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Understanding Lung Cancer: Causes, Symptoms, and Modern Therapies

Lung cancer, a pervasive and potentially fatal disease, remains a significant health concern worldwide. Understanding its multifaceted causes, ranging from environmental factors to genetic predispositions, and exploring the diverse treatment options available are crucial for combating this formidable illness. This article delves into the intricate web of factors contributing to lung cancer, emphasizing the importance of early detection and highlighting the advancements in treatment modalities, including surgery, chemotherapy, radiation therapy, immunotherapy, and targeted drug therapy.

Lung cancer is a type of cancer that begins in the lungs. It is caused by the abnormal growth of cells in the lungs, which can form tumors and spread to other parts of the body. The causes of lung cancer can be broadly categorized into two types: environmental and genetic factors. Environmental factors include smoking tobacco, exposure to secondhand smoke, occupational hazards (such as asbestos, radon, and certain chemicals), air pollution, and previous chronic lung diseases. Common symptoms associated with lung cancer include persistent coughing, coughing up blood, wheezing, chest pain, hoarseness, weight loss, loss of appetite, shortness of breath, and recurring lung infections.

Smoking is the most common cause of lung cancer, responsible for about 80-90% of all lung cancer cases. When one breathes in tobacco smoke, thousands of chemicals enter the lungs. Many of these chemicals have the potential to damage the DNA in lung cells. The body will work to repair the damage that's done by these chemicals, but over time, smoking can cause more damage than the body can heal. Eventually this may lead to the formation of cancer cells. Inhaling tobacco smoke can also damage the tiny air sacs called alveoli in the

lungs. These microscopic air sacs are the center of the respiratory system's gas exchange. They move oxygen into the blood, and expel carbon dioxide when exhaling. Over time, the damage to the alveoli in the lungs can lead to chronic obstructive pulmonary disease. Not every person who smokes will develop lung cancer, but smoking significantly increases the odds. People who smoke are 15 to 30 times more likely to get lung cancer than non-smokers. The longer one smokes and the more often one smokes, the higher the risk. Men who smoke have 23 times the risk of lung cancer and women who smoke have 13 times the risk of lung cancer compared to non-smokers. It's estimated that about 90 percent of lung cancers can be attributed to smoking.

Occupational hazards such as asbestos, radon, and certain chemicals can also increase the risk of developing lung cancer. In addition, research suggests that exposure to air pollution can increase a person's risk of developing lung cancer. Air pollution contains many carcinogens, including benzene, polycyclic aromatic hydrocarbons (PAHs), and nitrogen oxides. These substances can damage DNA in the cells lining the lungs, leading to mutations that can cause cancer.

Asbestos is a naturally occurring mineral that was once widely used in construction materials. When asbestos fibers are inhaled, they can become lodged in the lungs and cause scarring and inflammation. Over time, this can lead to the development of lung cancer. Radon is a naturally occurring radioactive gas that is found in soil and rocks. When radon gas is released from the ground, it can accumulate in buildings and homes. Exposure to high levels of radon gas over time can increase a person's risk of developing lung cancer. Certain chemicals used in manufacturing processes have also been linked to an increased risk of developing lung cancer.

Some genetic mutations that contribute to lung cancer run in families, but others do not. One of the most common genetic mutations that lead to lung cancer is an abnormal

EGFR mutation gene. This mutation is common among patients with non-small cell lung cancer, resulting in excess EGFR proteins. Inherited changes to DNA in chromosome 6 are also known to increase the risk of lung cancer, even in those who do not smoke. Some people inherit faulty DNA repair mechanisms, which makes it harder for them to repair DNA damage caused by radiation and carcinogenic chemicals. Most gene mutations that lead to lung cancer happen because of things one has been exposed to. Tobacco is the most common cause of genetic changes to lung cells, but it isn't the only one. One's genes could change if one comes into contact with asbestos or radon on a regular basis. Genetic testing can help identify people who are at higher risk of developing lung cancer. For the EGFR gene, 25% have a mutation in the KRAS gene. About 10% of people with non-small-cell lung cancer (NSCLC) have a mutation in target to these gene changes.

Lung cancer may cause symptoms such as shortness of breath, persistent cough, chest pain, and chest infections. Shortness of breath is a common symptom of lung cancer. It occurs when the tumor blocks or narrows an airway, making it difficult for air to flow in and out of the lungs. Persistent cough is another common symptom of lung cancer. It can be dry or produce phlegm and may worsen over time. Chest pain whether sharp or dull and may be felt in the chest, shoulder, or back. Chest infections occur when the tumor blocks an airway and causes mucus to build up in the lungs.

Additional symptoms of lung cancer include hoarseness, weight loss, fatigue, and loss of appetite. Hoarseness emerges when the tumor affects the nerve that controls the vocal cords. Weight loss and fatigue are outcomes of when the body uses more energy to fight the cancer cells. Loss of appetite may result due to a variety of reasons such as nausea, vomiting, or changes in taste and smell. It is crucial to note that not everyone with lung cancer will experience all these symptoms. Some people may not experience any symptoms at all until the disease has progressed to an advanced stage.

There are several types of cancer treatments available, and the type of treatment that one receives will depend on the type of cancer one has and how advanced it is. Here are some of the most common treatments:

Surgery is a common treatment for cancer and is often used to remove the cancer or as much of it as possible. The goal of surgery is to remove the tumor and any surrounding tissue that may contain cancer cells. Surgery can be used alone or in combination with other treatments such as chemotherapy or radiation therapy.

Chemotherapy uses drugs to kill cancer cells. It can be given orally or intravenously and is often used in combination with other treatments such as surgery or radiation therapy. Chemotherapy can be used to shrink tumors before surgery, destroy any remaining cancer cells after surgery, or slow the growth of cancer cells that have spread to other parts of the body.

Radiation therapy uses high-powered energy beams, such as X-rays and protons, to kill cancer cells. It can be used alone or in combination with other treatments such as surgery or chemotherapy. Radiation therapy can be used to shrink tumors before surgery, destroy any remaining cancer cells after surgery, or slow the growth of cancer cells that have spread to other parts of the body.

A bone marrow transplant is a procedure that replaces damaged or destroyed bone marrow with healthy bone marrow stem cells. It is used to treat certain types of cancer, such as leukemia and lymphoma. There are two types of bone marrow transplants: autologous (using one's own stem cells) and allogeneic (using stem cells from a donor).

Immunotherapy is a type of cancer treatment that helps the immune system fight cancer. It can be used alone or in combination with other treatments such as chemotherapy or radiation therapy. Immunotherapy works by stimulating the immune system to recognize and attack cancer cells.

Hormone therapy is a treatment that slows or stops the growth of breast and prostate cancers that use hormones to grow. Hormone therapy works by blocking the production or action of hormones in the body.

Targeted drug therapy uses drugs to target specific molecules (such as proteins) that are involved in the growth and spread of cancer cells. It can be used alone or in combination with other treatments such as chemotherapy or radiation therapy.

Clinical trials are research studies that test new treatments for cancer. They are designed to find better ways to treat cancer patients and are often available at major medical centers. Clinical trials are an important part of cancer research and can help improve the standard of care for future patients.

Lung cancer is a topic of interest for researchers, patients, and health professionals. According to a study by the Centers for Disease Control and Prevention (CDC), the overall risk of being diagnosed with lung cancer is expected to decrease in men and stabilize in women by 2050. Researchers are making significant progress in identifying many different genetic alterations that can drive lung cancer growth. Advances in genetic susceptibility, early detection, and individualized therapy based on each tumor's unique biological properties all hold promise for the future management of lung cancer. Immunotherapy is a promising treatment option for lung cancer. A recent FDA-approved treatment that combines chemotherapy and immunotherapy, given before surgery, is bringing new hope.

Researchers are also looking for new treatment options for all stages of lung cancer. According to Sandip P. Patel, MD, the future of lung cancer research is bright both in the domain of targeted therapies, using molecular testing to better understand the Achilles heels of cancer, and then adopting a targeted therapeutic approach, as well as the use of immunotherapy and novel immunotherapy targets such as TIGIT [T-cell immunoreceptor with immunoglobulin and ITIM (immunoreceptor tyrosine-based inhibitory motif) domain]

or novel therapeutic modalities such as antibody-drug conjugates, which will help increase the therapeutic armamentarium and determine the best particular option for a given patient.

In conclusion, lung cancer continues to pose a substantial threat to global public health, with its prevalence underscored by the staggering impact of various environmental and genetic influences. However, the ongoing strides in medical research, particularly in the realms of targeted therapies and immunotherapy, offer a ray of hope for improved outcomes and enhanced personalized treatment strategies. By fostering awareness, advocating for early screening, and harnessing the power of innovative therapies, the collective effort to combat lung cancer can potentially transform the landscape of cancer care and pave the way for a brighter, healthier future.

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