



Full Length Research Paper

Baseline study of sputum samples of individuals around the old Enugu coal mine

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Abstract

Since lung cancer is the leading cause of cancer related deaths worldwide, early detection of the disease will help in curbing the disease at the developmental stage. Therefore, sputum cytologic analysis was carried out on some residents of the Iva-valley area of Enugu, a coal mine settlement. Sputum samples were collected from 34 individuals who volunteered to participate in the study and proper cytologic analysis was carried out. Only five participants who have once worked in the coal mine showed the sign of slight atypia while the other 29 individuals showed no sign of any form of atypia. Nevertheless, a follow up study was recommended for those who showed a sign of slight atypia.

Keywords: Sputum cytology, Iva-valley coal mine, atypia, and lung cancer.

INTRODUCTION

The Enugu urban owes its status to the presence of coal mine located within the Iva-valley region in the outskirt of the city. The mine has been non operational since the late nineties but the effects of the mining operation is still very conspicuous within the environment. Most of the workers who once participated in the mining operations have settled within the valley which has now become their home.

Coal miners are subject to a number of lung diseases and disorders arising from their exposure to coal mine dust. These include pneumoconiosis, chronic bronchitis and obstructive lung disease. The occurrence and severity of disease depends on the intensity and duration of dust exposure. The specific composition of the coal mine dust also has a bearing on some health outcomes and many a times the development of lung cancer as result of radon inhalation in enclosed spaces are observed.

Many years ago, Saccomanno et al. (1974), defined the cytological changes that occur during the development of lung cancer. These changes were mainly documented in squamous metaplastic cells, and represent cellular aspects of toxic damage of respiratory

tract epithelium as a result of—for example, smoking or radon gas. The transition from mild, moderate, and marked atypia, to carcinoma in situ and then to invasive carcinoma has been described. The transition time varies considerably between patients, but on average the transition from mild to marked atypia takes five years, and the change from moderate atypia to carcinoma in situ and from marked atypia to invasive carcinoma takes an additional five years. Interestingly, patients developing squamous cell and small cell carcinoma show the same cytological changes. The point of development into one of the different types of carcinoma is unclear, but the transition time seems to be slightly shorter for patients developing small cell lung cancer Saccomanno et al. (1974).

Cytologic atypia of exfoliated cells has been shown to be associated with both prevalent and incident lung cancer (petty et al., 2002). In the Johns Hopkins Lung Project, 14% of the participants with sputum cytologic atypia graded as moderate or worse later progressed to lung cancer as compared with only 3% of those without atypia (Frost et al., 1984).

Because the inhalation of radon gas in enclosed

Table 1. Sputum cytologic conditions for the control group

characteristics	total participants	Sputum conditions			
		normal	slight atypia	moderate atypia	worse than moderate atypia
all	22				
Gender					
female	5	5	0	0	0
male	17	17	0	0	0
Age group					
10--19	8	8	0	0	0
20--29	11	11	0	0	0
30--39	2	2	0	0	0
40--49	1	1	0	0	0
education					
<= 6	0	0	0	0	0
>6	22	22	0	0	0
Smoking status					
never	14	14	0	0	0
low	4	4	0	0	0
moderate	2	2	0	0	0
high	2	2	0	0	0
Work place dust exposure					
non	22	22	0	0	0
low	0	0	0	0	0
high	0	0	0	0	0
residence (yr)					
1--5	6	6	0	0	0
6--10	7	7	0	0	0
11--15	2	2	0	0	0
16--20	5	5	0	0	0
21--25	2	2	0	0	0
medical history					
cough			0	0	0
Yes	13	13	0	0	0
No	9	9	0	0	0
phlegm					
Yes	7	7	0	0	0
No	15	15	0	0	0
wheezing					
Yes	2	2	0	0	0
No	20	20	0	0	0

spaces has been established to cause lung cancer, the aim of this work was to use sputum cytology screening as a tool in checkmating for any form of atypia in the lung cells of those who participated in the Iva-valley coal mining operations and those who are residents within the valley but never participated in the mining operations.

MATERIALS AND METHODS

Sputum samples were collected from the inhabitants of the Iva-valley coal mine. Participants in the study were former coal miners and non coal miners. Sputum

samples were collected from 22 individuals who have never participated in the mining operation while samples were also collected from 12 individuals whom were all ex-coal miners. At the time of sample collection, all participants completed standardized baseline questionnaires that included demographic characteristics; residential, occupational, smoking, and medical histories. The study received approval from the ethical review board, and informed consent was obtained for each participant.

Participants were provided with two containers filled with a fixative solution of 2% carbowax and 50% alcohol and instructed to collect an early morning, spontaneous

Table 2. Sputum cytologic conditions for the mine workers

characteristics	total participants	Sputum conditions			
All	12	normal	slight atypia	moderate atypia	worse than moderate atypia
Gender					
female	0	0	0	0	0
male	12	7	5	0	0
Age group					
41--50	3	3	0	0	0
51--60	4	2	2	0	0
61--70	3	2	1	0	0
71--80	2	0	2	0	0
education					
<= 6	5	1	4	0	0
>6	7	7	0	0	0
Smoking status					
never	7	7	0	0	0
low	2	0	2	0	0
moderate	3	0	3	0	0
high	0	0	0	0	0
Work place dust exposure					
non	0	0	0	0	0
low	10	7	3	0	0
high	2	0	2	0	0
residence (yr)					
10--19	2	2	0	0	0
20--29	8	4	4	0	0
30--39	2	1	1	0	0
medical history					
Cough					
Yes	8	3	5	0	0
No	4	4	0	0	0
Phlegm					
Yes	8	3	5	0	0
No	4	4	0	0	0
Wheezing					
Yes	5	2	3	0	0
No	7	5	2	0	0

cough sputum specimen for six consecutive days (3 days in the first container and 3 days in the second container). The second 3-day pooled sputum samples were those examined in this study. Specimens were homogenized, and then centrifuged at 1,500 rpm for 15 min, and four slide smears were prepared from the resuspended cell pellets. Slides were then air-dried, fixed with 95% alcohol, and stained using the Papanicolaou technique. Slides were initially screened and categorized by trained cytotechnologist. Final diagnosis was determined in all cases by review of the screened slides by a cytopathologist at the University of Nigeria Teaching Hospital (UNTH) Enugu Chest laboratory and the University of Port Harcourt Teaching Hospital, Port Harcourt, and cases were classified. Sputum cytology

diagnoses to be made were first categorized into five groups (unreadable, normal or squamous metaplasia, mild atypia, moderate atypia, or worse than moderate atypia).

RESULTS AND DISCUSSIONS

Table 1 shows the sputum cytologic result and the baseline demographic information of the individuals who are residents of the coal mining area but has never participated in any form of mining operations. From the demographic information, five of the participants were females while seventeen were males. None of the participants were above the 50 years age group. From

the sputum cytologic result, no form of atypia was recorded amongst all the twenty two individual who participated in the study, thirteen individuals have in one time or the other had episodes of cough, seven of them produced phlegm while two showed the sign of wheezing during the episodes. The cough were generally attributed to influenza which is common in the environment. Only eight individuals were recorded to have participated in one level of smoking or the other but there were no sign of atypia amongst those individuals. This could be attributed to the reason that none of the individuals have in any time worked in a dusty environment despite their living within the Iva-valley area.

Table 2 shows the sputum cytologic result and the demographic information of those who live within the Iva-valley area and who have in one time or the other participated in the mining operations. From the demographic result, all the twelve participants are males. About 58.3% of them have educational level of less than six years while the other 42.7% have educational level of above six years. This shows that most of them are illiterates. The age group of these set of individuals ranged from 40-80 years. Only five of the individuals have in one time participated in any level of smoking while the remaining seven have never participated in any form of smoking. From the result, there were cases of slight atypia (at the level of squamous metaplasia) for five individuals. The five individuals with cases of slight atypia were found to all be above the ages of fifty years and also have worked in environments where they were exposed to dust. Since squamous metaplasia is another common condition of the bronchial mucosa that result from chronic irritation. The most common cause is tobacco smoking and more than half of smokers contain foci of squamous metaplasia in their bronchi. Other conditions that may cause squamous metaplasia of the bronchial tree include organizing pneumonia, bronchiectasis, tuberculosis, fungal infection and irradiation (Akaogi et al., 1993). Veena et al. (2012), found persistent cough to be among clinical symptoms associated with malignancy in majority of cases, but it is difficult to distinguish cough associated with lung cancer from that of chronic lung diseases like COPD that usually results from smoking.

The present study suggests that amongst the individual who volunteered in participating in the study, the results of the sputum cytologic analysis shows that non was at the risk of lung cancer, though a follow up study will be recommended for those who show the sign of slight atypia in their sputum cells.

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