

MALIGNANT DISEASE IN THE TRANSCAAL

PART VIII: CONCLUSION

LIONEL COHEN, N. G. DE MOOR, AND P. KEEN, *Radiation Therapy Department, Johannesburg Hospital*

The Radiation Therapy Department of the Johannesburg Hospital is a regional centre catering for the radiation requirements of the population of Johannesburg, the Witwatersrand and the southern half of the Transvaal. With the exception of those relatively few patients who are treated privately, and the proportionately larger number of African patients who do not reach the Provincial hospitals, most cases of malignant disease arising in this population are seen, at one time or other during the course of their illness, in the Department. Patients may be referred for radical radiation therapy given as the sole method of treatment with curative intent; for post-operative irradiation of the tumour site as an adjunct to surgery; for pre-operative irradiation with the object of facilitating subsequent surgery; or for purely palliative radiotherapy to alleviate symptoms in uncontrolled cancer. The total number of patients in all these categories has been increasing slowly (Fig. 1) and is now tending to

As reported previously,¹⁻⁴ certain striking differences in the case frequency of cancer in various anatomical systems were noted either by comparing the two racial groups in this series or by comparison with cancer statistics from abroad. Subsequent reports⁵⁻⁷ have confirmed the tendency for certain tumours to appear with greater frequency in the African than in the European. In most of these there was presumptive evidence of environmental factors sufficient to account for the observed differences, suggesting that the major proportion of cancer in Africans might be attributable to chemical carcinogens. Since the feasibility of cancer prevention, as a practicable public health measure, depends upon confirmation of these findings, the accumulation of such statistics has been continued so as to provide a larger and more significant series.

Between 1950 and 1963, 12,564 patients with malignant tumours (in addition to a substantial number of benign cases) were treated in the Radiation Therapy Department. Of these 7,985 were Europeans and 4,669 Africans. The ratio averages 1.7, though the actual relative rate has changed considerably over the 14-year observation period (Fig. 1). Table I shows the distribution of these cases according to race and anatomical system, from which the following interesting facts emerge:

1. General Trends

Referring to Fig. 1, it will be noted that although there has been a relatively small increase in the total number of patients presenting for radiation therapy each year (1,356 in 1950-1,874 in 1963), there has been a much steeper increase in the number of cancer cases, ranging from 53% of the total in 1950 to 84% in 1963. This may be attributed to the rising population density of the area, possibly a rising cancer rate, fewer cases of non-malignant disease, because of a growing realization of the hazards of radiation applied in benign conditions, and an increased appreciation of the value of radiation therapy for cancer patients. The steeper rise from 1961 onwards follows the acquisition of megavoltage equipment in the Department in that year. It is significant, too, that the number of non-European cancer patients has risen even more steeply than

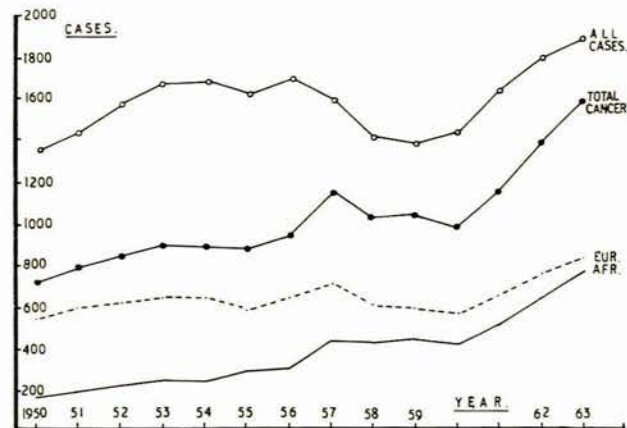


Fig. 1. See text.

stabilize at about 2,000 new cases annually, Europeans and Africans being represented in approximately equal numbers.

the average trend, from under 200 in 1950 to nearly 800 in 1963.

2. Anatomical Grouping

The distribution of cases among the various anatomical systems (Table I) shows that most cancers occur in only

TABLE I. FREQUENCY OF CANCER AFFECTING VARIOUS ANATOMICAL SYSTEMS IN EUROPEAN AND AFRICAN RADIOTHERAPY PATIENTS

System	European			African			Total %
	Male	Female	Total %	Male	Female	Total %	
Skin	1,501	1,033	32.0*	171	132	6.6	23.2
Musculo-skeletal	90	88	2.2	113	60	3.7	2.8
Respiratory	599*	120	9.1	358	64	9.1	9.1
Vascular	4	1	0.06	60	0	1.3*	0.5
Reticulo-endothelial	310	190	6.3	206	92	6.5	6.4
Alimentary	786	273	13.4	734	146	19.1*	15.5
Genito-urinary	325	1,033	17.2	171	1,641*	39.3	25.3
Endocrine	46	87	1.7	21	56	1.7	1.7
Nervous system	125	94	3.0	90	75	2.4	2.8
Breast	4	1,216	15.4	22*	457	10.4	13.6
Subtotals:	4,157	3,754	100	1,816	2,800	100	100
Total:	7,895			4,669			12,564

* Asterisks indicate significant or highly suggestive increase in system susceptibility above average values.

3 or 4 systems: the genito-urinary and alimentary tracts; the breast; and, in Europeans, the skin. Skin cancer is by far the commonest malignant disease in the White races of the Transvaal, among whom it accounts for fully 32% of all cases referred, greatly exceeding the next 3 sites (genito-urinary 17%, breast 15% and alimentary tract 13%). The African cancer distribution is strikingly different. The commonest sites in this population are the genito-urinary system, which accounts for nearly 40% of all cases, and the alimentary tract representing a further 19% of cases. Skin cancer is relatively rare (6.6%) and presents in a remarkably different manner.^{1,2} Other systems are practically equally represented in both racial groups, with the interesting exception of the vascular system. Although malignant vascular tumours are very uncommon, the African vascular system is relatively susceptible to Kaposi's sarcoma (1.3% of all cancer)—some 20 times higher than in the European (0.06%).³

3. Specific Organ Susceptibility

The most significant racial differences are encountered when the relative frequencies of cancers in various organs or subdivisions of each anatomical system are examined (Table II).

Systems

In the *respiratory system*, the total incidence of tumours appears identical in the two races (9.1% of all cancer), but the relative frequencies of cancers of the lung, larynx, nasopharynx and paranasal sinuses show interesting differences. In the European, cancer of the lung is by far the commonest tumour of the respiratory tract, accounting for two-thirds of all cancer in this system. Next comes the larynx (22%), nasopharynx (7%), and lastly the paranasal sinuses (5%). In the African, the frequencies are almost exactly reversed, tumours of the sinuses amounting to 37% of all respiratory tract cancer, larynx and nasopharynx together totalling 35% of cases, while the lung accounts for no more than 28% of the group. These differences have been attributed to the different tobacco habits of the two communities.⁴

A similar situation exists in the case of the *gastro-intestinal tract*. The most frequently affected organs in Europeans are,

in order of susceptibility, the lip, the mouth, the gut and, far less frequently, the oesophagus and salivary glands. In the African, on the other hand, the commonest alimentary tract tumours are carcinoma of the oesophagus (35%) and intra-oral cancer (tongue and buccal mucosa together constituting 35%), followed by the salivary glands (12%) and other sites (mainly liver, 12%) with tumours of the bowel and lip being relatively rare.

TABLE II. INTRA-SYSTEM VARIATION IN ORGAN-SUSCEPTIBILITY TO CANCER

System	Organ	European		African	
		Cases	%	Cases	%
Resp.	Lung	475	66*	119	28
	Larynx	159	22	94	22
	Nasopharynx	47	7	53	13
	Sinuses	40	5	156	37*
G-I	Lip	373	35*	53	6
	Mouth	343	33	314	35
	Salivary	45	4	102	12*
	Oesophagus	67	6	309	35*
	Other	231	22*	102	12
G-U	Cervix	535	39	1,424	79*
	Uterus	140	10*	57	3
	Ovary	251	19*	88	5
	Testis	54	4*	19	1
	Penis	19	1	62	3*
	Kidney	85	5	80	4
	Bladder	233	18*	55	3
Other	41	3	27	2	
Neur.	Conjunctiva	11	5	47	29*
	Retina	9	4	36	22*
	Brain	125	57	29	17
	Ganglia	9	4	14	8
	Other	65	30	39	23

* Asterisks indicate organs having increased susceptibility to cancer compared to other sites in the same system. Percentages are expressed in relation to the total cases for each system.

In the *genito-urinary system*, although carcinoma of the cervix is the commonest tumour in both races, the relative incidence is still strikingly different. Carcinoma of the cervix accounts for nearly 52% of G-U cancer in European females, but fully 87% of all G-U malignancy in African women (39% and 79% respectively if total incidence in both sexes is considered). A reverse situation applies to adenocarcinoma of the body of the uterus and ovary, which together account for 38% of G-U cancer in European women, but only 9% in Africans. A corresponding reversal is found in males in the frequencies of cancer of the testis and penis respectively. Of 92 cases of genital cancer in European men, 54 (58%) were testicular tumours, 19 (21%) affected the penis, and 19 tumours arose in the prostate and other less common sites. In the African, of 87 cases, 62 (71%) were penile cancer frequently associated with concomitant syphilis,⁴ 19 (22%) were testicular tumours, and only 5% arose in other sites.

Among the *other systems* the situation with regard to breast cancer shows few racially distinct features⁵ except for a distinctly greater proportion of males in the African series. Tumours of the thyroid gland, carcinoma of the conjunctiva, retinoblastoma, and neuroblastoma of autonomic ganglia are all more common among Africans. Nephroblastoma is at least 3 times as common in African children as in Europeans, with a remarkable preponderance in females.⁴

DISCUSSION

It must be emphasized that the figures quoted cannot be regarded as absolute cancer rates since they have been extracted from a selected population attending the Radiation Therapy Department. Their acceptance can, however, be justified for comparison of *relative* frequencies in the two racial groups on the grounds that the same criteria had been used in selecting cases for radiation therapy. This approach is supported by the fact that more rigorous analyses subsequently reported for the same

region⁹ have, in general, confirmed most of the conclusions derived from our initial survey.

The survey clearly demonstrates 3 organs affected with unusual frequency in the European section of the community: skin, lip and lung. In these 3 sites, aetiological factors are well established.¹ Ultraviolet irradiation (the intense sunlight to which all outdoor workers are exposed in the Transvaal) has been incriminated as the major causative factor in the case of both skin and lip cancer, while the high incidence of lung cancer correlates with similar findings in Europe and America, where an association with cigarette smoking has been proved. By analogy it seems probable that the particularly susceptible tissues in the African, i.e. the uterine cervix, the penis, the paranasal sinuses and the upper alimentary tract, may have been similarly exposed to environmental carcinogens. The probable role of chemical carcinogenic agents in this series of cases has been reported previously,³⁻⁶ and if valid, would have important epidemiological consequences. These unusually frequent tumours in Africans comprise at least two-thirds of all cases referred, which suggests that a similar proportion of cancer in the African is preventable.

The most significant conclusion which can be drawn from this investigation is that a substantial advance in the control of cancer in South Africa could be made through research into the chemical carcinogens responsible for the higher-than-average incidence of cancer of particular organs and tissues encountered in this community.

SUMMARY

12,564 cases of malignant disease treated in the Radiation Therapy Department of the Johannesburg Hospital between 1950 and 1963 have been reviewed. A striking variation in susceptibility of certain organs and systems was encountered when the relative frequencies of tumours in European and African patients were compared. It is concluded that the major proportion of cancer arising in the skin, respiratory tract, alimentary tract, and genitourinary system is probably due to environmental factors. On this basis, about two-thirds of all cancer arising in the Transvaal is theoretically preventable.

We are indebted to the late Dr. K. F. Mills, Medical Superintendent, Johannesburg Hospital, for access to hospital records and material. Expenses were defrayed through the Farquhar Bequest Cancer Research Fund.

REFERENCES

1. Cohen, L., Shapiro, M. P., Keen, P. and Henning, A. J. H. (1952): *S. Afr. Med. J.*, **26**, 932.
2. Shapiro, M. P., Keen, P., Cohen, L. and De Moor, N. G. (1955): *Ibid.*, **29**, 95.
3. Keen, P., Cohen, L., De Moor, N. G., Durbach, D. and Shapiro, M. P. (1957): *Ibid.*, **31**, 637.
4. De Moor, N. G., Durbach, D., Cohen, L. and Keen, P. (1960): *Ibid.*, **34**, 496.
5. Shapiro, M. P., Keen, P., Cohen, L. and Murray, J. F. (1953): *Brit. J. Cancer*, **7**, 45.
6. Keen, P., De Moor, N. G., Shapiro, M. P., Cohen, L., Cooper, R. L. and Campbell, J. M. (1955): *Ibid.*, **9**, 528.
7. Cohen, L., Palmer, P. E. S. and Nickson, J. J. (1962): *Acta Un. int. Cancr.*, **18**, 502.
8. De Moor, N. G., Durbach, D., Levin, J. and Cohen, L. (1961): *Radiology*, **77**, 35.
9. Oettlé, A. G. (1964): *J. Nat. Cancer Inst.*, **33**, 383.