BRITISH MEDICAL JOURNAL

LONDON SATURDAY JUNE 6 1953

FACTS AND FANCIES ABOUT CANCER OF THE LUNG*

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The startling rise in the recorded death rate from cancer of the lung and the implication of one of our favourite indulgences as chief culprit have suddenly made this a matter of public interest, which is no doubt the reason why this topic was selected for me. It is perhaps as well to remind ourselves, however, that the rise in the recorded death rate which is causing so much public concern to-day was already well established before the first world war, though it was only after it was over that the dramatic increase occurred. Even if we go back to King and Newsholme in 1893, we see that they were then maintaining that the registered increase in cancer deaths was due to improved diagnosis and better death certification. Adler in 1912, in his famous monograph, attacked the current opinion that malignant neoplasm of the lung was rare and maintained that this was a common disease which a physician might meet "any day in his practice amongst the young as well as amongst the old."

Doctors in England and Wales by 1949 were writing "cancer of the lung" on death certificates 25 times more often than they had been doing in 1912. There is no doubt to-day that the lung is one of the commonest sites in the human body for primary as well as for secondary malignant disease. The work that has been done in recent years makes it clear that some real increase in lung cancer has occurred in many parts of the world. What is not at all clear at present is the extent of that increase.

Much of the recorded rise can be accounted for. The number of persons living in England and Wales has gone up by $7\frac{1}{2}$ millions in the past 40 years, and the age distribution has so changed that 21 persons in every 100 alive to-day are over 55 years of age, while only 12 persons in every 100 were over 55 then. The number of doctors resident in this country has also increased in this period from 25,000 to 48,000, which is a change from about 1,400 persons per doctor to about 900. The recorded death rate from cancer as a whole has been increasing over the years, and although the lung has shown the most spectacular rise it has not been alone in this. Death rates from cancer of all sites taken together are steeply graded with increasing urbanization (Stocks, 1947), and they vary directly with the number of doctors per 100,000 people (Green, 1926). If you take the recorded

death rate from lung cancer per million persons living, by age and sex, and plot this on a logarithmic scale, you will see that the curve for each age group has almost the same overall slope, showing that the proportionate increase in death rates has been much the same at all ages (Stocks and MacKay, 1946). The rise has been recorded predominantly in men over 45 years of age, being most pronounced in those dying between the ages of 55 and 74, the age group which already had the largest death rate.

The sudden interest in this subject and the recent accumulation of many new facts has led to a fine display of fancy. The different fancies that people have about the same facts usually depend on their training and outlook. What the clinician so readily attributes to his diagnostic skill the research worker is apt to believe may well be due to the action of a specific carcinogen. Both need to take particular notice of the way their natural bias is apt to lead them and to remember their responsibility to an anxious and ill-informed public when they publish their views on serious problems of fatal disease.

Diagnosis

We are well aware that a revolutionary improvement has taken place in the diagnosis of lung cancer. It would be a most extraordinary thing if the rise in the recorded death rate which has accompanied this had no relation to it at all. The symptoms of bronchial carcinoma are common and non-specific. Doctors in practice inside and outside hospitals see large numbers of patients who complain of cough, many with dyspnoea, a number with haemoptysis, and not a few with pain in the chest. Many of these patients are past their first youth, but only a few have bronchial carcinomas.

In the same year that Röntgen discovered x rays, Killian used an instrument to remove a piece of bone from a bronchus, and in 1898 first wrote about his method of direct bronchoscopy. This was demonstrated in England in 1902. It was in 1917, when Chevalier Jackson first removed a tumour bronchoscopically, that the importance of this procedure as a means of diagnosis of bronchial neoplasms was recognized, but it was not until the 1930s that bronchoscopy became a common form of examination even in special chest hospitals. Bronchoscopies were performed at the Brompton Hospital in the 1920s by Sir James Dundas Grant, with the patient sitting in a special chair in the ear, nose, and throat room, but a search of the operating theatre records reveals only one bronchoscopy done there by the

*A shortened version of a B.M.A. Lecture delivered in Manchester on November 14, 1952. Much of the first part dealing with incidence, predisposing factors, and post-mortem records has been omitted, as these aspects of the subject have since been dealt with far more comprehensively, if with some differences in emphasis, by Dr. Richard Doll in his Milroy Lectures, 1953, to be published shortly.

surgeons between 1908 and 1925.⁷ In the next four years there were 29, and in 1930, 28; while the number to-day is over 800 per annum, or an average of nearly three in every full working day.

Improvement in the treatment of patients with chest infections has permitted more of them to recover from the pneumonia which may be associated with a bronchial carcinoma, and has also led to a change of thinking on the part of doctors who see patients with pneumonia who have failed to respond to treatment. The immense increase in diagnostic radiological examination of the chest has been another no less important factor in the diagnosis of bronchial tumours in the period since the 1914-18 war. The most rapid increase in registration of lung cancer deaths did not, in fact, occur until the modern facilities for diagnosis of this disease became generally available. Even to-day, however, the accuracy of the diagnosis of bronchial carcinoma in the country as a whole and the reliability of death certification from this cause must still be under grave suspicion.

In 3,280 cases of lung cancer registered from 46 centres in England and Wales during 1945 and 1946 (Stocks, 1950) only 11% had had post-mortem confirmation of the diagnosis and only 38% of the total had had any histological examination. The difficulties of diagnosis are considerable. Even with post-mortem examination mistakes can be made. We have found four cases in the past few years in which the post-mortem examination was in error, and three others in which the death certificates differed from the post-mortem findings.

In two of the first four cases, one was said to have had a primary carcinoma of the kidney and the other of the pancreas, both with widespread metastases. When we received these death certificates, in accordance with the usual practice of the joint consultation clinic for neoplastic disease of the Brompton Hospital and Royal Cancer Hospital, we sent a copy of our notes to the pathologists concerned to ask if there was any evidence that the primary might have been in a bronchus as suspected by us during life. In both these cases further examination of the slides induced the pathologist to change his diagnosis to primary bronchial carcinoma. In the second two cases a diagnosis of non-malignant disease of the bronchi was made; in one of these, further sections were cut at our request nearer to the bronchial wall and the presence of a carcinoma was confirmed; and in the other—a coroner's post-mortem examination following a street accident—the fact that the patient had a completely collapsed and contracted left upper lobe was not noticed by the pathologist and no piece was removed for examination from the tumour site (from which we had already obtained a positive section).

In the other three cases the diagnosis was made at post-mortem examination, but incorrect death certificates were signed beforehand by doctors who did not know the whole story, and these still remain as the official record at Somerset House. One was certified as dying of pulmonary tuberculosis, when, in fact, a carcinoma of the bronchus was present; another of carcinoma of the bronchus, although this diagnosis had been rejected during life and careful search at necropsy revealed only bronchiectasis in the lungs with no sign of recurrence of an old carcinoma of the rectum excised some years before; and the third of carcinoma of the bronchus, although multiple metastases from a primary carcinoma of the common bile duct was the diagnosis reached by the pathologist who performed the post-mortem examination.

An analysis of differences between the diagnoses made in hospital and those put on death certificates is interesting. Those patients who died in our hospitals naturally had death certificates in accordance with our diagnosis, and all those who died elsewhere had at one time or another had a letter giving our diagnosis sent to their doctors. In

respect of agreement between clinical diagnosis and death certification, therefore, ours is a specially selected group in which close agreement should be expected. A number of differences still occurred, however (Table 1).

TABLE 1.—*Analysis of Differences between Diagnoses on 591 Death Certificates and Those Made at the Brompton Hospital and Royal Cancer Hospital Joint Consultation Clinic, 1944-50*

1. *Diagnosis of Bronchial Carcinoma Accepted at the Clinic*

	Death Certified for Some Non-malignant Disease	Death Certified for Some Other Malignant Disease	No. of Death Certificates Examined
(a) With histological confirmation ...	5	12*	330
(b) Without histological confirmation ..	5	7†	224
Total ..	10	19	554

2. *Diagnosis of Bronchial Carcinoma Rejected at the Clinic, Death Certified as Bronchial Carcinoma*

Reasons for Rejection			No. of Death Certificates Examined
Insufficient Evidence of Primary Site	Diagnosis of Tumour of Some Other Site Established	Diagnosis of Some Non-malignant Disease Accepted	
12	3‡	6	37

* Four were certified as dying with metastases from unknown primary site, 3 (all with recurrent laryngeal palsy) as dying from cancer of the larynx, 2 as mediastinal tumour, and one each as cancer of the liver, rectum, and pancreas.

† Four were certified as dying from mediastinal tumour, one as metastases from unknown primary site, and one each as larynx and bone primary tumours.

‡ One had a carcinoma of the breast and one a carcinoma of the bile duct, both with lung metastases, and the third a disseminated reticulum-cell sarcoma.

Prior to the 1914-18 war it was unusual for a diagnosis of bronchial carcinoma to be made before death. Nearly all the cases reported came from the post-mortem room records. Only 6 of Sehr's 178 cases collected in 1904 had been diagnosed correctly during life. Ferenczy and Matolcsy (1927) found only 2 out of 40 (5%) diagnosed during life from 1896 to 1900, 18 out of 80 (22.5%) from 1907 to 1916, and 44 out of 150 (29.3%) from 1917 to 1925. In 84 post-mortem examinations of patients with lung-cancer made in a large hospital with a thoracic unit, Willis (quoted by Kennaway and Kennaway, 1947) found that the diagnosis made before death had been wrong in 35, or 42%. In Denmark—where the post-mortem examination rate is higher than in most other countries—Clemmensen and Busk (1947) found that of 564 patients recorded as dying of lung cancer there had been a post-mortem examination in 47%, the clinical diagnosis of lung cancer before death in this group being regarded as certain in 37%, uncertain in 26%, unknown in 15%, and not given in 22%. Even in 1952 McConnell, Gordon, and Jones, collecting 100 patients with lung cancer for a study of their smoking habits, had to reject 24 of their original cases because of proved errors in diagnosis in 11 and suspected errors in 13.

At our joint consultation clinic we had 821 patients referred to us with a diagnosis of lung cancer from 1944 to 1950. All these patients had already been seen by specialists in thoracic disease and had undergone a thorough investigation—including x-ray examination in all cases, bronchoscopy in most, and thoracotomy in some—and yet we have so far rejected the diagnosis in no fewer than 95 (8.6%) of them, and will probably reject it in more as the result of the repeated review of the evidence on which each patient's diagnosis rests which we make in the light of what happens over the years. If the 112 patients with this diagnosis seen during the same period at the Royal Cancer Hospital but not at the joint clinic are added, the number in which the diagnosis has been rejected is raised to 115.

From the large pool of patients dying with symptoms common to many chronic lung and heart disorders, an increasing number are being labelled "lung cancer" on a decreasing post-mortem examination rate for the total, despite a rising post-mortem rate for those dying in many hospitals. There is a wide variation in the degree of uncertainty with which this diagnosis is made. Death from respiratory disorders is comparatively common, from lung cancer comparatively rare. Without taking any account of patients dying from cardiac disease with similar symptoms there would still have been little difficulty in losing our entire present lung cancer death rate in the general death rate from respiratory disease in the past if these cases were really there to lose (see Chart).

Treatment

Your view of the effect of treatment on patients with lung cancer depends (like most things in life) on the way you look at it. If you see over 13,000 deaths in 1951 on a steeply rising curve, and estimate that probably fewer than 250 pneumonectomies for lung cancer were performed in that year, that it is unlikely that more than 1,000 radical courses of x-ray treatment were given for this disease, and that the five year survival rate for the whole group is likely to be no more than a fraction of 1%, you may well feel hopeless about the situation. If you see an extremely difficult problem both in early diagnosis and in treatment in an often rapidly fatal disease which is at last being tackled with some success, you may take a more optimistic view. The fact is that at present we offer no effective treatment at all to most patients with lung cancer. Mackenzie (1939) estimated that 95% were not treated; and Tod (1949), ten years later, found that 87% of patients registered with lung cancer in Bradford were still receiving no treatment. In our special group of 818 patients with a diagnosis of lung cancer accepted who were sent to us for treatment in hospital from 1944 to 1950, we judged that we could do nothing helpful with surgery or radiotherapy for 24%, despite our anxiety to try at least to relieve symptoms whenever possible, and in only 28% was it possible for us to make an attempt at radical treatment by surgery or x rays.

It was, however, 20 years ago this April that Evarts Graham, starting to do a lobectomy on a 48-year-old doctor and finding no satisfactory interlobar fissure, boldly did the first successful pneumonectomy for bronchial carcinoma. This patient is, I believe, still working as an obstetrician in Pittsburg, and there are hundreds of patients who have followed this one. Nevertheless, it is still unfortunately most difficult to find out what surgery really has to offer, since the standard of recording the results of treatment in patients with cancer is so deplorably low. Despite the large numbers involved it is hard to find papers which provide information on the subsequent history of big groups of patients with bronchial carcinoma, which include all those seen at one hospital over a period of years, which say how these patients were selected, and which express the survival of those treated surgically in terms

of the group as a whole. I know of no such report in this country. There nearly always seems to be some important piece of information missing.

Ochsner, DeCamp, DeBakey, and Ray (1952) give a full account of 308 patients with lung cancer observed for more than five years after treatment. They do not say over what period these patients were seen, but we may presume that none were omitted. In this group 32% were resected and 6% lived five years (19% of those resected). No patient lived five years without resection. The percentage of patients who are suitable for resection when first seen varies greatly from hospital to hospital, according to the way the patients are selected. Whereas with Ochsner *et al.*, for instance, 35% were resected, at the Brompton Hospital in 1951 this was possible only in 18% of the total of 256 new patients with bronchial carcinoma seen in that year. The survival rates at five years for those resected vary around the 20% mark, but the rate in terms of all the new patients seen in hospitals is a great deal lower, and in

Crude annual death rates for cancer of respiratory system compared with similar rates for all other respiratory diseases (1921-49). (Taken from the Registrar-General's Statistical Reviews of England and Wales.) Since 1940, when multiple causes were certified, deaths have been assigned to the cause selected by the certifying doctor instead of by arbitrary rule.

terms of the recorded death rate for the whole country is still pathetically small.

Mass miniature radiography may bring a few more patients to hospitals in the early stage. Overholt (1950) has been enthusiastic about its possibilities, and has reported 145 patients in whom lung shadows were detected; of these, 51 were due to tumours, 35 of which were malignant. He believes that no more than 10% of patients with lung cancer are operable by the time symptoms appear, and that mass surveys may offer many the chance of operation in the silent phase and so set treatment ahead by months or years.

All patients with lesions discovered on survey and sent promptly for treatment have been resectable in his clinic, and 75% have shown no signs of lymphatic spread. It would be interesting to know how many pneumonectomies were performed for patients with asymptomatic non-malignant conditions and what happened to them afterwards. Overholt does say that of one group of 12 patients explored four were found not to have lung cancer. We have not been fortunate with our few cases found by surveys. Most have volunteered for examination because they were already worried about their chest, and the delay in reaching hospital for treatment when something abnormal was shown usually destroyed what value the examination might have had. Only 5 out of 27 sent as the result of surveys had been

symptom-free when x-rayed, and the average delay in receiving treatment after the radiograph had been taken was more than four months.

Radiotherapy is frequently said to have little effect on survival. That patients have survived for many years following radiotherapy for proved lung cancer is established; that this is a rare occurrence and that a few patients survive for these long periods untreated is also true. With many errors in diagnosis the claims of a few successes cannot be accepted without the most rigorous inquiry. From the point of view of survival following treatment most publications on the value of radiotherapy are therefore quite useless. When the few operable cases are taken away there is not much left for the radiotherapist to treat which presents him with even a reasonable chance of success. When we rightly doubt the diagnosis as soon as one of our patients lives for a year or more and reject all those which do not seem certain, no very impressive survival rate is to be expected. It is possible that pre-operative x-ray treatment (a trial of which I have advocated for some years, and which I have suggested might at least be given while the patient is on the waiting-list for a surgical bed) may have some value in increasing the resectability rate and reducing the risk of metastasis. We have treated too few this way to have learnt much, but the results in our small group are set out in Table II. An examination of the lungs in

TABLE II.—*Patients with Bronchial Carcinoma Treated with Pre-operative Irradiation and Pneumectomy*

Age	Sex	Radiotherapy: Date Treatment Finished and Dose Given	No. of Days Before Pneumectomy	Subsequent History	Length of Survival Since First Treatment
45	M	December, 1947. 5,800 r in 36 days	68	Alive and well September, 1952	4 years and 10 months
26*	F	March, 1949. 6,000 r in 44 days	112	Alive and well November, 1952	3 years and 8 months
33	M	November, 1949. 6,300 r in 41 days	72	Died May 16, 1950	6 months, died
59	M	March, 1950. 2,700 r in 19 days	8	Died October, 1950	7 months, died
52	M	March, 1950. 2,400 r in 26 days	22	Alive and well August, 1952	2 years and 5 months

* This patient had a positive section before treatment, but no residual tumour was found in the lung at operation.

these patients may also give us information, in time, about what might be expected from irradiation in the small favourable group at present treated surgically. Another possible extension of combined treatment is the implantation of radioactive gold grains at thoracotomy in patients found to have inoperable growths.

Survey of 933 Patients

Here is a brief account of what has happened to all the patients registered at the Royal Cancer Hospital from 1945 to 1950 who either came to hospital with a diagnosis of bronchial carcinoma or in whom such a diagnosis was later made. These patients have mostly been seen in the joint consultation clinic held with the Brompton Hospital (Brooks, Davidson, Price Thomas, Robson, and Smithers, 1951), and all those seen at this clinic from 1944 to 1950 are included. In this series there are 933 persons—521 with histological confirmation of the diagnosis accepted, 297 without histological confirmation but with the diagnosis accepted on clinical grounds subject to review, and 115 in whom the diagnosis has been rejected (in 11 despite positive pathological reports, Table III). There are therefore 818 patients with an accepted diagnosis of bronchial carcinoma. Only 35 of these were treated surgically, the low proportion (4%) being due to the fact that the main source of supply (726 patients) was through our reference clinic, which is for patients already judged unsuitable for surgery. Of these 35 surgical cases 10 were alive three years or more after treatment. A radical course of x-ray therapy was given to

TABLE III.—*Eleven Patients with a Diagnosis of Bronchial Carcinoma Confirmed Histologically and then Rejected Clinically, 1944-50*

Pathological Report Given On	Sex and Age	Pathological Reports	Reason for Rejecting Diagnosis
Piece obtained at bronchoscopy	M 38	Squamous-cell carcinoma	Living 8 years after radiotherapy. Section review doubtful
	M 54	Oat-cell carcinoma	Necropsy. Lung and brain abscesses only
	F 61	Undifferentiated carcinoma	Living 3½ years later with adenoma of bronchus
	F 58	Squamous-cell carcinoma	Operation revealed fibroma. First section found to have belonged to another patient
Piece removed with a drill	M 68	Oat-cell carcinoma	Living 4½ years after radiotherapy. Section review doubtful
Lymph node removed from neck	F 50	Squamous-cell carcinoma with pigment. Malignant melanoma. (Two pathologists)	Living 4½ years after radiotherapy to mediastinal mass; no further lymph node enlargement
Sputum	M 65	Squamous-cell carcinoma	Lived 3½ years after radiotherapy
	M 36	Oat-cell carcinoma	Necropsy. Hodgkin's disease
	M 36	Carcinoma cells	Living 4½ years after radiotherapy
	M 48	Oat-cell carcinoma	Living 2 years after small dose of x rays
	M 66	Clumps of carcinoma cells	Living 2½ years without treatment

192 patients, and 6 of these were alive three years or more after treatment (Table IV). The most interesting fact is perhaps the survival rate in the group where the diagnosis was rejected.

Really ill patients with bronchial carcinoma seldom benefit from radiotherapy—which may well add to their discomfort while prolonging their dying—but antibiotics may control infection and allow many more patients to be relieved of distressing symptoms by radiotherapy than was possible in the past. To my mind the relief of superior vena-caval obstruction or of haemoptysis and the appreciable lessening of cough, dyspnoea, or pain is well worth achieving. I hold the view that providing such relief is one of the most important functions of a doctor. Too many general practitioners, remembering the past, when irradiation sickness was a commonplace, local reactions were severe, and relief of symptoms was unusual and of short duration, seem to

TABLE IV.—*Survival Times for 933 Patients Registered at the Royal Cancer Hospital in whom a Diagnosis of Cancer of the Lung was at One Time Made, 1944-50*

821* Patients seen in the Joint Consultation Clinic with the Brompton Hospital, 1944-50, and 112 Patients seen at the Royal Cancer Hospital only, 1945-50.

Treatment	No. of Patients	Survived More Than			Remarks
		1 Year	2 Years	3 Years	
Surgical ..	35*	20	14	10	1 still living at 7 years. 1 still living at 6 years 1 still living at 7 years
Radical x-ray therapy	192	66	17	6	
Palliative x-ray therapy	321	45	12	2	Mostly for the relief of one specific symptom only
Chemotherapy only	75	8	1	0	Some patients having x-ray treatment also had chemotherapy
Not treated ..	195	11	1	0	Mostly advanced cases with little prospect of symptomatic relief
Total ..	818	150	45	18	
Diagnosis rejected on review	115	50	28	24	One pneumectomy, 3 lobectomies, 42 x-ray therapy, 3 chemotherapy, 66 not treated

* Five with pre-operative irradiation (two alive over three years); 12 with post-operative irradiation (all died under three years).

me to be far too ready to deny their less debilitated lung-cancer patients the benefits of the treatment which is available to them to-day. We have started an investigation in conjunction with the general practitioners who send patients to us, to try to assess how far the palliative treatment given has been worth while. We are anxious to know what quality of life these patients lead before death and how they die.

Surgery offers a real chance of cure to the fortunate few, but does not at present do more than begin to touch the fringe of the problem presented by the thousands of patients dying with lung cancer. Radiotherapy is shouldering the burden of treatment to an increasing degree, and is doing useful work in relieving suffering in a way which is not possible at present by any other means, and is still not sufficiently available to all who need it. Chemotherapy with the nitrogen mustards has so far, in my experience, added nothing to this group of patients to compensate for the general ill effects it has produced, let alone done anything to advance treatment.

Conclusions

The startling rise in the recorded death rate from lung cancer is in large part due to change in numbers and age of the population and to improved diagnosis. It is due in part to a real increase, but we are not yet in a position to say how great that real increase is.

The size and the difficulty of this problem are clear to us all. Although the five-year survival rate for the fortunate few who are operable when they first reach hospital has risen from nothing to between 20 and 30% in 20 years, and while much can be done with x-ray treatment to relieve suffering and sometimes prolong life for the less fortunate ones who are, nevertheless, still in fairly good general condition, there are still thousands of these patients each year for whom no real attempt at treatment is being made. Since we all have to die, since some 90,000 people are doing so each year with lung symptoms, and since this number is falling well, we should ask ourselves how far we are performing a useful service by helping to make a public issue of a comparatively small change within that group, which may be in large part due to our own method of recording. We should not be too readily swayed by those who demand that the public be told "the truth" while we are still attempting to sort the facts from the fancies for ourselves, especially since "the truth" when told may not appear to them in at all the same light as it does to us. Anthony Hope once wrote that "telling the truth to people who misunderstand you is generally promoting a falsehood."

The moment the word cancer is mentioned to the public (of which doctors are but a part) emotion is aroused and any calm objective view of the value of evidence presented becomes most difficult. It is important that the medical profession take note of this difficult problem of lung cancer and help to deal with it more efficiently, but it is also important that they do not make matters worse by merely joining in a cry and increasing the alarm. A sensible view of the relationship of smoking to this problem, for instance, should be and, after some wild comments in the lay and medical press, is now being presented to the general public; but no comparable effort seems to be going into an endeavour to persuade the authorities to cleanse the air of our industrial towns. As a profession which speaks so much and so rightly of the need to allay the cancer fear we should beware of putting extravagant accounts of rising cancer death rates and their causes before the public,

especially when neither the magnitude of the one nor the degree or responsibility of the other has yet been fully established.

I am greatly indebted to Sir Clement Price Thomas and Dr. Kenneth Robson, the other members of our joint consultation clinic at the Brompton Hospital and the Royal Cancer Hospital, for allowing me to use material collected from our records. Dr. J. R. Bignall, a research fellow jointly with the Institute of Diseases of the Chest and the Institute of Cancer Research, who is attached to our clinic, has kindly obtained much other information for me from the Brompton Hospital records; and Mr. P. M. Payne, the research fellow in medical statistics in the Radiotherapy Department of the Royal Cancer Hospital, helped me with the chart and tables. I am grateful to Miss J. Thompson and Miss M. Jeffries for the considerable amount of work which they did in the records department and library while we were preparing the original lecture of which this paper formed a part.

REFERENCES

- Adler, I. (1912). *Primary Malignant Growths of the Lungs and Bronchi: A Pathological and Clinical Study*. Longmans, Green and Co., New York, London, Bombay, and Calcutta.
- Brooks, W. D. W., Davidson, M., Price Thomas, C., Robson, K., and Smithers, D. W. (1951). *Thorax*, 6, 1.
- Clemmesen, J., and Busk, T. (1947). *Brit. J. Cancer*, 1, 253.
- Ferenczy, K., and Matolcsy, T. (1927). *Wien. klin. Wschr.*, 40, 621.
- Green, H. W. (1926). *Amer. J. Publ. Hlth*, 16, 605.
- Kennaway, E. L., and Kennaway, N. M. (1947). *Brit. J. Cancer*, 1, 260.
- Killian, G. (1898). *Münch. med. Wschr.*, 45, 844.
- King, G., and Newsholme, A. (1893). *Proc. roy. Soc.*, 54, 209.
- McConnell, R. B., Gordon, K. C. T., and Jones, T. (1952). *Lancet*, 2, 651.
- Mackenzie, S. (1939). "Cancer: An Inquiry into the Extent to Which Patients receive Treatment." Ministry of Health Reports on Public Health and Medical Subjects, No. 89. H.M.S.O.
- Ochsner, A., DeCamp, P. T., DeBakey, M. E., and Ray, C. J. (1952). *J. Amer. med. Ass.*, 148, 691.
- Overholt, R. H. (1950). *Amer. Rev. Tuberc.*, 62, 491.
- Sehr, E. (1904). *Beiträge zur Kenntnis des primären Lungenkarzinoms*. Inaugural Dissertation. Leipzig.
- Stocks, P. (1947). "Regional and Local Differences in Cancer Death Rates." General Register Office Studies on Medical and Population Subjects No. 1. H.M.S.O., London.
- (1950). "Cancer Registration in England and Wales. An Enquiry into Treatment and its Results." General Register Office Studies on Medical and Population Subjects, No. 3. H.M.S.O., London.
- and MacKay, R. (1946). *Monthly Bull. Minist. Hlth, Lond.*, 5, 172.
- Tod, M. (1949). *An Inquiry into the extent to which Cancer Patients in Great Britain receive Radiotherapy*. Sherratt, Altrincham.

FACTORS IN THE MORTALITY OF CLOSED HEAD INJURIES

BY

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It has been estimated that in this country every year road accidents account for over 20,000 cases of head injury severe enough to require admission to hospital. Their number and mortality are matters of some concern. Mortality figures for non-missile head injuries vary widely, depending on the selection of cases and on the circumstances in which the particular series is compiled, but most clinics in this country and abroad quote rates of 12–20%, and emphasize that in 60–70% of the fatal cases death occurs within the first twenty-four hours. These early deaths are due frequently to the severity of the brain lesion, but there is a danger of assuming too readily that such is necessarily the case and of failing to recognize those complications for which treatment may be effective. Some early fatalities—and later ones too—are due to intracranial haematomas; and there are other cases in which extracranial factors such as chest complications are responsible.

The remarkable capacity of the brain to recover from or compensate for the effects of injury has also to be remembered. Thus, aphasia and hemiplegia are com-