The Epidemiology of Lung Cancer

KEVIN M. DINEEN, GERARD A. SILVESTRI

4.1 Introduction

Lung cancer is the most common cause of cancer and cancer death throughout the world. In the United States alone, lung cancer is expected to account for an estimated 169,400 of the 1.28 million new cases of cancer and 154,900 of 555,500 cancer deaths for 2002 (Jemal et al. 2002). Because the widespread incidence of lung cancer around the world mirrors the high rates of the United States, it is vital that the disease be studied in an effort to reduce the incidence of this disease. It is clear that cigarette smoking is the primary cause of lung cancer, thus making it a largely preventable disease. Epidemiology is the field of study that investigates the frequency, etiologies, incidence, and mortality of various disease states. This chapter will endeavor to highlight lung cancer incidence and mortality worldwide, identify changing trends in the lung cancer epidemic, and discuss the numerous etiologies of this deadly cancer.

4.2 World Epidemiology

Lung cancer is the most commonly diagnosed cancer worldwide (Coleman et al. 1993). It was a relatively rare malignancy at the beginning of the 20th century when rates were less than five per 100,000 (Gordon et al. 1961). However, the 1930s saw the beginning of a steep increase in the incidence of lung cancer until it became the most common cause of male cancer death by mid-century (ACS 1999). This increased incidence has continued in both the United States and the rest of the developed countries of the world, although there may be some trend towards a decrease in incidence in developed countries. Despite advances in diagnostic technology, chemotherapy, radiation, and surgery, lung cancer incidence and mortality continue to nearly mirror each other throughout the world. In the United States, the five-year cancer survival rates for all races between 1974 and 1997 have failed to change significantly, ranging from 11% to 15% (Jemal et al. 2002). European data reveals a similar survival rate of approximately 10% (Berrino et al. 1999).

Following the worldwide rates and trends in lung cancer incidence is a daunting task as there is no universal cancer registry. Lung cancer has traditionally been more common in the developed nations of the world such as North America and Europe and less common in developing countries such as those in Africa and South America (Parkin et al. 1994). Within each country, the rate of lung cancer for males is higher than that for females. However, the international rankings of lung cancer incidence for men and women from the same countries differ only slightly, so that the highest rates of lung cancer for both sexes occur in the same regions of the world (Samet 2002).

In 1996, the National Cancer Institute in Bethesda, MD published worldwide cancer rates for the years between 1986 and 1988 (National Cancer Institute 1996). The age-adjusted death rate per 100,000 population for men was highest in Belgium (77.2) and Scotland (75.5), with the ten highest rates all European...
countries. The lowest rates for men were from Thailand (5.5) and Ecuador (7.1), with the ten lowest rates found primarily in South America and Asia. For women, the highest rates were in Scotland (27.1) and Hong Kong (25.0), with Hong Kong and Singapore the only countries outside of Europe and North America. The lowest rates for females were also in Thailand (2.0) and Ecuador (2.9), with only France, Spain, and Portugal the only countries in the bottom ten outside of South America and Asia.

In January 2002, the American Cancer Society published an overview of cancer frequency, incidence, mortality, and survival statistics for the year 2000. The cancer death rates per 100,000 for multiple types of cancer in 45 countries were age-adjusted to the World Health Organization world standard population. Lung cancer rates were separated out from those of other types of cancer. For males, Hungary (86.2) and Poland (71.5) are expected to have the highest death rates from lung cancer, with each of the top ten highest rates again expected in European countries. The lowest rates are predicted for Trinidad and Tobago (13.2) and Mauritius (16.7), with a predominance of South American and Asian countries comprising those with the ten lowest rates. For females, the highest death rates are expected in the United States (27.2) and Denmark (26.2), with only Cuba and New Zealand from outside of North America and Europe among the ten highest rates. The lowest rates for females are found in Spain and Mauritius (4.2 each). The ten countries with the lowest expected death rates are found in Asia, Europe and the Caribbean (Jemal et al. 2002).

One of the more disturbing trends in lung cancer is the burgeoning epidemic in the countries of the developing world. In 1985 it was estimated that there were 921,000 lung cancer deaths worldwide – an increase of 17% from 1980 (Liu et al. 1998). The International Agency for Research on Cancer in France found that the rates of lung cancer in Africa were similar to those of the United States in the 1930s at about 5 per 100,000 (Gordon et al. 1961; Parkin et al. 1994). By 1999, the rate of male lung cancer in the developing countries was 14.1 per 100,000 and on the rise as compared to a rate of 71.4 per 100,000 in the developed countries, which continues to decline. For women, the lung cancer rate is 5.1 per 100,000 versus to 21.2 per 100,000 in developed countries (Pisani et al. 1999). These rates may actually underestimate the true rates of lung cancer as many cases may go undiagnosed or unreported in areas where health care is not readily available (Liu et al. 1998; Pandey et al. 1999). The etiologies of lung cancer outside of cigarette smoking are not well defined in much of the developing world due to a lack of epidemiological studies.

China is one exception where a fair number of studies have been performed to investigate lung cancer. China’s large population makes it possible to have large powered studies (many over 100,000) (Liu et al. 1998). Liu et al estimated in that nearly 800,000 Chinese men would die of lung cancer in 1998 (Liu et al. 1998). Peto et al predicted that China, given that it holds one-third of the world’s smokers, will have lung cancer death numbering in the millions annually by the middle of the twenty-first century (Peto et al. 1994). As with every other country, the epidemic of lung cancer in China is mainly due to cigarette smoking. Chinese men smoke 11 cigarettes per day on average, equivalent to the highest rate seen in the United States. In fact, the consumption of cigarettes in China alone may surpass that of all of the developed countries combined (Liu et al. 1998; Yang et al. 1999). Overall, 66.9% of Chinese men and 4.2% of Chinese women smoke. This is in large part due to poor education as to the risks of cigarette smoking. Only 4% of individuals studied were aware that smoking is related to heart disease and only 36% knew that smoking caused lung cancer (Liu et al. 1998; Yang et al. 1999).

In addition to the high rate of smoking, several other factors play a role in the increasing rates of lung cancer in the developing world. Diet likely plays a key role. On the whole, the inhabitants of countries in the developing world consume fewer calories and less fats and refined sugars. Low fruit, high fat, and red meat rich diets in countries like India (Sankaranarayanan et al. 1994) and China (Gao 1996) have been shown to be linked to lung cancer. An important component involving diet is the manner and environment in which food is prepared. For instance, nonsmoking women in China have elevated lung cancer rates (Liu et al. 1998). In America, only 20% of women with lung cancer are nonsmokers as compared to 90% in mainland China and 62% in Hong Kong (Kit 1997). A number of studies have proposed that the elevated lung cancer rates seen in nonsmoking women could be due to the indoor burning of coal used for cooking (Du et al. 1996; Gao 1996; Liu et al. 1998; Zhong et al. 1999). Another possibility is the vapors from the cooking oil which is known to contain a known carcinogen, benzo[a]pyrene (Du et al. 1996; Gao 1996; Kit 1997; Seow et al. 1998; Zhong et al. 1999). While these studies have been suggestive of an association between coal use and Chinese-style cooking and lung cancer, further investigation is needed to confirm this relationship. Lastly, the countries of the developing world have higher rates of lung