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SURGICAL TREATMENT OF BRONCHIAL CARCINOMA

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Less than a generation ago primary cancer of the lung was thought to be a rare curiosity; to-day it is recognized as a common condition, and ranks next to cancer of the colon in frequency in men. I see an average of some 75 new cases each year. In spite of this high incidence the diagnosis is often overlooked for many months—frequently until death is imminent. The problem of diagnosis is a large one, and cannot be dealt with fully here, but certain aspects that impress one as important demand comment.

First and foremost we must, as a profession, become more "carcinoma-minded" in regard to the lungs. We are carcinoma-minded in regard to the breast, and so is the general public. We are less so in the case of the abdominal viscera, but far more so than in the case of the lungs. Malignant disease of an abdominal organ should be thought of whenever there is any disturbance of function or even awareness of the presence of any particular viscus. This, and no more, should give rise to suspicion, and calls for investigations that will lead to early identification of malignant disease or to its reasonable exclusion. The same is true of the lungs. The first signs or symptoms of bronchial carcinoma consist of *any change from normality*, and the commonest of these is cough. This is usually dry and unproductive, and is often dismissed as "smoker's cough," "bronchial catarrh," or some such vague condition. When an alarming symptom such as haemoptysis compels attention the story may be obtained of this premonitory cough extending back over many months but treated symptomatically or not at all.

By far the most important group of symptoms arises from the infection that sooner or later follows upon bronchial obstruction; this may affect the whole lung, a lobe, or only a segment of a lobe. It often begins as an apparently straightforward attack of pneumonia or "influenza," but significantly resolves incompletely or not at all. "Delayed resolution," "unresolved pneumonia," recurrent or smouldering sepsis in part of a lung, particularly in a patient of middle age, should always give rise to a strong suspicion of malignant disease. The attack of pneumonia that ushers in the illness of a bronchial carcinoma may be followed by an empyema which is drained in the ordinary way. Since the empyema is due to infection in the obstructed bronchial tree, which is now able to drain only peripherally, healing does not occur, and a chronic empyema follows; further operations may be performed in an attempt to secure healing. I find that every year I see some half-dozen cases of empyema of this type in which the real diagnosis has been quite unsuspected.

General deterioration of health, loss of weight, and loss of strength should not be regarded as signs of carcinoma of the lung if the patient is to be successfully treated. They are

usually the signs of approaching death, and so far as operability is concerned their presence almost always means that the case is unsuitable. If at the first glance the patient is seen to be ill, wasted, toxic, or distressed, then it is my experience that little can be done. Surprise is often expressed that a diagnosis of carcinoma of the lung has been made when the patient looks so well; only too often the fell possibility has been overlooked because of this apparent well-being. If we are to diagnose this grave and fatal condition in a reasonably curable phase it *must* be remembered that the slightest departure from normality in the lungs and bronchi is suspicious and needs pursuing. It is true that the operability of carcinoma of the lung is low—rather less than 10%—and a case missed until the condition is too far advanced to treat may be of little moment in a series of figures. That one missed case may, however, cover a considerable personal or family tragedy which, with good fortune and medical alertness, might have been avoided.

Once the presence of a growth of the lung is suspected careful clinical examination must follow, but reliance upon this alone is apt to lead astray. Physical signs may be absent or equivocal, and our first dependence must be on good radiographs of the chest, lateral as well as postero-anterior. Any suspicious shadow revealed will demand further investigation by bronchoscopy, especially when the diagnosis of "unresolved pneumonia" has been suggested. Bronchoscopy should precede a bronchogram, which is then often found to be unnecessary if the growth can actually be seen and a piece removed for biopsy.

Treatment

In the present state of our knowledge the only way to achieve cure of a bronchial carcinoma is by operation. Deep x rays are of value, and may produce striking temporary recession of the growth and relief of distressing symptoms. On the whole the results are disappointing and life is but rarely prolonged, which is not surprising in view of the advanced state of the disease and the associated sepsis that is so often present when the patient is sent for treatment; in many cases death is actually hastened. Local treatment by radium or radon is also disappointing and certainly never curative. It may cause striking improvement by recanalizing the obstructed bronchus and allowing infected material to drain (Brock and Cann, 1938), but just as often it is followed by a rapidly progressive increase in the infection, leading to fatal pneumonia or massive haemoptysis.

Surgery alone holds out the hope of permanent cure to the sufferer from bronchial carcinoma, and the correct operation is removal of the whole lung by dissection of the main vessels and bronchus and of the adjacent mediastinal lymphatic glands. This procedure is in accordance with the sound surgical principles followed in the treatment of malignant disease of other organs, such as the breast and colon. Treatment by lobectomy is

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but rarely possible technically owing to the nearness of most growths to the hilum, and is undesirable on general grounds as the removal is necessarily incomplete. In practice the recurrence rate after lobectomy is unduly high—much higher than after pneumonectomy. It is an operation that may be indicated at times in an elderly patient with a peripherally situated growth for whom pneumonectomy would seem to be too great a risk.

Lest it be thought that dissection pneumonectomy is a drastic operation to propose it should be remembered that bronchial carcinoma itself is no gentle process, but is a severe and drastic disease. The operation is actually very well borne by the patient and is fully justified by the results. It was first performed successfully by Graham in 1933, the patient being a physician who was still alive and engaged in active practice up to one year ago and, so far as I know, still is.

Although many reports of series of cases, both large and small, have been published from America, no large series has to the best of my knowledge yet been published from this country. A few cases have been recorded in English journals (e.g., Allison and Stanbury, 1938), but it is high time that a more comprehensive report of experiences with the operation appeared for critical assessment. One of the objects of this paper is to present such a series.

One finds that those seeking information about pneumonectomy for bronchial carcinoma usually want to know four things: (1) How often can the operation be performed? (2) What is the mortality? (3) How long may the patient be expected to survive? (4) How much can he do afterwards? I propose to present my own series of cases and experiences so as to answer these four questions.

1. Operability

The operability appears to vary with different surgeons, but this is probably due largely to the type of patient being seen. For instance, the operability rate is rather higher in patients of better class than in the middle-aged or elderly poor. Moreover, a surgeon who receives his cases principally from a physician will have a higher operability rate than one who sees a larger number of cases first-hand, for the preliminary examination by the physician will lead to many being rejected at once. The operability rate of the surgeon who sees all types of patients will be much lower, much gloomier, but will be more accurate for the disease as a whole.

In 1938 I published an analysis of 106 consecutive cases seen over a period of 15 months, and in only 13 of these was exploratory thoracotomy considered worth doing, the remainder being unsuitable on account of age, poor general condition, or the extent of the growth. Of these 13, four refused operation, and of the remaining 9 who consented five were inoperable; in only four could the growth be removed.

I have kept records of another series of consecutive cases seen during the last 2½ years (since Jan., 1941), and the figures are as follows:

Total number of cases seen	187
Thoracotomy advised	37
refused	4
accepted	33 (18%)
Operable by pneumonectomy 14	15 (8%)
lobectomy 1	
Died from operation	2
Inoperable at thoracotomy	18
Total inoperable	172 (92%)

It will be seen that the incidence of operable cases is but little higher than in the earlier series, and is still only 8%. These figures may be compared with those published by Overholt (1940) of Boston, whose findings were as follows:

Total cases	104
Thoracotomy advised	52 (50%)
Pneumonectomy 17	21 (20%)
Lobectomy 4	
Died	7
Total inoperable	83 (80%)

This series represents Overholt's experience over a period of six years, and at first sight it would seem that he has shown the condition to be much more favourable than appears from my own series. I think the explanation lies in the fact that many of his cases were selected before being referred for consideration of operation. This is supported by the fact that

over a period of nine years I have performed exploratory thoracotomy on 65 cases, of which 29, or rather less than half, were found to be operable. This agrees closely with Overholt's findings at operation, and suggests that the apparent discrepancy lies in the grand total of all cases seen by him being relatively rather small. Whereas he has seen 104 cases over a period of six years, I estimate that I have seen a total of some 450 cases over a period of nine years.

The conclusion, therefore, is that, taking cases of bronchial carcinoma as a whole, rather less than 20% are considered to be favourable enough to justify exploratory thoracotomy, and in rather less than half of these will the growth be found operable. The actual operability rate is at present approximately 8%. It is hoped that this figure will be improved upon with earlier diagnosis, but the condition even then would still remain one of the utmost gravity.

2. Mortality

Since the number of cases found operable in this series is relatively small it is clear that no hard-and-fast conclusions can be drawn; it is only possible to present the figures as they now stand and to draw what conclusions one can. The small number of cases is also rather disproportionately and adversely affected by the higher mortality that necessarily occurred in the early days, when the operation was less well understood. Thus I was unfortunate in losing, for one reason or another, my first four pneumonectomies—a bad start which has needed much making up. The present position is:

Total cases found operable	29 (3 lobectomy)
Died from operation	8
Died from recurrence	7
Alive and well	14

The operative mortality of 29% given by these figures is undoubtedly exaggerated. As already mentioned, four of the deaths occurred in the first four patients submitted to pneumonectomy, at least two of which would have been avoided to-day. Again, of the 8 deaths four were in patients over 60. I have had only one patient over 60 survive; he was a man of 63 who underwent lobectomy and not pneumonectomy, and is still alive and working 2½ years after. Out of 70 successful cases collected from the literature by Overholt (1940) only 6 were in patients over 60 years of age. It would thus appear that the operation carries a much higher mortality in these older patients.

The four deaths from operation since the first four consecutive deaths occurred in patients aged 64, 65, 64, and 46; the last of these had a large growth and was a poor risk; he died three weeks after operation from an abscess in the remaining lung. With the exception of this man all the patients under 60 since the first four fatal cases have survived operation. The mortality should also be considered in connexion with a series of 14 cases in which I have performed pneumonectomy 10 times and lobectomy 4 times for the condition of so-called bronchial adenoma, with only two deaths. Although the tumour in these cases was not frankly malignant these patients are usually just as bad operative risks as those with frank carcinoma.

One is therefore justified in postulating that pneumonectomy performed properly for carcinoma in a patient under the age of 60 should not carry a high operative risk—certainly not much more than 10%.

3. Recurrence Rate

It is next necessary to consider the prospect of freedom from recurrence that awaits those patients who survive the operation for removal of their growth. Here again the smallness of the numbers introduces an element of error, which is also aggravated by the relatively short time that has elapsed since operation in many of the survivors. In any case, the problem is a complex one and dependent in great part on the type of growth with which one is dealing. For instance, a young patient with an anaplastic carcinoma has a poor expectation of life, however early the growth is removed. A patient in the fifties with a small well-differentiated squamous-celled growth can reasonably expect long survival or even cure. Graham's first successful case, it should be remembered, has certainly enjoyed at least nine years of freedom from recurrence, and this patient is probably still alive, more than ten

years after. There are as yet only a few records in the literature of cases followed up for as long as five years, but enough exist to show that for shorter periods the prognosis compares favourably with that of the surgery of cancer of most other organs. It should be remembered that, although occasional untreated patients may live for as long as one or two years, the average expectation of life is generally accepted as being about six months.

The results in my own 21 survivors of operation are as follows:

Patients still alive and well after operation (14):	
After 4½ years	1
.. 3	2
.. 2½	1
.. 2	3
.. 1½	2
.. 1 year or less	5
Deaths from recurrence (7):	
Lived 2½ years	1
.. 1½	1
.. 1 year	1
.. 9 months	2
.. 2	2

The two patients who died from recurrence two months after operation had soft, rapidly growing, poorly differentiated tumours. There is little doubt that if this type can definitely be recognized without operation it should be submitted to deep x-ray therapy in preference to pneumonectomy.

4. How Much can the Patient do After Successful Pneumonectomy?

Providing the patient has survived operation and is free from recurrence, what disability is he to expect from his pneumonectomy? The answer is that disability is negligible or absent in almost all cases. A small proportion may be left with a discharging sinus, but with modern methods this should not happen often. Of my own 21 patients who survived operation sound healing occurred in all but one, which is a recent case still undergoing treatment. Only one patient needed a thoracoplasty; the rest healed by primary intention or after a short period of drainage, and with *no deformity*. Every one of the survivors has been able to return to his former occupation or to one of a similar type. These occupations include hard manual work for long hours. For instance, one patient is able to work a 14-hour shift and does heavy digging in his garden and on his allotment; another is a motor mechanic; a third a butcher working a full day and lifting heavy loads; yet another is a London taxi-driver. It is impossible, when watching these patients working or walking about, to detect any disability or abnormality. Although a few may complain of some dyspnoea on hurrying or climbing stairs for the first few months after operation, this soon passes off, and all ordinary things can be done with no sign of distress at all. One patient recently drove himself 550 miles in two days without fatigue.

Even in those patients who succumb to recurrence the operation is usually well worth while, since by the removal of the obstructed and infected lobe or lung they lose their toxæmia, fever, and sputum, and are able to carry on normally almost until the end.

Conclusion

Although bronchial carcinoma remains a terrible and fatal disease in by far the greater proportion of cases, the outlook has been improved in that, whereas a few years ago the diagnosis was synonymous with a death warrant, to-day rather less than one patient in ten has a good chance of survival if submitted to early radical operation. Of those who survive operation a number will be cured, a number will have their life prolonged, and all can expect to continue to earn their living in comfort and without disability. Surgery can be said to have justified itself in the treatment of bronchial carcinoma.

It is therefore imperative that as a profession we should be on the alert to diagnose these cases early, so that the small proportion of favourable cases should not be robbed of the chance of cure or relief that is open to them.

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EXPLOSIVE EPIDEMIC OF SONNE DYSENTERY

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Recent investigations of outbreaks due to *B. dysenteriae* Sonne have stressed the importance of carriers and ambulant cases in the spread of disease (E.P.H.L.S., May, 1942; Hobbs and Allison, 1942). In rare instances milk has been shown to be a direct vehicle of infection, as reported by Scott (1938) and Faulds and Gavin (1942), while more frequently milk or milk dishes have been suspected, but without final proof being obtained (Graham, 1942; E.P.H.L.S., May, 1942). A search of the literature has not revealed any instance of an epidemic in which the possibility of water-borne infection was subsequently supported by laboratory evidence. For this reason the circumstances attending the onset of an outbreak in a Somerset town are recorded.

While diarrhoea of a mild and indeterminate nature has been observed in this district for some years it was not until Sept., 1941, that *B. dysenteriae* Flexner was isolated from a number of the affected individuals. This small outbreak quickly subsided and few secondary cases developed. Since that time the community has been relatively free from dysentery until the serious outbreak in July, 1942.

Onset of the Epidemic

The earliest noted case was that of a young boy whose initial symptoms of nausea and vomiting were diagnosed as acute appendicitis. Operation was followed by diarrhoea. This led to the unmasking of ten cases in children who were all day scholars or boarders at a small private school. Within a week many cases were seen, and it was evident that residents in all parts of the town were simultaneously affected. *B. dysenteriae* Sonne was isolated on desoxycholate-citrate agar (Hynes, 1942) from the stools of the first six cases examined. The epidemic involved both sexes, at all ages from 2 to 80 years.

The total number was uncertain, as the only cases for which medical aid was invoked were the children and older people. It was estimated that from July 14 to July 20, the first week of the epidemic, there were no fewer than 200 cases. Within the first month the total of cases was close on 400 out of a population of 10,000.

Clinical Notes

In the individual case the onset was heralded by sudden prostration, with headache, slight rigor, rise of temperature to 101° F., sickness and vomiting, colic, and diarrhoea. Stools were usually profuse and watery, offensive, with blood and mucus intermingled. Fever tended to subside within three to five days, but in some cases the acute phase lasted a week. Relapses were common, especially in children who clamoured successfully for more solid food soon after the acute phase was over. Post-dysenteric colitis was noted in several subjects. The administration of salines with a light fluid diet, continued for several days after the cessation of diarrhoea, was the general line of treatment. Astringent sedatives for the arrest of persistent diarrhoea and colic were required in many cases.

Distribution of Cases

Cases were distributed at random all over the town. Owing to the fact that a relatively small proportion sought medical advice it was impossible to state categorically whether any area was affected more than others. The larger proportion of notified cases resided in the upper part of the town, due probably to the fact that it was occupied by the wealthier section of the community, who were more likely to seek medical advice.

In addition to the main town, a small village derived its water supply from the same source, although the water was stored after chloramination in a reservoir used solely by the village. The volume of the water in the reservoir was such