A study of lung cancer in Johannesburg, South Africa

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Introduction

Lung cancer remains the most common malignancy, with an estimated 1.61-million new cases each year worldwide, and accounts for 12.7% of new cancer cases.1,2 Of these cases, 55% occur in the developing world. Lung cancer is more common in men than in women, with an incidence ratio of approximately 2:1. It is the cause of 1.38-million deaths each year worldwide, accounting for 18.2% of cancer-related deaths.2 Lung cancer mortality in South Africa is estimated to account for 17% of cancer-related deaths.3 This makes lung cancer the leading cause of cancer mortality and morbidity in the world.3

There is evidence in the literature of racial and gender differences with respect to histological types of lung cancer. However, data from South Africa are sparse. A study from Wilcox et al documented that squamous cell carcinoma was the most common histological type in 34% of patients at Groote Schuur hospital. The majority of the patients were of mixed race, reflecting the demographics of that part of the country. Only 11% of patients were operable.4 A more recent study from Cape Town suggested that adenocarcinoma had overtaken squamous cell carcinoma in frequency.4 That study went further and highlighted the lack of data over the past decade, documenting the ranked frequency of the various histological types of lung tumour.5

The primary objective of the current study was to investigate whether differences exist in the demographic and histological features when lung cancer in black versus white patients was compared. Black patients were younger and smoked fewer cigarettes. Squamous cell carcinoma was the most common cancer in all patients, except black females, in whom small cell carcinoma was more common.

We investigated whether or not differences existed between black and white patients in Johannesburg with regard to the demographic and histological features of lung cancer. This was a retrospective case record review of patients with lung cancer, seen over seven years in the pulmonology units of three hospitals attached to the University of the Witwatersrand. Seven hundred and seventy-eight black and white patients were enrolled. Six hundred and thirty-two (77.4%) of these patients were known to have smoked. The white patients were older than the black patients [median age of 66 years (range of 32-92) vs. 57 years (range of 26-86), p-value < 0.001], and had significantly greater mean pack years of smoking (52.7 ± 21.7 vs. 21.7 ± 14.3, p-value < 0.001). [Pack years is the numerical value of lifetime exposure to cigarettes, calculated as follows: the number of cigarette smoked x years of exposure/20 (a pack of cigarettes usually has 20 cigarettes)]. Histological cell types of lung cancer were squamous cell carcinoma in 341 (43.8%), adenocarcinoma in 167 (21.5%), small cell carcinoma in 129 (16.6%) and large cell carcinoma in 68 (8.7%) of the cases. More white than black patients had small cell carcinoma (p-value 0.01). More black than white patients had large cell carcinoma (p-value 0.04). There were also differences between the genders within the two racial groups. There were significant differences in the demographics and histological features when lung cancer in black versus white patients was compared. Black patients were younger and smoked fewer cigarettes. Squamous cell carcinoma was the most common cancer in all patients, except black females, in whom small cell carcinoma was more common.

References


cancer who presented to the pulmonology units of three university hospitals in Johannesburg between January 1992 and December 1998. The Human Research Ethics Committee of the University of the Witwatersrand approved the study (Ethics Clearance Protocol Number M990804). Demographic data, including patient age, gender, population, smoking history (including pack years), histological cell type, radiological features on chest radiographs, as well as the operability of the patients, were recorded. Patient population groups in South Africa are divided into black, white, coloured and Asian for demographic purposes. The primary end-point was to compare and contrast these features in black and white patients. The 1981 World Health Organization (WHO) classification of histological cell types was utilised to interpret the histological types of lung malignancy.5

Statistical analysis was performed using GraphPad® 3.10 for Windows. The Mann-Whitney test was used to determine whether or not there were any differences in age and pack years between black and white patients. When the groups were further stratified according to gender, comparisons were carried out using the Kruskal-Wallis test. Analysis of pack years in individual groups was undertaken using the Wilcoxon signed-rank test. The chi-square test of contingency tables was utilised to analyse the histological data, radiological features and mode of diagnoses to assess potential differences.

Results

Patient demographics for the total group of patients

Eight hundred and seventeen patients with lung cancer were seen during the study period. The age group of the total sample ranged from 26-92 years, with a median of 61 years. Overall, 632 of 817 (77.4%) of patients were known to be smokers, either current or ex-smokers. There were 32 (3.9%) non-smokers, and no details of smoking status for the remaining 153 (18.7%) patients.

The population classification of these patients, in decreasing order of frequency, was 441 white and 337 black patients (a total of 778).

The comparative demographics of the black and white patients

Table I illustrates the demographics stratified according to population and gender. Black patients were significantly younger and smoked fewer cigarettes than white patients. Black females tended to smoke the least.

The radiological features for the total group of patients

A lung mass was identified on chest radiograph in the majority of patients. Table II illustrates the radiological features that were observed. Lung masses were documented in 130 black (41.5%) versus 227 white patients (49.9%) (p-value < 0.0001). The other radiological features were not significantly different between the two race groups.

Mode of diagnoses for the total group of patients

Bronchoscopy was the mode of diagnosis for the majority of the 778 patients (479, 54.7%), followed by sputum cytology in 152 (18.3%) of cases, and fine-needle aspiration in 105 (12.7%). The remaining cases were diagnosed on pleural tap in 11 (1.3%), tissue biopsy in 23 (2.7%), surgery in 8 (1%) and autopsy in 1 (0.1%). No information on the modality of diagnosis was available for 44 (5.3%). In some cases, more than a single modality of investigation was utilised to obtain a diagnosis. Sputum cytology was positive in more black (85, 23.2%) than white patients (67, 14.3%), (p-value 0.0005). There were no significant differences in the utilisation of other modalities of diagnosis.

The histological types of lung cancer for the total group of patients

Squamous cell carcinoma was the most commonly observed tumour type overall. It was also the most prevalent in each population classification.
of the race groups. The rank order frequency is illustrated in Table III. Significant differences were noted in the frequency of the different lung cancer types in the black and white patients, in that more white patients had small cell carcinoma than black patients (p-value 0.01). Secondly, a significant proportion of black patients had large cell carcinoma compared to white patients (p-value 0.04). However, differences were also noted between the genders within the two racial groups. The most common histological type was squamous carcinoma followed by adenocarcinoma in black males and white females, while it was small cell carcinoma followed by adenocarcinoma in black females. It was squamous carcinoma followed by small cell carcinoma in white males, while squamous carcinoma was only ranked third in black female patients. Small cell carcinoma occurred predominantly in male white patients, while it was exclusively found in female black patients (p-value < 0.005) (Table III).

The operability of the total group of patients

The clinical, radiological and laboratory features of lung cancer were reviewed for possible operability. Six hundred and twenty cases (79.7%) were considered to be inoperable, and only 74 (9.5%) were determined to be operable on presentation. The remaining 84 (10.8%) of patients were of unknown operability status. There were no significant differences in the operability of the patients when stratified according to gender and population, as illustrated in Table IV.

Discussion

The majority of the patients in this study were middle-aged (a mean of 61 years) and cigarette smokers (77%), while the most common mode of lung cancer diagnosis was a bronchoscopy (54.7%), followed by sputum cytology (18.3%). The chest radiographs showed a lung mass in the majority of cases (71.3%). Squamous cell carcinoma (43.8%) was the most common cell type overall, followed by adenocarcinoma (21.5%), but significant differences existed among the different racial groups and within genders within the two racial groups. Almost 80% of the study population was considered to be inoperable at the time of presentation.

The majority of patients were male. This is in keeping with local and international findings. However, the incidence of lung cancer in men worldwide reached a plateau in the early 1980s, and since then it has been in decline. In this study, similar to previous ones, the mean age of the study population was middle-aged. Black patients were significantly younger than white patients (p-value < 0.001), an observation which

Table II: The radiological features of lung cancer in 778 patients

<table>
<thead>
<tr>
<th>Chest radiograph</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mass</td>
<td></td>
</tr>
<tr>
<td>Lung</td>
<td>357 (46.5%)</td>
</tr>
<tr>
<td>Hilar</td>
<td>166 (21.6%)</td>
</tr>
<tr>
<td>Mediastinal</td>
<td>18 (2.3%)</td>
</tr>
<tr>
<td>Pleural effusion</td>
<td>82 (10.7%)</td>
</tr>
<tr>
<td>Lung atelectasis</td>
<td>78 (10.2%)</td>
</tr>
<tr>
<td>Infiltrate</td>
<td>29 (3.2%)</td>
</tr>
<tr>
<td>Consolidation</td>
<td>25 (3.2%)</td>
</tr>
<tr>
<td>Pericardial effusion</td>
<td>1 (0.1%)</td>
</tr>
<tr>
<td>Hilar nodes</td>
<td>1 (0.1%)</td>
</tr>
<tr>
<td>Normal</td>
<td>4 (0.5%)</td>
</tr>
<tr>
<td>Other*</td>
<td>7 (0.9%)</td>
</tr>
<tr>
<td>Total**</td>
<td>768 (100%)</td>
</tr>
</tbody>
</table>

*: Lung mass with atelectasis. **: No data for 10 patients

Table III: The histological types of the lung cancer in 778 patients, stratified according to population and gender

<table>
<thead>
<tr>
<th>Histology</th>
<th>Black males, n (%)</th>
<th>Black females, n (%)</th>
<th>Total blacks, n (%)</th>
<th>White males, n (%)</th>
<th>White females, n (%)</th>
<th>Total whites, n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Squamous cell</td>
<td>137 (57.8)</td>
<td>12 (13.6)</td>
<td>153 (45.4)</td>
<td>127 (41.4)</td>
<td>54 (45)</td>
<td>188 (42.6)</td>
</tr>
<tr>
<td>Adenocarcinoma</td>
<td>46 (19.4)</td>
<td>24 (27.3)</td>
<td>72 (21.4)</td>
<td>55 (17.9)</td>
<td>38 (31.7)</td>
<td>95 (21.5)</td>
</tr>
<tr>
<td>Small cell carcinoma</td>
<td>0 (0)</td>
<td>40 (45.5)</td>
<td>41 (12.2)</td>
<td>85 (27.7)</td>
<td>1 (0.8)</td>
<td>88 (20)</td>
</tr>
<tr>
<td>Large cell carcinoma</td>
<td>30 (12.7)</td>
<td>7 (8)</td>
<td>38 (11.3)</td>
<td>19 (6.2)</td>
<td>10 (8.3)</td>
<td>30 (6.8)</td>
</tr>
<tr>
<td>Other*</td>
<td>24 (8.4)</td>
<td>5 (5.8)</td>
<td>33 (9.8)</td>
<td>21 (6.8)</td>
<td>17 (14.2)</td>
<td>40 (9.1)</td>
</tr>
<tr>
<td>Total**</td>
<td>237 (100)</td>
<td>88 (100)</td>
<td>337 (100)</td>
<td>307 (100.0)</td>
<td>120 (100)</td>
<td>441 (100)</td>
</tr>
</tbody>
</table>

The percentages are column percentages

*: Mixed small cell and squamous cell carcinoma, mixed small cell and large cell carcinoma, mixed adenocarcinoma, as well as intermediate and indeterminate cell type carcinoma formed the “Other” group

**: There were no details on the gender and population of 26 patients with lung cancer

Table IV: The operability of 778 lung cancer patients stratified according to population*

<table>
<thead>
<tr>
<th>Operability</th>
<th>Black, n (%)</th>
<th>White, n (%)</th>
<th>Total, n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>29 (8.6)</td>
<td>45 (10.2)</td>
<td>74 (9.5)</td>
</tr>
<tr>
<td>No</td>
<td>262 (77.7)</td>
<td>358 (81.2)</td>
<td>620 (79.7)</td>
</tr>
<tr>
<td>Unknown</td>
<td>46 (13.6)</td>
<td>38 (8.6)</td>
<td>84 (10.8)</td>
</tr>
<tr>
<td>Total</td>
<td>337 (100)</td>
<td>441 (100)</td>
<td>778 (100)</td>
</tr>
</tbody>
</table>

The percentages are column percentages

*: There were data of operability with intent to cure for only 694 patients
is comparable with that made elsewhere in the world. The majority of the lung cancer patients were smokers. This is compatible with the known association between lung malignancy and cigarette smoking. The degree of smoking of the white patients, irrespective of gender, was significantly more than that of the black patients, as reflected in the pack years (p-value < 0.001). By contrast, American black adults have a higher prevalence of smoking, despite a decline in smoking in the general population, a trend which has been persistent for several years.\textsuperscript{7}

A chest radiograph plays an important role in diagnosing lung cancer. In our study, a mass was detected in the majority of patients on chest radiograph. The masses were found either in the lung, hilar area or mediastinal distribution (46.5%, 21.6% and 0.3%, respectively). More white patients were discovered to have a lung mass on the chest radiograph (p-value < 0.001).

The majority of patients were diagnosed using bronchoscopy (57.7%), followed by sputum cytology (18.3%). This may be a reflection of available expertise within the tertiary services, and to some extent the difficult nature of the patients presenting to the pulmonology units of the institutions. The Western Cape experience, as described by Abdullah and Wilcox, documented the use of fine-needle aspiration as the most common modality of diagnosis in their tertiary institution.\textsuperscript{8} More black patients in the current study were sputum cytology-positive, while the remaining modalities utilised to diagnose lung malignancy showed no racial difference.

Adenocarcinoma (30%), squamous cell carcinoma (25%), small cell carcinoma (20%), and large cell carcinoma (10%)\textsuperscript{5,9} are the four major histological subtypes of lung cancer documented in the literature, in descending order of frequency. This distribution reflects the smoking patterns of the study population, with the majority being cigarette smokers. Alberg et al noted that lung cancer was of similar prevalence in black and white American women, while on the contrary, black American men had a higher prevalence than white American men.\textsuperscript{19} The rank frequency of the histological distribution did not reflect racial disparity, an observation which is contrary to other international and local data. Internationally, black patients have been shown to have a propensity for developing adenocarcinoma. Black male smokers constitute the majority in this regard.\textsuperscript{7} The study by Wilcox et al reported on ethnic differences with regard to cell subtypes. Squamous cell carcinoma was more common in black patients than in white and mixed-race patients.\textsuperscript{3} Black females had a high prevalence of small cell carcinoma in the current study, while squamous cell carcinoma was the most common cell type in black males, and white males and females. Small cell carcinoma was the second most common histological cell type in white males, followed by adenocarcinoma. Adenocarcinoma was the second most common tumour in black males and white females. This observation is in contrast to the international trend, where in terms of dominance, adenocarcinoma has overtaken squamous cell carcinoma in all gender groups.\textsuperscript{10,11}

For decades, squamous cell carcinoma was the predominant smoking-related cancer in the developed world, followed by small cell carcinoma.\textsuperscript{10}

The internationally reported operability rate for lung cancer is estimated to be 15-25%.\textsuperscript{12} In our study, approximately 10% of the patients who were diagnosed with lung cancer appeared to be operable, irrespective of population and gender. This dismal finding suggests advanced disease on presentation. The Groote Schuur study concurred with this observation. Only 11% of their patients underwent surgery.\textsuperscript{2} Owing to the high incidence of inoperability, it is anomalous that only one patient was radiologically reported to have regional lymphadenopathy. The reliability of the radiological features is doubtful in this regard.

**Limitations of the study**

Potential limitations of this study are fivefold. Firstly, the study was restricted to 1992-1998. Changes in the histological pattern may well have occurred in the intervening years. Secondly, as a retrospective case record review, some of the data that the authors wished to review were not available. Thirdly, the old histological classification was utilised. However, the large number of cases adds to the scant literature in the South African setting. A further limitation is that background rates of smoking were not collected on a comparable control group.

**Strengths of the study**

This study has a significant contribution to make in respect of the public health of patients, since it reinforces the important association of smoking and lung cancer. Smoking cessation may be able to reduce the incidence of lung cancer. The study also highlights the importance of screening high-risk patients for early detection, with the potential benefit of curative surgery for localised disease.

**Conclusion and recommendations**

It would be important to repeat this study, and to include patients from recent years, to determine if the observed findings and differences still remain, or whether changes have occurred, particularly when the current WHO classification and staging is taken into consideration. The potential impact of human immunodeficiency virus (HIV) infection also needs to be investigated further. Epidemiological data suggest that there is an elevated risk of lung cancer in HIV-infected individuals, even independent of smoking.\textsuperscript{13,14} The carcinogenic role of antiretroviral nucleoside drugs and their interaction with smoking needs to be examined. Since 90-95% of lung cancer is preventable, it would also be interesting to determine the overall impact of anti-smoking campaigns on the decline in lung cancer.

**Acknowledgements**

This study formed the basis of a Masters in Medicine (Internal
Medicine) research report. It was presented at the South African Thoracic Society Congress in Sun City in 2009.

Conflict of interest

The authors declare no conflict of interest.

References


Important notice:

Please note that, for reference/citation purposes:
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Southern African Journal of Infectious Diseases (South Afr J Infect Dis)(ISSN 2312-0053)

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