or reduced cardio-respiratory reserve, 45; (3) widespread bronchiectasis,

37; (4) failure to return, 23; (5) refusal of surgery, 23; (6) too old, 19; (7) nasal sepsis, 8 patients. The basic features were appropriate postural drainage and chemotherapy under the supervision of the general practitioner, and physiotherapy.

SURGICAL MANAGEMENT

Criteria of operability These were as described by Lindsog and Hubbell (1955); (1) symptoms of a degree sufficient to cause discomfort, inconvenience or complications; (2) the existence of bronchiectatic changes proved adequately and localized by bronchography; (3) an adequate cardiorespiratory reserve; and (4) no concurrent disease of a magnitude to contra-indicate major surgery. The general aim of removal of all diseased segments was influential in the first years of the study but it became clear that many patients were either unsuitable for this treatment owing to dysnoea following major resection or that they improved so much after a limited resection that they did not appear to require further operation.

The following symptoms or findings alone or in combination were the indications for surgery in 242 patients: (1) chronic pulmonary sepsis, 211; (2) haemoptysis, 71; (3) recurrent pneumonia, 48; (4) persisting foul sputum, 38; (5) suspected carcinoma, 18; (6) other reasons, 16 patients.

Distribution of disease and extent of resection Of the 220 patients with unilateral disease, complete resection was carried out in 57%, incomplete resection in 4%, and conservative treatment in 38%. In the 161 patients with bilateral disease complete resection was performed in 5%, incomplete resection in 57%, and conservative treatment in 37%. One patient had a simultaneous bilateral operation. The segments removed at the first and second operations are shown in Tables I and II. Twelve patients did not have bronchograms.

TABLE I
SEGMENTS REMOVED: LEFT LUNG

Segment										No. of Patients	
1	2	3	4	5	6	7	8	9	10		
<i>First operation</i>											
			*	*		*	*	*	*		50
			*	*	*	*	*	*	*	*	27
					*	*	*	*	*	*	16
*	*	*	*	*	*	*	*	*	*	*	14
					*	*	*	*	*	*	11
				*	*	*	*	*	*	*	6
				*	*	*	*	*	*	*	4
Other combinations (each occurring less than four times)										18	
										146	
<i>Second operation</i>											
			*	*		*	*	*	*		6
			*	*	*	*	*	*	*		2
Other combinations (each occurring once only)										6	
										16	

Enumeration of segments according to Boyden (1955).

TABLE II
SEGMENTS REMOVED: RIGHT LUNG

Segment										No. of Patients	
1	2	3	4	5	6	7	8	9	10		
<i>First operation</i>											
			*	*							19
	*	*	*	*	*	*	*	*	*	*	12
			*	*	*	*	*	*	*	*	11
				*	*	*	*	*	*	*	10
				*	*	*	*	*	*	*	9
				*	*	*	*	*	*	*	5
	*	*	*	*	*	*	*	*	*	*	5
*	*	*	*	*	*	*	*	*	*	*	4
Other combinations (each occurring less than four times)										20	
										95	
<i>Second operation</i>											
			*	*			*	*	*	*	3
			*	*			*	*	*	*	2
Other combinations (each occurring once only)										8	
										15	

Enumeration of patients according to Boyden (1955).

QUALITY AND DURATION OF FOLLOW-UP This ranged between one and 15 years. Of the 393 patients, 43 (11%) could not be traced at final follow-up. In 12% the follow-up consisted of a report from a health visitor, an answer to a questionnaire or a brief personal communication. Twenty-eight patients (7%) are known to have died. Approximately 60% of the patients were interviewed and examined by one of us (M.J.) at final follow-up and 9% were seen and discharged from follow-up by the surgeon.

Roughly two-thirds of the patients were followed up more than seven years from the date of first attendance. Of those who could not be traced, half were lost to follow-up within three years. The follow-up by health visitor, questionnaire or personal communication was about evenly distributed year by year throughout the follow-up period. The follow-up to discharge by the surgeon was usually two to three years.

RESULTS

Clinical assessment at one year, at final follow-up, and at more than 10 years is shown (Table III).

Smoking habits The smoking habits of adults at final follow-up were examined. Sixty-four per cent claimed to be non-smokers. Twelve per cent smoked more than 10 cigarettes daily and these patients were spread fairly evenly between the grades.

Assessment of work capacity This was made at the final follow-up and the annual incapacity due to chest illness was less than one week in 70%, between one and 12 weeks in 22%, and more than 12 weeks in 8%. The majority of the latter had severe or almost complete incapacity.

TABLE III

	Grade		
	At End of 1st year	At Final Follow-up (2-15 yr)	At > 10 yr
Excellent	77	84	33
Good	87	74	29
Fair	133	84	38
Poor	67	66	28
Worse	—	14	8
Dead	12	28	28
Lost	17	43	43
Total	393	393	207

For key to grading see footnote to Table VI.

Final grading in relation to age This is shown in Table IV. The proportion of younger patients with an excellent, good or fair final grading is considerably greater than occurs in older patients. In fact there is a progressive deterioration in the final grading with advancing age.

RESULTS OF SURGICAL AND CONSERVATIVE MANAGEMENT ACCORDING TO CLINICAL SEVERITY

There was no association between result and clinical severity in the surgical cases but an association was found in the cases managed conservatively (Table V).

TABLE V

RESULTS OF SURGICAL AND CONSERVATIVE MANAGEMENT ACCORDING TO INITIAL CLINICAL SEVERITY

	Excellent or Good	Fair	Poor or Worse	Totals
<i>Surgical group</i>				
Severe	61%	23%	15%	170
Mild	67%	28%	5%	46

$\chi^2=2.71$; not significant ($P > 0.05$).

	Excellent or Good	Fair	Poor or Worse	Totals
<i>Conservative group</i>				
Severe	15%	28%	57%	80
Mild	50%	37%	13%	24

$\chi^2=18.35$; significant ($P < 0.05$).

MORTALITY The overall mortality of the complete series was 7.1% and the mortality attributable to bronchiectasis was 4.6%. If those patients lost to final follow-up are excluded, the respective figures would be 8% and 5.3%.

There were eight deaths (3%) among the 242 surgical cases. Of these, one death occurred on the operating table and seven occurred later. Of the latter, four were attributable to bronchiectasis and three to other causes. There were 20 deaths (13%) among the 151 conservatively treated cases, of which 13 were attributed to bronchiectasis and seven to other causes.

Details of the 18 cases in whom death was attributed to bronchiectasis are shown in Table VI. The causes of death in the other 10 were coronary thrombosis, 5; subacute bacterial endocarditis, 1; rheumatic endocarditis, 1; accidental poisoning, 1; carcinoma of stomach, 1.

COMPLICATIONS OF SURGERY Of the 242 patients treated surgically (272 operations), there were 81 early complications. In 64 of these the complication was mild, consisting of transient air leak (longer than one week) with or without associated partial lung collapse and, in seven cases, diffuse bronchitis. Serious complications comprised seven bronchopleural fistulae that were associated with empyema in five cases, and six cases of empyema without fistula. The case incidence of fistula was thus 3% and of fistula and/or empyema 5%.

RESULTS AFTER FISTULA AND EMPYEMA Information was available on 12 of the 13 cases. At final follow-up one was classed as excellent, four good, one fair, four poor, and two had died. Both deaths were from respiratory disease.

PRESERVATION OF APICAL SEGMENT OF LOWER LOBE This segment, when apparently normal bronchographically, was spared after basal segmental resection on the left side on 76 occasions, and

TABLE IV

COMBINED CONSERVATIVE AND SURGICAL CASES: RESULTS ACCORDING TO AGE

	0-14 yr	15-29 yr	30-44 yr	45-59 yr	60+ yr
Total no. of cases	88	144	90	67	4
Final grading (%)					
Excellent, good or fair	83	62	56	40	25
Poor or worse	13	18	20	34	75
Dead	1	4	9	20	—
Lost to follow-up	3	16	15	6	—

TABLE VI
DEATHS—BRONCHIECTASIS MAIN FACTOR

Case	Age (yr)		Survival from First Attendance (yr)	Duration of Symptoms: Onset—Death (yr)	Condition at First Attendance			
	At First Attendance	At Death			Extent of Disease			
					Sputum	Dyspnoea	Lobes*	Segments
<i>Following conservative treatment</i>								
1	43	53	10	20+	3	3	5	13
2	39	44	5	20+	3	2	4	14
3	46	47	1	20+	3	3	4	9
4	10	11	1	7	3	0	3	10
5	39	41	2	10+	0	3	No Bgm	No Bgm
6	47	56	9	20+	2	3	2	6
7	32	36	4	20+	0	1	2	5
8	58	66	8	10	3	2	2	3
9	50	55	5	20+	3	2	No Bgm	No Bgm
10	53	61	8	20+	2	3	4	7
11	45	50	5	40+	3	1	4	11
12	39	44	5	30+	3	2	3	10
13	36	42	6	10+	3	4	2	3
<i>Following surgical treatment</i>								
14	27	32	5	30+	3	4	5	15
15	27	35	8	30+	3	0	4	14
16	18	26	8	20+	3	1	5	16
17	46	48	2	3	3	2	1	5
<i>Operative</i>								
18	46	46	0	40+	3	3	5	13

Sputum

1=trace—teaspoonful (2.5 ml)
2=tablespoon—eggcupful (15–60 ml)
3=half cupful or more (80 ml)

Dyspnoea

1=Unusual exertion
2=On hills
3=On stairs
4=On level

*Lingula regarded as one lobe

Bgm=bronchogram

apical segmental resection was required subsequently in only two of these patients. On the right side the apical segment was spared on only 17 occasions and subsequently removed in two of these.

RESULTS OF COMPLETE AND INCOMPLETE RESECTION

These are shown in Table VII. There is clearly a preponderance of excellent results after complete resection but the cases are not comparable and the Table is included only for purposes of comparison with figures from other reported series.

MATCHED SURGICAL AND CONSERVATIVE CASES
Twenty-three patients refused operation but only

12 of these had adequate follow-up at one year and eight at final follow-up. These cases were matched by age, sex, and extent and severity of disease with surgically treated cases and their gradings at one year and final follow-up are shown in Table VIII.

It appears that the overall condition at follow-up was fair in the conservatively managed group and good in the surgical group.

SIGNIFICANCE OF HAEMOPTYSIS AS SOLE SYMPTOM

Of the 24 patients whose only symptom was one or more large haemoptyses, one died while on the waiting list for surgery. The remaining 23 had resections. The final follow-up grades were: excellent, 11 cases; good, 8; fair, 1; and poor, 3.

TABLE VI (cont.)

Condition at First Attendance			Reasons for Conservative Treatment or No. of Segments Removed	Condition at 1 yr Follow-up	Cause of Death		
Extent of Disease		Bronchographic Evidence of Bronchitis (B) & Emphysema (E)					
Bil./Uni.	Degree of Bronchial Dilatation						
Bil.	Mixed	B & E	Extensive disease; bronchitis & emphysema Extensive disease; low FEV Died while on waiting list for operation Age (child)	7	Presumed bronchiectasis cardiorespiratory Cor pulmonale Haemoptysis while on waiting list Presumed bronchiectasis /pneumonia; mentally retarded Cor pulmonale Presumed cardiorespiratory Cor pulmonale (asthma from infancy)		
Bil.	Gross	—		7			
Bil.	Mixed	—		6			
Bil.	Mod	—		6			
No Bgm Uni.	Gross Slight	—	Extensive disease; low FEV Bronchitis & emphysema; age Asthma, bronchitis & emphysema; low FEV Refused operation; age Bronchitis & emphysema; low FEV; age Bronchitis & emphysema; age Extensive disease; advanced disease Refused operation Bronchitis & emphysema; dyspnoea + +	5	Cardiorespiratory + ? haemoptysis ? Cor pulmonale; 'miner's chest' Cardiorespiratory Cardiorespiratory Cardiorespiratory + repeated haemoptysis		
Uni.	Slight	B & E		7			
Uni.	Gross	—		4			
No Bgm	Gross	E		4			
Bil.	Mixed	B & E		4			
Bil.	Gross	—		4			
Uni.	Gross	—		3			
Bil.	Gross	B & E		4			
				Excised			
				Lobes		Segs.	Bil./Uni.
Bil.	Mixed	B	2	7	Uni.		
Bil.	Gross	—	2	7	Uni.		
Bil.	Gross	—	2	6	Uni.		
Uni.	Gross	B & E	2	7	Uni.		
Bil.	Mixed	B	0	0	—		

Condition at follow-up

1=Excellent—no symptoms at all
 2=Good—full physical capacity, occasional cough and sputum
 3=Fair—improved; tendency to cough and sputum + susceptibility to respiratory infection, haemoptysis or dyspnoea

4=Poor or ISQ—residual symptoms
 5=Worse—steady deterioration
 6=Dead
 7=Lost to final follow-up

INCIDENCE OF BRONCHITIS AND COMPLETE RESECTION Cough and sputum in bronchiectasis may be due to the lesion itself or to associated chronic bronchitis. If the bronchiectatic segments have been completely removed and cough and sputum persist the cause is likely to be chronic bronchitis. Other causes may be the presence of unsuspected bronchiectasis which was not removed at operation or the development of new, infected bronchiectasis after operation. These conditions would probably be present in only a small proportion of cases (Helm and Thompson, 1958). An important factor is, of course, the smoking habits before and after operation. In the present study cough and sputum persisted in 12% of the patients who had complete resection and were adequately followed up. Twenty per cent of both bronchitics and non-

bronchitics admitted smoking at the time of follow-up but there was no obvious difference in the dyspnoea grade between smokers and non-smokers.

Besides cough and sputum another clue to the possible presence of bronchitis is the appearance of small sacculations from the proximal bronchi in the bronchograms or seen at bronchoscopy. Simon and Galbraith (1953) found these in 50% of chronic bronchitics and used them as part of the evidence for the presence of the disease. Borrie and Lichter (1965) stated that they usually began to appear in bronchiectasis in the late teens. Localized sacculations in the proximal bronchi were noted in the bronchograms of 13 patients who had complete resections. Cough and sputum were lost after operation in all these cases. Nasal

TABLE VII
RESULTS OF COMPLETE AND INCOMPLETE RESECTION (PER CENT)

Follow-up	Resection	Excellent	Good	Fair	Poor	Worse	Dead	Lost or Inadequate Follow-up	Total No. Patients Reviewed
One year	Complete	33	24	17	3	—	—	23	103
	Incomplete	9	27	33	7	—	1	23	76
$\chi^2 = 20.8 \text{ P} < 0.005$									
Final	Complete	36	16	15	8	—	2	23	103
	Incomplete	10	26	25	10	1	1	27	79
$\chi^2 = 21.9 \text{ P} < 0.005$									

TABLE VIII

ASSESSMENT OF MATCHED SURGICALLY AND CONSERVATIVELY TREATED PATIENTS AT ONE YEAR AND AT FINAL FOLLOW-UP

		Grading of 12 Cases											Total	Mean	
		A	B	1	2	3	4	3	2	3	4	3			2
1st year result	A	4	3	4	3	4	3	3	4	4	3	4	3	42	3.5
	B	1	2	1	3	4	2	3	2	1	4	2	2	27	2.25
Final result	A	—	3	—	—	—	3	1	3	4	4	3	3	24	3.0
	B	—	2	(1)	(2)	(4)	2	1	4	1	1	2	2	15	1.9

Gradings: A = conservatively treated patients

B = surgically treated patients

1 = excellent; 2 = good; 3 = fair; 4 = poor; — = no final follow-up data.

For key to grading see footnote to Table VI.

sepsis was noted in 53% of the bronchitics and in 25% of the non-bronchitics.

DISCUSSION

A disadvantage of a retrospective survey over many years is the change in treatment which may occur. In this series, surgical policy in the first few years was biased towards complete resection but then changed to partial resection and reassessment of the patient after one operation. Partial resection became more frequent, particularly in dyspnoeic or bilateral cases. The apparent benefit of complete as compared with partial resection (Table VIII) is misleading and probably relates to the high proportion of disabled patients with extensive disease who had partial resections.

INFLUENCE OF SURGICAL COMPLICATIONS The most serious complications of surgery are broncho-pleural fistula and empyema. In this series, as in others (Meade, Kay, and Hughes, 1947; Ochsner, DeBakey, and DeCamp, 1949; Lindskog and Hubbell, 1955; Helm and Thompson, 1958), the results after such complications were not good but, as the incidence was low, the overall result was not greatly affected.

BRONCHITIS AND BRONCHIECTASIS The possible role of bronchiectasis as an initiating factor of

chronic bronchitis and the effect of pulmonary resection in chronic bronchitis associated with bronchiectasis are of great importance. The diagnosis of bronchitis in the presence of bronchiectasis is not possible because cough and sputum are the only criteria of the former by definition yet they are also very common in bronchiectasis. Some idea of the incidence may be obtained from the persistence of cough and sputum after complete resection and perhaps from the incidence of sacculations in bronchograms (Simon and Galbraith, 1953). Kamener, Becklake, Goldman, and McGregor (1958) showed that judicious surgery can be followed by a gradual improvement in lung function if the remaining lung is normal. Helm and Thompson (1958), using diffuse post-tussive wheeze as a sign of bronchitis, found generalized bronchitis to be associated with bronchiectasis in 20% of 159 patients. Symptomatic deterioration and the development of new or increased bronchiectasis occurred more frequently in this group than in patients without bronchitis.

We found that chronic bronchitis was present after complete resection in as many as 12% of patients. It was interesting to note that sacculations in the bronchograms prior to complete resection did not prevent an excellent clinical result after operation, suggesting that this appearance does not always indicate the presence of widespread or irreversible bronchitis. Our evidence is

inconclusive but if resection does have an effect in prevention or amelioration of chronic bronchitis it would need to be performed early in the course of the disease.

MORTALITY DATA The mortality and morbidity of bronchiectasis have been affected by advances in diagnosis and treatment (Table IX).

CONSERVATIVE TREATMENT Early series prior to 1941 gave mortality rates of between 21% and 49% over a 10-year period. During the next 10 years there was a progressive reduction in mortality among conservatively treated patients. In Wynn-Williams's (1957) report, covering the period 1947-57, the overall mortality was 10% and that attributable to bronchiectasis was 6%. His cases, however, were clinic cases and he thought they were likely to be less severe than hospital referral cases. In our own series, covering the years 1952-67, the overall mortality was 13% and that attributable to bronchiectasis was 9%.

Deaths from bronchiectasis vary according to the severity of the disease, and Martin and Berridge (1942), Evans and Galinsky (1944), and Fine and Steinhausen (1946) reported the finding of bronchiectasis in service personnel, most of whom were in the highest medical categories and had remained in good health. McKim (1952) found that among medically treated ambulant patients attending a chest clinic the overall mortality was 16% and that attributable to bronchiectasis was 10%. In 1940 Perry and King showed that most deaths occurred in the 21-30 age group, whereas in our own series most of the deaths occurred in and after the fifth decade.

SURGICAL TREATMENT In 1940 Perry and King estimated the operative mortality for lobectomy in bronchiectasis to be roughly 10%. During the past 20 years the operative mortality has declined from 3% to less than 1%.

Since 1955 the data on five major studies of surgically treated patients can be compared (Table IX). It can be seen that the operative and later deaths from bronchiectasis (that is, excluding deaths from other causes) in this series of reports has steadily fallen and in our series was only 2% over a 2-14-year period. Of the late deaths among surgically treated patients we find roughly half resulted from bronchiectasis and half from other causes. In fact the results of surgically treated cases are now very good indeed.

Although the various series of cases of bronchiectasis treated surgically and conservatively are not strictly comparable, there seems to have been a progressive decline in mortality in the surgical groups which is greater than the decline in the conservative groups.

We have some evidence from this series that surgery used in the way described is preferable overall to conservative treatment. First, the surgical cases in the small matched series show a better final follow-up result than the conservative cases (Table VIII). Secondly, there was an association between the result and the initial severity of the disease, as defined by us, in the conservative group (Table V) but not in the surgical group. A severe case did not necessarily do badly in the surgical group. The deterioration of even mild cases treated conservatively was quite striking. Thirdly, the overall mortality in this series of cases from bronchiectasis that was treated mainly surgically is low compared with that of comparable series treated conservatively (Table IX). Nevertheless all these points can be criticized. A patient who refuses operation is to some extent unco-operative and may neglect alternative conservative measures. The conservatively managed group is not matched with the surgical group and the criteria of severity are arbitrary. Also the quality of conservative measures was not under strict control. Lastly, it is not possible to compare accurately the severity and results of this series with others.

INDICATIONS FOR SURGERY AND TYPE OF OPERATION The decision whether to advise operation is not urgent (Lander, 1950) and depends on many factors in the individual patient but surgery should be considered in most cases. We agree with Wynn-Williams (1957) that the response to a trial of thorough conservative management, including appropriate postural drainage and chemotherapy, good working conditions, and no smoking, is important. The condition should then be assessed on grounds of response to treatment, clinical severity, distribution of disease and degree of bronchial dilatation, and associated shrinkage or atelectasis of segments, age, associated bronchitis, ventilatory reserve, whether the patient is likely to be a lifelong co-operator in a conservative regimen, and, if so, whether facilities are adequate for such a regimen.

In addition to the orthodox indications listed in the introduction, we would add the principle of trying to convert the severe to the mild cases by partial resection in poor-risk patients and the mild

T A B L E I X

Author (Date)	Place	Years Diagnosed	No. of Patients and Treatment	Op.	Deaths			Total		Follow-up (yr)
					Bronchiectasis*	Other Causes	No.	%		
Roles and Todd (1933)	Brompton Hospital, London, UK	1928-33	56 Surgical	?	?	?	18	32	3-6	
Bradshaw <i>et al.</i> (1941)	Philadelphia, USA	1925-35	45 Conservative	-	59	24%	22	49	3-15	
Perry and King (1940)	Massachusetts, USA	1926-38	140 Surgical	?	?	?	16	11	1-12	
McKim (1952)	New York, USA	1930-50	260 Conservative	-	5	10%	66	25	9-20	
Chesterman (1951)	Sheffield, UK	1945-49	49 Conservative	2	4	6%	8	16	1-4	
Lindskog and Hubbell (1955)	Yale, USA	1937-52	106 Surgical	4	-	-	4	3	1-15	
Ginsberg <i>et al.</i> (1955)	Mayo Clinic, Minnesota, USA	1942-53	138 Surgical	6	12	16%	15	20	1-11	
Helm and Thompson (1958)	The London Hospital, UK	1939-52	77 Conservative	3	3	4%	9	4	5-18	
Wynn-Williams (1957)	Bedford, UK	1947-57	221 Surgical	3	5	5%	9	6	2-10	
Crutcher and Pellegrino (1960)	Kentucky, USA	1950-59	159 Surgical	0	-	-	-	Nil	2-10	
Borrie and Lichter (1965)	New Zealand	1952-62	15 Surgical	1	12	6%	21	10	2-10	
Sealey <i>et al.</i> (1966)	North Carolina, USA	1954-63	80 Surgical	1	2	4%	6	7	1-9	
Swierenga <i>et al.</i> (1969)	Dunedin, New Zealand	1952-62	125 Surgical	1	5	5%	10	8	1-10	
Sanderson <i>et al.</i>	Utrecht, The Netherlands	1953-67	140 Surgical	1	1	1%	2	1	?	
	Stoke-on-Trent, UK		750 Surgical	1.5%	?	?	?	?	?	
			300 Conservative	-	4	2%	23	8	Av. 7	
			242 Surgical	-	1	9%	8	3	1-15	
			151 Conservative	-	13	9%	20	13		

*Percentage mortality of combined operative and late deaths.

to symptomless cases by complete resection in good-risk patients. Foul sputum can usually be eliminated by resection of bronchiectatic, shrunken or atelectatic segments. The risk of spread of bronchiectasis is a factor in all age groups with or without operation but there may be a relatively safe period between puberty and the late teens (Helm and Thompson, 1958; Field, 1961; Clark, 1963; Borrie and Lichter, 1965). Spread is more likely to affect bronchitic patients and segments adjacent to bronchiectatic segments (Helm and Thompson, 1958). There may be a case in some children for postponing operation until after puberty. It is also clear that caution should be exercised in advocating surgery for patients in whom bronchitis is suspected. The results of surgery appear to be not so good in older patients and it is probable that partial resection is advisable in such patients as this carries less risk of reducing the respiratory reserve to a crippling degree. In bilateral disease, we have practised operating on the worse side first and been satisfied with unilateral resection in many cases. When the apical segment of the lower lobe is bronchographically normal, we have followed the recommendations of Collis (1953), Hoffman (1955), and Borrie and Lichter (1965) rather than those of Kergin (1950) and tended to preserve this segment. An exception is the right lower lobe apical segment when the middle lobe and basal segments are to be excised. We consider that the general policy of preservation of the apical segment is justified.

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