Cancer of the Lung in Rhodesian Blacks

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SUMMARY

A retrospective survey has been carried out on lung cancer as seen in a large referral hospital in Rhodesia. The incidence of this disease is less common than in Europe and North America, but more common than in some other countries in Africa. Smoking was one important aetiological factor and mining, particularly gold mining, may have been another. Squamous cell tumours were more common and anaplastic tumours less common than in many other parts of the world. Both types were associated with cigarette smoking. The clinical presentation was similar to that in other series.

Many patients presented with advanced disease and only 10% underwent radical surgery. Most of the patients were lost to follow-up and the remainder died within 5 years.

S. Afr. Med. J., **48**, 2314 (1974).

Cancer of the lung has been extensively documented over many years, but most reports have been from North America and Western Europe and comparatively few from Africa.

Those reports from Africa are based mainly on autopsy or biopsy data. Most authors have stressed the rarity of the condition. Davies *et al.*[1] reviewed the hospital clinical records of Mengo Hospital, Uganda, from 1897 to 1956, and found only 10 cases of lung cancer, while Strachan,[2] in 1 901 autopsies on South African Black patients, did not record a single case. Elmes and Baldwin[3] from Nigeria reviewed autopsy and biopsy material and found only 5 lung cancers out of a total of 1 000 tumours of all kinds. Gelfand[4] from Rhodesia reported 5 lung cancers out of 2 000 autopsies and 7 out of 334 malignant biopsy specimens.

In particular, there has been little reported on age and sex distribution, clinical features and aetiological factors of lung cancer in Blacks. Accordingly, our hospital experience of this disease has been reviewed to discover its frequency and any differences which may exist between Rhodesian Blacks and other reported groups.

PATIENTS AND METHODS

A retrospective survey was made of the clinical records of Harare Hospital, Salisbury, Rhodesia, for the years 1961-1972 inclusive. Harare Hospital is the teaching hospital of the University of Rhodesia. It is the district general hospital for the Black population of Salisbury and its environs, and the referral hospital for most of the northern half of the country. The total population which it serves is not accurately known, but is in the region of 2 100 000. The records of patients with lung neoplasms with histological proof of the diagnosis were studied, and information on the following points was extracted.

The age and sex of patients were noted, but many Black patients, particularly the elderly, do not know their age accurately, and consequently an estimation has to be made. Male admissions to the hospital in general outnumber female by 3 to 1. This is probably due to a preponderance of men living in or near Salisbury because of the greater employment opportunities.

Patients' occupations were noted and particular attention was paid to mining, since this is common in Rhodesia. From the records it was usually possible to determine the type of mine where the patient worked, but it was not usually possible to determine the exact nature of the work nor how long he had been thus employed.

Information on smoking was available in two-thirds of the patients. A consumption of 10 or more cigarettes a day was recorded as 'heavy', and less than 10 as 'light' (10 cigarettes a day is a high consumption for a Rhodesian Black). If no actual figures were stated it was usually possible from the records to classify patients as either 'heavy' or 'light' smokers. For comparison, a survey of the smoking habits of 100 patients treated for trauma was performed. This sample was of the same age and sex distribution as the main study. It was not, however, matched for place of residence. This is because many patients who come from a rural area to an urban one for medical treatment, give an urban address. Thus data from the notes of the lung cancer patients would not be accurate in this respect.

Secondary tumours and lymphomas were excluded. The histological classification of lung tumours used was basically that of Millard.[5]

The histological sections of all tumours except the squamous cell carcinomas were reviewed by one of us (N.F.C.G.). Tumours originally reported as undifferentiated carcinomas, but which showed unequivocal areas of squamous or adenomatous differentiation, were reallocated to the appropriate group, while one tumour was reclassified as a carcinoid tumour, and one as muco-epidermoid carcinoma.

Symptoms and signs which were present at the initial examination were recorded, as well as their duration. Loss of weight is a prominent symptom in many series, but it has been ignored here. Most of our patients have little idea either of their normal weight or of any fluctuations, which makes inclusion of this feature of little value.

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The method whereby malignant cells were first obtained was noted. In most cases where cytology was performed, later studies of histological material enabled a more definite pathological diagnosis to be made.

Methods of treatment were recorded, and if radical surgery was not performed the reason was noted. In many cases there was more than one reason, and therefore the one first encountered in the original investigation of each patient has been recorded.

RESULTS

During the years 1961 - 1972 inclusive there were records of 661 discharges or deaths of patients with a clinical diagnosis of lung cancer. Histological proof of the diagnosis was obtained in 342 (52%). Of the total hospital admissions for all causes during this period, the higher figure is 6,9% and the lower figure 3,5%.

This gives an approximate incidence per year in the population served by the hospital of 2,6/100 000 for all cases, or 1,3/100 000 for those histologically proven. The age standardised rate for men per 100 000 population is 2,8 standardised to the African Standard population.[6] The numbers for women are too small for useful analysis.

The results which follow refer only to those in whom histological proof of the diagnosis was obtained.

Age and Sex

The majority (74,2%) were between the ages of 40 - 69 years, and 37,8% were between 50 and 59 years. There were 24 patients under the age of 40 years. Males accounted for 90% of the patients.

Occupation

Almost half of the men (45,7%) were farm labourers, gardeners or rural subsistence farmers, while 15% were miners, and most of the remainder were industrial or domestic workers. Of the miners, 41% were gold miners. In the region as a whole, 4,8% of the employed population (mostly males) are miners, of whom 27,6% are gold miners.

Associated Lung Disease

Tuberculosis was found in 5% of the patients, which is 100 times the average among Blacks during the years 1961 - 1972. Pneumoconiosis was present in 4 patients and chronic bronchitis and emphysema in 18, but the frequency of these diseases in the general population is not known.

Pathology

The histological classification of the tumours is set out in Table I.

TABLE I. HISTOLOGICAL CLASSIFICATION IN MALES AND FEMALES

Tumour type	No. of patients	Male	Female	Percentage
Squamous cell carcinoma	229	217	12	66,9
Small undifferentiated cell carcinoma	24	24	0	7,0
Large undifferentiated cell carcinoma	50	42	8	14,6
Adenocarcinoma	21	13	8	6,1
Bronchiolo-alveolar cell carcinoma	4	2	2	1,2
Muco-epidermoid-carcinoma	2	1	1	0,6
Carcinoid tumour	6	4	2	1,8
True adenoma	1	1	0	0,3
Sarcoma	2	0	2	0,6
Mesothelioma	2	2	0	0,6
Cytology only	1	1	0	0,3
Total	342	307	35	100,0

Two-thirds of the tumours were squamous cell carcinomas. The squamous and undifferentiated carcinomas occurred mainly in men, while adenocarcinomas were relatively more frequent in women. The sarcomas were a fibrosarcoma and a pleomorphic sarcoma. In addition to the above, one myoblastoma was diagnosed.

Smoking

In 31,6% no information on smoking was available. The smoking habits of the remaining 234 are set out in Table II. They are compared with the smoking habits of the control group. The difference in cigarette smoking between the patients and the controls is statistically significant ($P = 0,01$).

TABLE II. SMOKING HABITS OF 234 PATIENTS COMPARED WITH CONTROLS

Smoking habits	Males	Females	Total	Percentage	Controls
Nil	18	18	36	15,4	48
Cigarettes					
Light (<10/day)	100	2	102	43,5	27
Heavy (≥10/day)	81	1	82	35,0	11
Snuff-taking	7	2	9	3,9	13
Pipe	5	0	5	2,2	1
Total	211	23	234	100,0	100

Smoking and histological classification were compared by studying those patients with tumours of the main histological types who were also either non-smokers or cigarette smokers. Of these patients, smokers accounted for 90% of those with squamous cell tumours, 83% of those with undifferentiated tumours and 60% of those with adenocarcinomas.

Duration of Symptoms

Fifty-nine per cent of patients presented within 3 months of the onset of symptoms; 15% between 3 and 6 months; 14,3% between 6 and 12 months; while 8% had symptoms which had been present for at least one year.

Presenting Symptoms and Signs

Table III shows the frequency of various symptoms and signs present when the patients were first seen. Cough and chest pain were by far the most frequent, with haemoptysis the next most common complaint. No cases of myopathy, peripheral neuropathy or endocrine secretion by the tumour were noted. Only 6 patients were referred from a mass miniature radiography unit.

TABLE III. SYMPTOMS AND SIGNS PRESENT WHEN FIRST SEEN

Symptoms and signs	No. of patients	Percentage
Cough	269	86,5
Chest pain	262	76,5
Dyspnoea	161	47,1
Haemoptysis	147	43,0
Supraclavicular or cervical lymph node enlargement	142	41,5
Clubbing	128	37,4
Pleural effusion	77	22,5
Atelectasis	56	16,4
Pneumonia	43	12,6
Superior venacaval obstruction	22	6,4
Recurrent laryngeal nerve palsy	20	5,9
Bone metastases	20	5,9
Liver metastases	18	5,2
Brain metastases	13	3,8

Method of Diagnosis

Table IV shows the method whereby histological proof of the diagnosis was first obtained. The 16 'other' methods were mainly biopsy of metastases.

TABLE IV. METHOD OF DIAGNOSIS

Method of diagnosis	No. of patients	Percentage
Bronchoscopy and biopsy	185	54,1
Autopsy	52	15,2
Lymph node biopsy	38	11,1
Thoracotomy	32	9,3
Sputum cytology	10	2,9
Pleural biopsy	6	1,8
Lung biopsy	3	0,9
Other	16	4,7
Total	342	100,0

Treatment

In almost two-thirds supportive treatment only was possible. A total of 37 patients (10,8%) had some form of radical surgery, either with or without radiotherapy, while 85 patients (24,8%) had radiotherapy alone.

Approximately half the remaining 305 patients were unsuitable for surgery either clinically (27,2%) or as a result of the findings on bronchoscopy (21,4%). Ten per cent of patients were offered surgery but refused, and in 9,4% thoracotomy was considered justified but the tumour was unresectable at operation. Only 6,4% were rejected because of poor general condition. In 14,3% the diagnosis was not made until after death. There was often more than one contra-indication to treatment. For example, all the oat cell tumours were rejected on histological grounds but were also unsuitable for at least one other reason.

Pneumonectomy was performed in 20 patients, lobectomy in 12 and sleeve resection in 5.

Results of Treatment

The great majority (63,8%) of patients were lost to follow-up, for reasons which will be discussed later. All the remainder (124) died within 5 years. Of these, 9 died after operation, 5 of them within 15 days. Most of these had extensive resections, sometimes involving the chest wall, and died from postoperative complications. The remaining 4 patients died from secondary spread of tumour.

DISCUSSION

There are several problems associated with determining disease incidence in developing countries. These have been set out by Doll[1] and are applicable to surveys in Rhodesia. Firstly, the population size is not accurately known, and long distances and arduous terrain make field surveys difficult. Secondly, hospital statistics will depend on the willingness of patients to seek Western methods of investigation and treatment, and also on transport availability where long distances are involved. Thirdly, not only is the total population not known, but neither is the population served by the hospital. Indeed, this population varies with different diseases; for example the 'catchment area' for neurosurgical conditions is very much larger than for malaria. Fourthly, surveys confined to urban areas (where the population is known) may not be accurate, since many patients from rural areas who come to the town for hospital treatment give an urban address. Lastly, death certification in Rhodesia is not required outside urban areas.

Because of these problems, estimates of incidence from our data can only be approximate, but it is probable that the great majority of patients with lung cancer in our population who seek medical care in the first place will be referred to Harare Hospital, since only this hospital possesses the necessary facilities for full diagnosis and treatment.

Our age-standardised rate for men is 2,8 per year per 100 000 population. This compares with 38,4 for Birmingham, England[8] and 23,0 for Connecticut, USA.[9] In Africa rates of 25 have been reported from Bulawayo, Rhodesia,[10] and 0,9 from Ibadan, Nigeria.[11] Oettlé[12] found in Johannesburg Blacks an incidence of 4,6 and Prates[13] from Lourenço Marques, Mozambique, an incidence of 2,5. From Jamaica, Bras *et al.*[14] report an incidence of 12,8. All these rates are standardised to the African Standard population.[6] Many of these discrepancies in Africa are doubtless due to the problems outlined above. In particular the Bulawayo figures, which are for an urban population only, probably reflect a higher referral rate than our series, although other factors such as smoking may be important. Schonland and Bradshaw[15] similarly found a striking difference between urban and rural populations in Natal.

The age and sex distribution in our series shows a similar distribution to series from Africa,[10] Europe[8] and North America[16] when the age structure of the population is taken into account.

Some industrial causes of cancer of the lung have been reviewed by Doll.[17] They include nickel, chromates, asbestos and arsenic, all of which are found in Rhodesia. Arsenic occurs as an impurity in many non-ferrous ores and is of particular interest to us, since Osburn[18,19] has found a large number of patients with lung cancer among Black workers in the Gwanda gold mines of Rhodesia. There is a high arsenic content in the rock of some of these mines and many of his patients had arsenical hyperkeratoses of the skin.

Miners constitute a higher proportion of the males in our series than the population served by the hospital. There are also more gold miners in our series than would be expected. This supports the work of Osburn, but further work is needed on smoking habits, length of time of employment, type of work performed by gold miners and the arsenic content of the rock of the mines.

It is accepted that lung cancer and tuberculosis not uncommonly occur together, probably owing to a reactivation of tuberculosis by the cancer. This association was found in 5% of our series and is a potential diagnostic hazard. This is not, of course, to say that tuberculosis was the cause of cancer in those patients.

In this series squamous cell carcinoma accounted for 66,9% of all tumours, large undifferentiated cell carcinoma for 14,6%, small undifferentiated cell carcinoma for 7,0% and adenocarcinoma for 6,1%.

Nicholson *et al.*,[18] whose figures are reasonably similar to those of most other European and North American series, give a lower incidence of squamous carcinoma (56%), but a higher incidence of the anaplastic types (37%). Some authors give anaplastic tumours as the predominant cell type.[19,20]

In a predominantly Negro population from Jamaica, Bras *et al.*[14] found 43% squamous and 38% anaplastic tumours. From Natal, South Afrca, Schonland and Bradshaw[21] found 46% squamous carcinoma and 34% anaplastic tumours. Gelfand *et al.*,[22] from this hospital, found 62,5% squamous and 34,4% anaplastic tumours in 32 male patients.

Therefore it would appear that the percentage of squamous cancers is rather higher and that of anaplastic cancers rather lower in our series than in series from other parts of the world. This may in part be due to differences in interpretation by different pathologists; histological classification being particularly difficult when a tumour consists of more than one cell type or is based on a small biopsy specimen.

There can be little real doubt of the association between cigarette smoking and carcinoma of the bronchus. Smoking seems to be associated with the squamous and anaplastic types, but not with adenocarcinoma, bronchiolo-alveolar cell carcinoma or adenoma.[23] Our figures suggest a similar pattern, with a much higher incidence of smoking among the patients than the controls, and a positive relationship between squamous and anaplastic tumours and smoking. However, these conclusions can be only tentative, since retrospective estimates of smoking are often inadequate and much of our data was incomplete. Our control group of trauma patients may contain a larger number of urban dwellers than the main study, and is therefore likely to overestimate the amount of smoking in the general population.

There have been few reports on smoking and cancer from Africa, but Gelfand[22] from Rhodesia found that 87,5% of a series of 32 patients were smokers compared with 22% of the controls. The number of cigarettes smoked was small, two-thirds of the patients smoking less than 10 a day. The relationship between cell type and smoking was similar to our series. They discuss the relative importance of the method of smoking, of atmospheric pollution, and of the inhalation of wood smoke. Oettlé[12] in Johannesburg and Schonland and Bradshaw[24] in Durban found a close association between lung cancer and smoking.

Delay by the patient in seeking medical care is important prognostically in this disease. Unfortunately patients may not remember accurately how long they have been ill, and our figures probably underestimate the delay. Nevertheless, they are similar to other series.[25]

In this series, as in others,[26,27] the great majority of patients presented with one or more of the cardinal signs of respiratory disease—cough, chest pain, dyspnoea and haemoptysis. The incidence of metastases in this series is similar to elsewhere. Few patients (2%) were referred from mass miniature radiography units, because this facility is not often accessible to the older age groups who live in the rural areas.

Bronchoscopy and biopsy were by far the most important confirmatory investigations. Indeed, our patients were more often diagnosed by bronchoscopy and less often by thoracotomy than in many other series.[28,29] This is possibly because many of our patients presented late, when the tumour was visible bronchoscopically. The number diagnosed by cytology is disappointingly low. This is probably because only recently has an adequate cytology service been available.

Treatment is disappointing in this series; the great majority of patients could only be treated symptomatically, and only 10,6% underwent radical surgery. This contrasts with other series, Le Roux[26] finding a resection rate of 27% in 4 000 tumours, and Taylor *et al.*[28] a rate of 20,6%.

The commonest contra-indications to surgery in this series were either clinical or bronchoscopic, probably

because of presentation late in the disease. Only 6,4% were judged to be in too poor a general condition, which contrasts with 15,9% found similarly unsuitable in Le Roux's series.[26] A relatively high proportion (10,2%)refused surgery; almost the same as those who had radical surgery.

The great majority of our patients were lost to follow-up and all the remainder died within 5 years. This makes meaningful comparison with other series impossible. The reasons for poor attendance at follow-up are mainly those of long distance, expense and the understandable reluctance of patients to attend a clinic where little further help could be offered.

We wish to thank the physicians and surgeons of Harare Hospital; Mr D. Barley, Medical Records Officer, Harare Hospital; the Central Statistical Office, Salisbury; Dr Gordon Blake for statistical help; the Secretary for Health for facilities; and the University of Rhodesia for a research grant.

REFERENCES

1. Davies, J. P. N., Elmes, S., Hutt, M. S. R., Mtimavalye, L. A. R., Owor, R. and Shaper, L. (1964): Brit. Med. J., **1**, 259.
2. Strachan, A. S. (1934): J. Path. Bact., **39**, 209.
3. Elmes, B. G. T. and Baldwin, R. B. T. (1947): Ann. Trop. Med. Parasit., **41**, 321.
4. Gelfand, M. (1949): S. Afr. Med. J., **23**, 1010.
5. Millard, M. *in* Anderson. W. A. D., ed. (1971): *Pathology*, p. 963. St Louis: C. V. Mosby.
6. Doll, R., Muir, C. S. and Waterhouse, J. A. H., eds (1970): *Cancer Incidence in Five Continents*, vol. 2., p. 334. Geneva: UICC.
7. Doll, R. (1959): *Methods of Geographical Pathology*, p. 11. Oxford: Blackwell.
8. Waterhouse, J. A. H., Levi, J. M. and Powell, J. *in* Doll, R., Muir, C. S. and Waterhouse, J. A. H., eds (1970): *Op. cit.*[6], p. 274.
9. Eisenberg, H. and Connelly, R. R. (1970): *Ibid.*, p. 162.
10. Skinner, M. E. G., Parker, D. A., Mitchell, H. F. and Ross, W. F. (1970): *Ibid.*, p. 94.
11. Edington, G. M. and Hendrickse, M. (1970): *Ibid.*, p. 90.
12. Oettlé, A. G. (1964): J. Nat. Cancer Inst., **33**, 383.
13. Prates, M. D. *in* Doll, J. A. H., Waterhouse, J. A. H. and Payne, P., eds (1966): *Op. cit.*[6], p. 30.
14. Bras, G., Whimster, W. F., Patrick, A. L. and Woo-Ming, M. (1972): Cancer (Philad.), **29**, 1590.
15. Schonland, M. and Bradshaw, E. (1968): S. Afr. J. Med. Sci., **33**, 33.
16. Linden, G., Dunn, J. E. and Arellano, M. G. (1970): *Op. cit.*[6], p. 154.
17. Doll, R. *in* Bignall, J. R., ed. (1959): *Carcinoma of the Lung*, p. 81. Edinburgh: Livingstone.
18. Osburn, H. S. (1957): Cent. Afr. J. Med., **3**, 215.
19. *Idem* (1969): S. Afr. Med. J., **43**, 1307.
20. Whitwell, F. (1961): Brit. J. Cancer, **15**, 429.
21. Schonland, M. and Bradshaw, E. (1969): S. Afr. Med. J., **43**, 1058.
22. Gelfand, M., Graham, A. J. P. and Lightman, E. (1968): Brit. Med. J., **3**, 468.
23. Doll, R., Hill, A. B. and Kreyberg, L. (1957): Brit. J. Cancer, **11**, 43.
24. Schonland, M. and Bradshaw, E. (1969): Int. J. Cancer, **4**, 743.
25. Bignall, J. R. (1955): Lancet, **1**, 786.
26. Le Roux, B. T. (1968): *Bronchial Carcinoma*, London: Livingstone.
27. Ochsner, A., Ochsner, A., H'Doubler, C. and Blalock, J. (1960): Dis. Chest, **37**, 1.
28. Taylor, A. B., Shinton, N. K. and Waterhouse, J. A. H. (1963): Thorax, **18**, 178.
29. Bernstein, L. (1967): Ann. Otol. (St Louis), **76**, 242.