Effects of Air Pollution on Small Cell Lung Cancer in Guangxi Zhuang Autonomous Region

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Abstract. This article hopes to investigate the relationship between air pollution and small cell lung cancer through statistical data, and summarize experience. We investigated the causes of lung cancer in Beihai of Guangxi Zhuang Autonomous Region in recent 10 years. Results we found that there were relatively more lung cancer cases among workers of paper mills, residents living nearby and cottage residential areas, and the incidence of lung cancer among women increased and tended to be younger. Through statistical analysis, we believe that SO2 and smoke in the air are the main causes of small cell lung cancer.

1. Introduction

Lung cancer is one of the most common malignant tumors in China, which seriously threatens human life. The high mortality rate of lung cancer is mainly in Shanghai, Tianjin, Beijing, Liaoning, Jilin, Heilongjiang and other places.

Small cell lung cancer (SCLC) accounts for 15%-20% of all small cell lung cancers. It mainly consists of three subtypes: lymphocyte (oat cell) and intermediate cell (spindle, polygonal and other) and mixed type. There was no significant difference in prognosis among the three subtypes. Most small cell lung cancers are related to smoking, while others may be related to environment or heredity. The clinical manifestations of SCLC are similar to those of non-small cell lung cancer (NSCLC), such as cough, hemoptysis, chest pain, chest tightness, asthma, etc. Compared with NSCLC, SCLC has the characteristics of rapid tumor multiplication, high malignancy, extensive metastasis and abnormal endocrine syndrome. About 67% of small cell lung cancer patients had evident extrapulmonary metastases at the time of diagnosis, while only 33% of limited stage small cell lung cancer patients had lesions confined to a single radiation field in the thoracic cavity [1].

Traditionally, smoking is considered to be the first killer of small cell lung cancer. In recent years, according to the statistics of China's health authorities, although the smoking level of Chinese people has not changed significantly in the past 40 years, the incidence of small cell lung cancer has shown a significant upward trend. One of the most important factors is the deterioration of atmospheric environment.

Small cell lung cancer mostly occurs after 40 years old, the peak age of onset is between 70 and 79 years old. There are more male patients than female patients, and the ratio of male to female is 2.13:1 in our country. In recent years, the proportion of female small cell lung cancer patients has increased correspondingly due to the significant increase of female smokers. Although the etiology of small cell
lung cancer is not completely clear up to now, a large number of data show that the incidence of small cell lung cancer in urban residents is higher than that in rural areas, which indicates that it is related to air pollution and the presence of carcinogens in smoke and dust. Therefore, on the basis of advocating non-smoking, we should strengthen the work of urban environmental sanitation.

2. Methods and data

2.1. Statistical data
The incidence data of small cell lung cancer came from Beihai Cancer Registration and Reporting System. Population data are provided by the Household Registration Management Section of Beihai Public Security Bureau. The population of each age group is calculated year by year according to the "100-year-old table" of the national census, according to the number of births in that year, minus the number of deaths in each age group. Standardized rate is calculated according to the age group composition standard of the 2012 National Population Census. The environmental monitoring data are provided by the environmental monitoring station of the Municipal Environmental Protection Bureau. The monitoring items include: SO2, NO, ISP; the investigation of industrial exhaust emissions includes: SO2, hydrogen fluoride, industrial dust, smoke and dust; the air sampling method is carried out in January, April, July and October of each year for 5 consecutive days; the environmental monitoring is undertaken by professional and technical personnel; Evaluation criteria: according to GB3095 - 82 "Air Environmental Quality Standards" in the secondary standard evaluation; quality control: according to the "Environmental Monitoring Technical Specification" issued by the State Environmental Protection Bureau [2]. The data were processed by statistics. See Table 1.

| Year      | Men Cases | Men Morbidity | Women Cases | Women Morbidity | Total Cases | Total Morbidity |
|-----------|-----------|---------------|-------------|-----------------|-------------|-----------------|
| 2000-2006 | 109       | 46.89         | 35          | 16.21           | 144         | 32.12           |
| 2006-2012 | 227       | 62.48         | 75          | 21.99           | 302         | 42.87           |
| P         | <0.01     | <0.05         |             |                 |             |                 |

From 2000 to 2012, 446 cases of small cell lung cancer occurred in Beihai city, accounting for 22.84% of all malignant tumors in the same period, ranking first among all kinds of malignant tumors. The average annual incidence was 38.69/100,000 and the standardized rate was 26.58/100,000, of which 336 cases were male small cell lung cancer. The morbidity was 56.40/100,000, the standardized rate was 39.03/100,000; 110 cases were female, the morbidity was 19.75/100,000, the standardized rate was 13.39/100,000, and the sex ratio was 2.91:1. In order to eliminate the influence of the difference of population age composition on the incidence of small cell lung cancer, whether the incidence of small cell lung cancer in urban areas is higher than the average level of the whole city is judged? The expected incidence is calculated by the age-specific incidence of the whole city and the number of urban population. Then, the actual incidence is compared with the expected incidence, i.e. the standardized incidence ratio. Incidence ratio, SIR for short. The results showed that from 2000 to 2012, 280 cases were expected to occur in urban areas, while 446 cases were actually occurring and SIR was 1.59. The 99% confidence interval of Poisson distribution was 391-500 by normal approximation method, while 280 cases were expected to occur in small cell lung cancer, which was significantly lower than the lower limit of 391 cases (P < 0.01). The City Environmental Protection Bureau carried out a detailed investigation on the pollution sources (waste water and waste gas) of industrial enterprises in the city. The results showed that the annual discharge of industrial waste gas in the city was 595.52 million standard cubic meters, of which the urban area accounted for 25.4 % of the total. Industrial exhaust gas mainly concentrated in cement, chemical industry, brick and tile, printing and dyeing industries, accounting for 81.7% of the city's total load. Among the industrial exhaust pollutants, S([2], hydrogen fluoride are the main ones, accounting for 71.2% of the total load, and the treatment rate is 54.36%. The discharge of industrial exhaust gas pollutants (tons/square
kilometers per year) is detailed in Table 3. The emission of various pollutants (tons/square kilometers per year) in urban areas is much higher than that in towns and villages. U-test shows that the difference is very significant (P<0.001). The concentrations of SO2, NQ and TSP in the atmosphere of urban areas during 2000-2012 are the highest in 2006, the lowest in 2011. According to the Atmospheric Quality, the concentrations of SO2, TSP and NO are lower in 2010 and 2011. Except that TSP exceeded the secondary standard in 2009, the air quality in urban areas remained above the secondary standard in other years.

2.2. Results
The results showed that there were relatively more cases of small cell lung cancer among the workers, the long-lived households nearby and the cottage residential areas. The number of female cases of small cell lung cancer increased, and the incidence of small cell lung cancer tended to be younger. 177 women with small cell lung cancer had no history of smoking. However, the risk of small cell lung cancer is much higher than that of smokers.

Scholars have done a lot of research on the causes of small cell lung cancer, but it is still not fully clear. Nakanishi [4] and others found that the gases produced by indoor coal combustion can cause carcinogenesis. The patients' lungs contain high levels of benzopyrene. It is believed that the mutants contained in coal pollute indoor air and cause small cell lung cancer. Jakbosson et al.'s studies suggest that exposure to high concentrations of automobile exhaust may promote the occurrence of small cell lung cancer, but there are still different views on the relationship between air pollution and the incidence of small cell lung cancer. Van Rowland et al. think: the relationship between the two. Due to the influence of many factors, such as population density, degree of industrialization, industrial nature, energy types, number of vehicles, urban living conditions, green coverage, etc., it is difficult to draw a conclusion. The results show that the emissions of SO2, HF industrial dust and soot (tons/square kilometers per year) in urban areas are much higher than those in towns (P < 0.001). Although the overall air quality assessment from 2000 to 2012 shows that except one year when TSP exceeds the secondary standard, the other years remain above the secondary level, some people believe that the main hazards to human body are the changes of subclinical and physiological functions due to the low-dose and long-term characteristics of air pollution. The author also supports this view.

3. Discussion
Traditionally, smoking is considered to be the main culprit of small cell lung cancer. However, clinical data in recent ten years show that air pollution is the main cause of small cell lung cancer. In the air pollution, Grey Xinjiang is particularly concerned. Haze is related to harmful micro-dust caused by automobile exhaust, industrial exhaust, and volatile chemicals and so on. Surveys in China show that the mortality rate of small cell lung cancer in heavy industrial cities is positively correlated with the concentration of benzopyrene in the air [5]. The gas discharged from paper mills is monitored by the environmental protection departments at county, city and provincial levels, and all of them are toxic gases. It's mainly sulfur dioxide. Industrial smoke from SO2 emitted by paper mills causes' difficulty in breathing and nausea and vomiting in severe cases at high depths. Suspended particulate matter, such as dust and smoke, enters the lungs with breathing and can deposit in the lungs, which can easily cause respiratory diseases. Urbanized industrial pollution, pesticide pollution and automobile exhaust pollution have brought about a kind of environmental disease of malignant small cell lung cancer. The traditional view is that smoking is the first killer of small cell lung cancer, but in the past two years, the author and some academia have changed their views and put more and more emphasis on the role of air pollution. A large number of studies have proved that smoking is an important risk factor for small cell lung cancer. The incidence of small cell lung cancer in smokers is 25 times higher than that in non-smokers. 85% to 90% of male small cell lung cancer is related to smoking. The greater the daily smoking is, the younger the age at which smoking begins, the greater the risk of small cell lung cancer. In recent years, the proportion of women with small cell lung cancer has gradually increased, basically equal to that of men. The proportion of women in small cell lung cancer patients is
increasing, and the rate of increase is very fast. In modern society, with the improvement of women's status, the pressure of work also increases, especially for some white-collar women. Because of the pressure of work, they often choose to smoke to alleviate, thus becoming "hidden smokers". Air pollution in small environments is also a risk factor for increased risk of respiratory tract tumors. Oil fume from cooking at home is also harmful to human body. The pollution of decoration is also a kind of air pollution of small environment. Dancers practice dancing on carpeted stage, and their dust can also cause lung disease. Athlete's outdoor training in haze and toxic gas environment is a risk factor for small cell lung cancer. Clinical practice has proved that SO2 and smoke in the air are the main causes of small cell lung cancer.

![Image](image_url)

**Figure 1.** Tissue sample of small cell lung cancer affected by air pollution.

### 4. Conclusion

Small cell lung cancer (SCLC) is one of the main causes of small cell lung cancer. At present, it is considered that it is related to long-term air pollution, long-term smoking and genetic factors, as well as exposure to some radioactive and carcinogenic substances. The specific qualitative reasons are not very clear at present. For different people, the reasons and incentives are also different. Small cell lung cancer in small cell lung cancer is still a poor prognosis, prone to early metastasis, and treatment is more difficult. If it is found in a timely manner, there is no multiple metastasis, then for peripheral small cell lung cancer can be resected surgically. If it is located in the hilum of the lung, it can not be resected surgically, it can be done chemotherapeutically. Therapy and radiation therapy are helpful for delaying the growth of tumors and prolonging the survival time.

### References

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