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Opinion

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An Analysis of the Interactions between Modern Chemotherapy Medications and Traditional Remedies for the Treatment of Non-Small Cell Lung Cancer

Jacob Taylor*

Abstract

The fact that lung cancer is the most common cancer to cause death makes it a desirable condition for study and potential improvement of therapeutic treatment choices. Lung cancer is frequently treated with surgery, radiation, chemotherapy, targeted therapies, and immunotherapy alone or in combination. Chemotherapy-based regimens appear to have achieved a therapeutic plateau, yet these treatment modalities may have varied side effects. As a result, this problem needs to be addressed and hopefully resolved with the help of efficient, better-tolerated medicines. Recent developments have made it possible for biologists to more thoroughly explore the potential application of natural chemicals for the control or therapy of many malignant conditions. Chemotherapy has relied on natural substances for the past 30 years. However, only a small number of substances have been studied in cancer patients, and there is only scant information about their clinical efficacy. Here, we evaluate the evidence for the therapeutic benefits of natural substances (such as Wortmannin and Roscovitine, Cordyceps militaris, Resveratrol, OSU03013, Myricetin, Berberine, and Antroquinonol) and current chemotherapy medicines, including those against non-small cell lung cancer. We suggest using these medicines in combination with chemotherapeutic treatments for patients with advanced and/or refractory solid tumours based on the literature review.

Keywords: Chemotherapy; Solid tumors; Surgery; Natural compounds; Radiation

Introduction

Lung cancer is the most common cause of death worldwide among all cancers. It is responsible for 1.4 million (or 17.7%) of all cancer deaths per year. The most prevalent form of lung cancer, lung adenocarcinoma, affects smokers and non-smokers as well as people under the age of 45. For men who smoke and for women who smoke, adenocarcinoma makes up about 30% and 40%, respectively, of primary lung tumors. These figures are close to 60% for men and 80% for women among non-smokers. Asian populations are also more likely to develop this specific type of lung cancer. In Taiwan, the number of lung cancer deaths has been on the rise. Although novel treatment modalities have been developed, the overall 5-year survival rate has only slightly increased over the past 2.5 decades, hovering at roughly 16%. Non-Small Cell Lung Cancer (NSCLC) screening, early diagnosis methods, and hits are still absent. Unfortunately, many lung cancer patients receive a diagnosis at an advanced stage-stage 3rdb or 4th-when there is no curative treatment available. Male cancer deaths in Taiwan are most frequently caused by liver, lung, stomach, colon, and oral cavity cancers, whereas female cancer deaths are most frequently caused by lung, liver, cervix uteri, breast, and stomach.

Smoking, drinking alcohol, and chewing betel nut are three significant lifestyle factors linked to an elevated risk of cancer in Taiwan. In a dose-response connection, smoking has been shown to increase the risk of developing lung, hepatoma cellular carcinoma, oral cavity, neural progenitor cells, esophageal, urinary bladder, and cervical cancer. Similar to this, tobacco use accounts for 85% of lung cancer cases in western countries and is one of the major etiological factors. A higher dietary consumption of fruits or vegetables is associated with a lower chance of developing lung cancer, according to studies on the connection between nutrition and the disease. Endogenous variables are likely to have a role in lung cancer development as only 10% to 15% of smokers do. Small Cell Lung Cancer (SCLC) and Non-Small Cell Lung Cancer (NSCLC) are the two main kinds of lung cancer, with non-small cell lung cancer accounting for 80% to 85% of diagnosis. Each form of cancer has a unique growth and dissemination pattern. NSCLC is usually categorized as squamous cell carcinoma, adenocarcinoma, or large-cell carcinoma based on histological classifications. Only 3% to 4% of cases of other, less common subtypes like Bronchiolo Alveolar Carcinoma (BAC) occur, while 10% to 15% of adenocarcinomas exhibit BAC characteristics. About 15%-20% of instances of lung cancer with neuroendocrine morphological characteristics are SCLC.

Therapy for lung cancer

Any cancer treatment seeks to eradicate the malignant cells while sparing the healthy ones. Surgery, radiation, and chemotherapy are the most popular forms of cancer treatment. These treatments can be used alone or in conjunction with one another or with other treatments. Surgery is usually the first line of treatment for most malignancies, especially solid tumors, and entails the removal of the obviously malignant tissue. To validate a biochemical diagnosis and further ascertain the size and distribution of the tumor, ultrasound and/or CD scanners are employed as diagnostic techniques. High energy X-rays are used in radiation therapy to shrink tumors. It is typically used in conjunction with surgery or an alternative form of chemotherapy, or as a neo-adjuvant therapy to help with surgery by shrinking a tumor, and is regarded as a local treatment because it only affects the area surrounding the tumor. However, tumor radio-resistance, systemic tumor growth, and local or distant metastases frequently restrict the therapeutic efficacy of radiotherapy alone for treating locally or regionally advanced disease. In Section Two below, we'll go into further depth about chemotherapy.

Chemotherapy drugs and treatment

Numerous anticancer medications used in lung cancer chemotherapy treatment have progressively lost their efficacy for

***Corresponding author:** Jacob Taylor, Editorial Office, Clinical Oncology: Case Reports, United Kingdom E-mail: oncologyreport@escienceopen.com

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patients who have a positive mutation of the tumour marker p53 as a result of genomic studies that have been supporting an efficient application of anticancer treatments. Chemotherapy, which uses chemicals or medications to kill cancer cells, has widespread impacts. Based on their modes of action, anticancer medications currently fall into a number of different types, which include the following: Antimetabolites, which substitute for the regular RNA and DNA building blocks, Alkylating chemicals, which degrade DNA, Antibiotics, which obstruct DNA replication enzymes; mitotic inhibitors, which prevent mitosis and cell division; topoisomerase inhibitors, which block either topoisomerase I or II, the enzymes responsible for unwinding DNA during replication and transcription; and corticosteroids, which are used to treat cancer and lessen the side effects of other medications.

Chemotherapy used as a palliative measure may be beneficial for patients with metastatic and unrespectable cancer. A platinum agent-based doublet, such as cisplatin or carboplatin, in conjunction with a third-generation cytotoxic medication, gemcitabine, a taxane (paclitaxel, docetaxel), or vinorelbine constitutes first-line chemotherapy treatment, according to current recommendations. The clinical outcome of cisplatin doublets is marginally better than carboplatin-based chemotherapy without being associated with an increase in severe adverse effects, according to meta-analyses of randomized clinical studies comparing the two drugs. When compared to platinum-based comparator regimens, a different meta-analysis revealed that gemcitabine-platinum regimens reduced overall mortality.

Bevacizumab, a monoclonal antibody that targets the Vascular Endothelial Growth Factor (VEGF), was authorized in late 2006 for use in conjunction with the chemotherapeutic drugs paclitaxel and carboplatin for the first-line treatment of patients with non-squamous NSCLC. Bleomycin, doxorobucin, etoposide (VP-16), cisplatin, and methotrexate are some anticancer medications used to treat lung cancer. These medications have been shown to increase the expression of the Fas ligand (FasL) on the surface of cells that express the Fas receptor, suggesting that the apoptosis these medications cause may be mediated by Fas cross-linking. Those with a positive K-ras mutation can benefit from platinum medicines, whereas patients with high Her-2 expression cannot benefit from many medications. Taxanes are also more successful when p27 is expressed more; however they are ineffective for patients who have a positive beta-tubulin mutation. In conclusion, patients with high Excision Repair Protein (*ERCC1*) expression would not benefit from cisplatin or other platinum medicines.

Radiotherapy/Chemo-radiotherapy

A locally advanced tumor that cannot be surgically removed affects around one in three NSCLC patients. As a result, radiation is still a popular therapeutic choice for patients with this stage of lung cancer. However, more research is still needed to completely understand how radiation affects cancer cell migration and transformation as well as other malignant biological behaviors. The median overall survival rate with radiation alone, however, is 9 months to 11 months, and the dismally low 5-year survival rate of 3% to 10%. Despite the fact that radiotherapy is a significant therapeutic approach for the treatment of cancer, prior research has indicated that radiation may stimulate tumor migration, distant metastasis, and the invasive capacity of cancer cells in unfavorable ways.

NSCLC cell lines, in contrast to SCLC cell lines, are typically less sensitive to radiation and are weakly impacted by existing medicines, which implies that for roughly 25% of patients who are resectable at diagnosis, surgery constitutes practically the only curative option. On the other hand, chemotherapy prior to radiation therapy makes cancer cells more susceptible to it. As a result, various studies have examined the outcomes of combining radiation and chemotherapy for patients with stage IIINSCLC that is unrespectable. However, this study found that the group receiving concomitant chemo-radiotherapy experienced higher toxicity, nauseousness, and vomiting. Therefore, if we can provide radiation treatment and natural substances that can sensitize NSCLC for radiation therapy, it may be beneficial in terms of minimizing toxicity and boosting the effect of radiation therapy.

Natural compounds

Anticancer substances have long been found in natural substances. Traditional Chinese Medicine (TCM) has been used for many years in China and other countries to treat malignancies. Herbal remedies are typically inexpensive, readily available, and exhibit relatively little toxicity or adverse effects in clinical settings. The most important substances, including paclitaxel and the Vinca alkaloids, were sometimes found by chance or through slow, arduous in vivo screening. The development of medications or vaccines that specifically target important chemicals that can prevent the growth, metastasis, and proliferation of tumor cells is a major focus of current research in cancer therapies. The effects of natural substances on cellular defense mechanisms, such as the detoxifying and antioxidant enzyme systems, and the induction of anti-inflammatory, antitumor, and anti-metastasis responses, frequently by targeting specific key transcription factors, are what cause cancer prevention and/or protection.

Due to the formation of resistance, conventional chemotherapy is ineffective for the majority of NSCLC patients receiving clinical treatment. As a result, it is vital to create new treatment plans to increase cancer cells' sensitivity to chemotherapy-induced cell death. In the examples below, we show how certain naturally occurring chemicals can target apoptotic pathways and how these events can be used to treat cancer.

Conclusion

Patients with NSCLC in the early stages often have two treatment options: surgery or radiotherapy. Chemotherapy has demonstrated some efficacy when administered alone to individuals with stage IV illness, as well as when combined with radiotherapy to treat patients with locally progressed disease and those with early-stage NSCLC prior to surgery. Based on clinical research and the findings of meta-analyses, platinum medicines are still regarded as being of utmost importance, despite their documented toxicity and inherent resistance. Chemotherapy's poor efficacy and significant toxicity have led to a lot of scepticism about this strategy for a long time because just a minor improvement in survival rates was noticed. Today, chemotherapy is a widely established type of treatment for stage IIIB/IV NSCLC, and interest in its application in the early stages of the illness when paired with other (local) therapies is developing. Natural substances, meantime, have been utilized to treat a variety of illnesses and are expanding as a key field of study for the development of new drugs. In individuals with advanced and/or refractory solid tumors, combining natural medicines with chemotherapy medications may lessen the toxicity risk it produces and offer a practical means of managing and controlling cancer.

Author Affiliations Top

Editorial Office, Clinical Oncology: Case Reports, United Kingdom