Chapter 4
Terpenes and Lung Cancer

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ABSTRACT

Terpenoids, a broad category of secondary metabolites found in plants, have been recognized for their antioxidant, anti-inflammatory, and anticancer characteristics. These substances, which encompass monoterpenes to poly-terpenes, have been observed to impact various phases of tumor development, from the early onset and progression of tumorigenesis to the later stages of angiogenesis, invasion, and metastasis. With respect to lung cancer, a number of terpenoids have demonstrated potential effectiveness. Monoterpenes, for instance, have been associated with the prevention of cancers in the breast, liver, and lungs. Additionally, cannabinoids, a subset of terpenes, have exhibited anti-tumor effects specifically targeting lung cancer. While the anticancer properties of terpenoid are promising, there is a need for more comprehensive preclinical and translational research to fully understand

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their potential and to develop effective therapeutic strategies. A key area of focus in this research is understanding the complex interplay between apoptosis and autophagy, which is driven by the activation or silencing of specific proteins, in the context of terpenoid induced autophagy in cancer cells. In conclusion, terpenoids present a promising path for the development of new therapies in the management and treatment of lung cancer.

1. INTRODUCTION

The lungs, which are vital organs for breathing, are where lung cancer starts. Non-Small Cell Lung Cancer (NSCLC) is the most prevalent kind of lung cancer, making up over 85% of cases. Adenocarcinoma, squamous cell carcinoma, and giant cell carcinoma are among its subtypes (Li et al., 2022). Small Cell Lung Cancer (SCLC) is a less common but more aggressive form of the disease that spreads swiftly and is frequently discovered at an advanced stage. Chest pain, shortness of breath, coughing up blood, and unexplained weight loss are all signs of lung cancer (Ettinger et al., 2022). Smoking is the main cause of lung cancer, accounting for the majority of cases. A family history of lung cancer and exposure to radon gas, asbestos, secondhand smoke, and other toxins are additional risk factors. Sputum cytology, biopsies, and imaging tests (such as CT and X-rays) are used to diagnose lung cancer (Skoulidis et al., 2022). Surgical removal of the tumor or a portion of the lung, radiation therapy using high-energy rays to kill cancer cells, chemotherapy using drugs to kill cancer cells, targeted therapy using drugs that target specific mutations in cancer cells, and immunotherapy to strengthen the immune system to fight cancer are all possible treatment options for lung cancer, depending on its type and stage (Zappa and Mousa, 2016).

With a mean age at diagnosis ranging from 54 to 70 years, lung cancer is usually detected in India over ten years sooner than in Western nations (Noronha et al., 2024). Air pollution, exposure to carcinogens like asbestos and chromium, and passive smoking are some of the contributing causes to the high number of non-smokers who get lung cancer in India. Between 1990 and 2019, the age-standardized incidence rates (ASIR) of lung cancer increased from 6.62 per 100,000 to 7.7 per 100,000. Both males and women have seen this growth (Biswas et al., 2023). With an annual incidence of 72,510 cases and 66,279 fatalities, lung cancer continues to be the most common cause of cancer-related deaths in India. Unfortunately, 75% of cases of lung cancer in India are detected between stages 3 and 4, meaning that the disease is frequently detected at an advanced stage, leading to poor outcomes and high fatality rates. By 2025, the number of lung cancer cases in India is expected to have more than tripled from a decade ago. Addressing this expanding health issue