

## **New Advances in Lung Cancer Treatment**

Lung cancer is the most deadly type of cancer among other types of cancer. Lung cancer is estimated to cause more than 1.38 million deaths annually. Lung cancer mortality exceeds the accumulated mortality rate of the three most common types of cancer, namely colon cancer, breast cancer, and prostate cancer. The 5-year survival rate in lung cancer patients in 2006-2012 only reached 18.7%.

Histologically, lung cancer can be categorized into 2 types, namely small cell lung carcinoma and non-small cell lung carcinoma (NSCLC). Small cell lung carcinoma includes 15% of lung cancer cases, while non-small cell lung cancer is the most common type of lung cancer, covering 85% of lung cancer cases. The non-small cell lung cancer is further classified into 3 types, namely squamous cell carcinoma, adenocarcinoma, and large cell carcinoma.

Factors that are closely related to the occurrence of lung cancer are smoking. Smoking is estimated to have caused 80-90% of lung cancer cases. The presence of cigarette exposure to people who do not smoke (passive smoker) is also another strong risk factor for lung cancer. The risk of lung cancer in the passive smoker is 1.14 to 5.20 in non-smokers who live with smoker. In addition to smoking, exposure to certain carcinogenic substances is also known to trigger lung cancer. Radon, a naturally-occurring carcinogen, which is often exposed to mine workers is known to be another risk factor for lung cancer and is thought to have caused 21,000 lung cancer cases in United States. Asbestos exposure in industrial workers can also increase the risk of lung cancer. In addition, another risk factor that is equally strong is the history of lung cancer in the family. With a history of lung cancer in the family is suspected to be accompanied by a mutation in certain genes which can then trigger lung cancer.

Currently available therapeutic options for lung cancer include surgery, adjuvant therapy, chemotherapy, radiotherapy, and targeted therapy. The choice of therapy for patients who have stage I, II, and III NSCLC is surgery to take part of the lobe that has a tumor. Surgery can only be done on resectable tumors. To be able to find out whether a tumor is resectable, imaging and biopsy tests need to be done first. Adjuvant therapy is given to patients who have undergone surgical

therapy first. Adjuvant therapy can include radiation, chemotherapy, and targeted therapy. The aim of adjuvant therapy is to reduce the risk of lung cancer relapse. Patients who have stage IIA, IIB, and IIIA NSCLC usually receive chemotherapy after surgery to kill cancer cells that may still remain.

Chemotherapy is the main therapeutic modality in patients who have stage IV. The goal of giving therapy to these patients is to improve survival and reduce the risk of adverse events. Radiotherapy is usually given to NSCLC patients who are localized and are not candidates for surgery. Radiotherapy can also be palliative care to improve the quality of life of NSCLC patients who do not respond to surgery or chemotherapy.

In the last few decades, there have been various advances in the field of molecular characterization of lung cancer resulting in more effective target therapy. Unlike traditional chemotherapy which generally targets rapidly dividing cells and target therapy that works on molecular events in cancer cells that play a role in triggering growth and invasion of cancer cells, immunotherapy has a role to assist in recognizing cancer cells as foreign bodies by the body's immune system, stimulating work from the immune system, and restore the inhibitory effect that was initially disrupted and cause cancer cell growth.

The principle used in immunotherapy as one of the treatment options for lung cancer is the concept that the immune system has an important role in antitumor activity. Under normal conditions, the body's immune system will recognize cancer cells and initiate a response to kill cancer cells after the tumor antigen is identified. However, cancer cells have the ability to avoid early detection by the immune system and prevent antitumor effects that should occur. This then causes the continued growth and spread of cancer cells.

Immunotherapy has a role to strengthen the body's immune system and trigger the appropriate response to cancer cells. Immunotherapy can work actively or passively. Active immunotherapy modulates the immune system and stimulates humoral immunity and cell-mediated immunity. Some immunotherapy included in active immunotherapy are recombinant cytokines such as interleukin-2 and interferon-a, cancer vaccines such as sipuleucel-T, and immunomodulatory monklonal antibodies such as nivolumab and atezolizumab. On the other hand,

passive immunotherapy does not require activation of the immune system to work. Therapy included in passive immunotherapy are oncolytic virus, target-specific monoclonal antibodies, and T-cell therapy. The administration of immunotherapy to lung cancer patients is reported to produce more effective treatment results and help to increase survival rates. In the past few decades, there has been significant progress in the field of lung cancer treatment. Immunotherapy that is being developed can provide many benefits for increasing survival rates in patients with lung cancer. However, further research is needed to develop other therapeutic options.

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