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# LUNG CANCER: ITS CONCLUSION AND EFFECTS

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## ABSTRACT

Anyone can develop lung cancer, but cigarette smoking and exposure to smoke, inhaled chemicals, or other toxins can increase the risk. Lung cancer can be life threatening, but effective diagnoses and treatments, including chemotherapy and surgery, are improving the outlook. Lung cancer has one of the lowest survival states because cases are often diagnosed at later stages, when the disease is less likely to be curable. The national average of people alive five years after a lung cancer diagnosis is 26.6%, which is a 22% improvement over the last five years. Lung cancer is cancer that forms in tissue of the lung, usually in the cells that line the air passages. It is the leading cause of cancer death in both men and women. A study in this topic is really needed.

**Key words**: lung cancer, survival, chemotherapy.

## INTRODUCTION

Lung cancer is a disease characterized by uncontrolled cell growth in tissues of the lung. If left untreated, this growth can spread beyond the lung in a process called metastasis into nearby tissue and, eventually, into other parts of the body. [1] Most cancers that start in lung, known as primary lung cancers, are carcinomas that derive from epithelial cells. The main types of lung cancer are small-cell lung carcinoma (SCLC), also called oat cell cancer, and non-small-cell lung carcinoma (NSCLC). [2] The most common cause of lung cancer is long-term exposure to tobacco smoke, which causes 80–90% of lung cancers. Nonsmokers account for 10–15% of lung cancer cases, and these cases are often attributed to a combination of genetic factors, radon gas, asbestos, and air pollution including second hand smoke. [3, 4, 5]

The most common symptoms are coughing (including coughing up blood), weight loss and shortness of breath. Lung cancer may be seen on chest radiograph and computed tomography (CT scan). [6] The diagnosis is confirmed with a biopsy. This is usually performed by bronchoscopy or CT-guided biopsy. Treatment and prognosis depend on the histological type of cancer, the stage (degree of spread), and the patient's general well-being, measured by performance status. Common treatments include surgery, chemotherapy,

and radiotherapy. NSCLC is sometimes treated with surgery, whereas SCLC usually responds better to chemotherapy and radiotherapy. [7]

Survival depends on stage, overall health, and other factors. Overall, 15% of people in the United States diagnosed with lung cancer survive five years after the diagnosis. Worldwide, lung cancer is the most common cause of cancer-related death in men and women, and is responsible for 1.38 million deaths annually, as of 2008.

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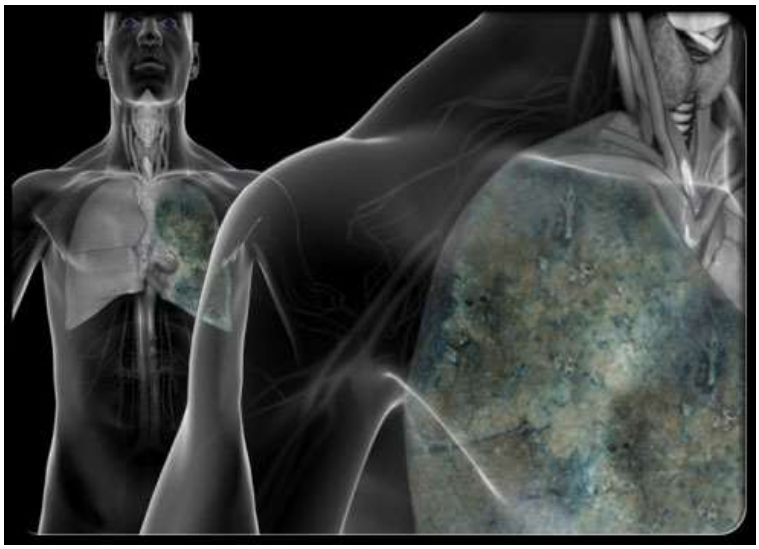


**CAUSES OF LUNG CANCER**

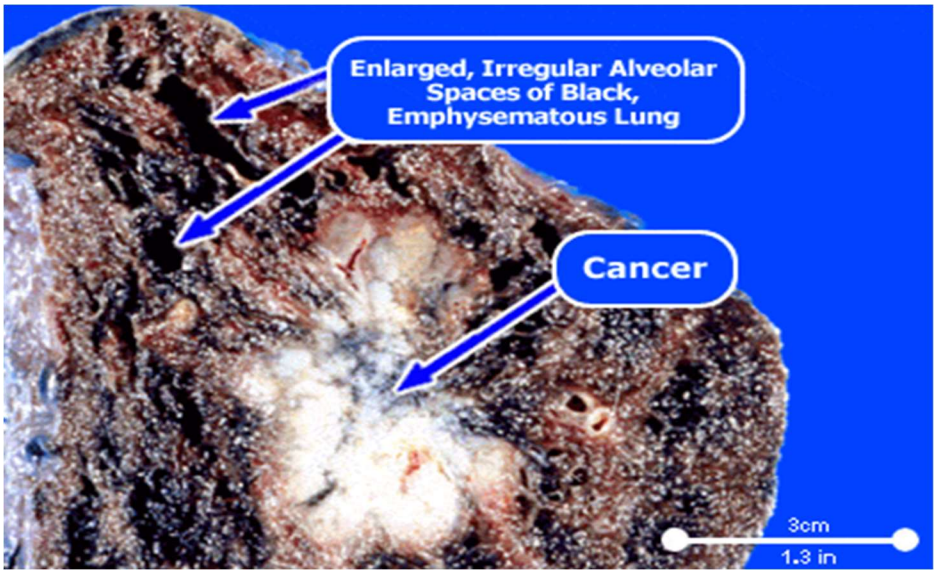
What is lung cancer? Cancer of the lung, like all cancers, results from an abnormality in the body's basic unit of life, the cell. Normally, the body maintains a system of checks and balances on cell growth so that cells divide to produce new cells only when new cells are needed. Disruption of this system of checks and balances on cell growth results in an uncontrolled division and proliferation of cells that eventually forms a mass known as a tumor.

Tumors can be benign or malignant; when we speak of "cancer," we are referring to those tumors that are malignant. Benign tumors usually can be removed and do not spread to other parts of the body. Malignant tumors, on the other hand, grow aggressively and invade other tissues of the body, allowing entry of tumor cells into the bloodstream or lymphatic system and then to other sites in the body. This process of spread is

termed *metastasis*; the areas of tumor growth at these distant sites are called *metastases*. Since lung cancer tends to spread or metastasize very early after it forms, it is a very life-threatening cancer and one of the most difficult cancers to treat. While lung cancer can spread to any organ in the body, certain organs particularly the adrenal glands, liver, brain, and bone are the most common sites for lung cancer metastasis.

The lung also is a very common site for metastasis from tumors in other parts of the body. Tumor metastases are made up of the same type of cells as the original (primary) tumor. For example, if prostate cancer spreads via the bloodstream to the lungs, it is metastatic prostate cancer in the lung and is not lung cancer. [8]

The principal function of the lungs is to exchange gases between the air we breathe and the blood. Through the lung, carbon dioxide is removed from the bloodstream and oxygen from inspired air enters the bloodstream. [9] The right lung has three lobes, while the left lung is divided into two lobes and a small structure called the lingula that is the equivalent of the middle lobe on the right. The major airways entering the lungs are the bronchi, which arise from the trachea. The bronchi branch into progressively smaller airways called bronchioles that end in tiny sacs known as alveoli where gas exchange occurs. The lungs and chest wall are covered with a thin layer of tissue called the pleura. [10]




Lung cancers can arise in any part of the lung, but 90%-95% of cancers of the lung are thought to arise from the epithelial cells, the cells lining the larger and smaller airways (bronchi and bronchioles); for this reason, lung cancers are sometimes called bronchogenic cancers or bronchogenic carcinomas. (Carcinoma is another term for cancer.) Cancers also can arise from the pleura (called mesotheliomas) or rarely from supporting tissues within the lungs, for example, the blood vessels. [11]

How common is lung cancer? Lung cancer is the most common cause of death due to cancer in both men and women throughout the world. The American Cancer Society estimated that 222,520 new cases of lung cancer in the U.S. will be diagnosed and 157,300 deaths due to lung cancer would occur in 2010. According to the U.S. National Cancer Institute, approximately one out of every 14 men and women in the U.S. will be diagnosed with cancer of the lung at some point in their lifetime.

Lung cancer is predominantly a disease of the elderly; almost 70% of people diagnosed with lung cancer are over 65 years of age, while less than 3% of lung cancers occur in people under 45 years of age. [12]

Lung cancer was not common prior to the 1930s but increased dramatically over the following decades as tobacco smoking increased. In many developing countries, the incidence of lung cancer is beginning to fall following public education about the dangers of cigarette smoking and the introduction of effective smoking-cessation programs. Nevertheless, lung cancer remains among the most common types of cancers in both men and women worldwide. In the U.S., lung cancer has surpassed breast cancer as the most common cause of cancer-related deaths in women . [13]

**Causes of lung cancer**

**Smoking**

The incidence of lung cancer is strongly correlated with cigarette smoking, with about 90% of lung cancers arising as a result of tobacco use. The risk of lung cancer increases with the number of cigarettes smoked and the time over which smoking has occurred; doctors refer to this risk in terms of pack-years of smoking history (the number of packs of cigarettes smoked per day multiplied by the number of years smoked). For example, a person who has smoked two packs of cigarettes per day for 10 years has a 20 pack-year smoking history. While the risk of lung cancer is increased with even a 10-pack-year smoking history, those with 30-pack-year histories or more are considered to have the greatest risk for the development of lung cancer. Among those who smoke two or more packs of cigarettes per day, one in seven will die of lung cancer. [14] Tobacco smoke contains over 4,000 chemical compounds, many of which have been shown to be cancer-causing or carcinogenic. The two primary carcinogens in tobacco smoke are chemicals known as nitrosamines and polycyclic aromatic hydrocarbons. The risk of developing lung cancer decreases each year following smoking cessation as normal cells grow and replace damaged cells in the lung. In former smokers, the risk of developing lung cancer begins to approach that of a nonsmoker about 15 years after cessation of smoking. [15]

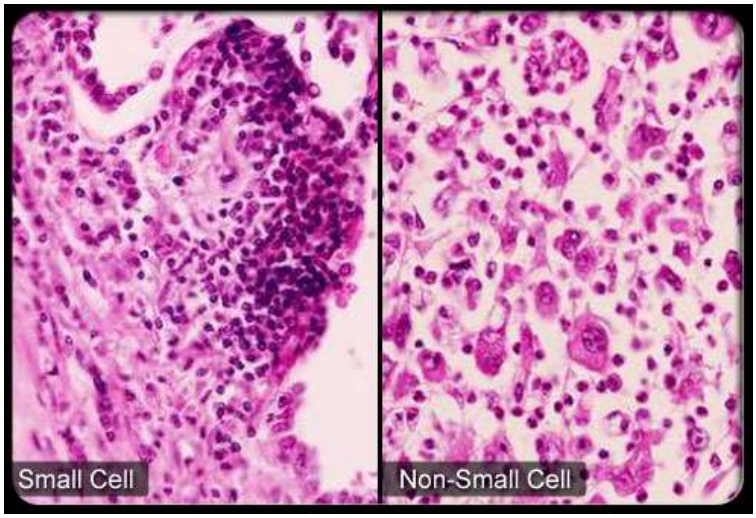
**Asbestos fibers**

Asbestos fibers are silicate fibers that can persist for a lifetime in lung tissue following exposure to asbestos. The workplace is a common source of exposure to asbestos fibers, as asbestos was widely used in the past as both thermal and acoustic insulation. Today, asbestos use is limited or banned in many countries, including the U.S. Both lung cancer and mesothelioma (cancer of the pleura of the lung as well as of the lining of the abdominal cavity called the peritoneum) are associated with exposure to asbestos. Cigarette smoking drastically increases the chance of developing an asbestos-related lung cancer in workers exposed to asbestos. Asbestos workers who do not smoke have a fivefold greater risk of developing lung cancer than nonsmokers, but asbestos workers who smoke have a risk that is fifty to ninetyfold greater than nonsmokers. [16]

**Radon gas**

Radon gas is a natural, chemically inert gas that is a natural decay product of uranium. Uranium decays to form products, including radon, that emit a type of ionizing radiation. Radon gas is a known cause of lung cancer, with an estimated 12% of lung-cancer deaths attributable to radon gas, or about 20,000 lung-cancer-related deaths annually in the U.S., making radon the second leading cause of lung cancer in the U.S. As with asbestos exposure, concomitant smoking greatly increases the risk of lung cancer with radon exposure. Radon gas can travel up through soil and enter homes through gaps in the foundation, pipes, drains, or other openings. The U.S. Environmental Protection Agency estimates that one out of every 15 homes in the U.S. contains dangerous levels of radon gas. Radon gas is invisible and odorless, but it can be detected with simple test kits. [17]

**Types, Symptoms and Signs of lung cancer**



Lung cancers, also known as bronchogenic carcinomas, are broadly classified into two types: small cell lung cancers (SCLC) and non-small cell lung cancers (NSCLC). This classification is based upon the microscopic appearance of the tumor cells themselves. These two types of cancers grow and spread in different ways and may have different treatment options, so a distinction between these two types is important. [18]

SCLC comprises about 20% of lung cancers and are the most aggressive and rapidly growing of all lung cancers. SCLC are strongly related to cigarette smoking, with only 1% of these tumors occurring in nonsmokers. SCLC metastasize rapidly to many sites within the body and are most often discovered after they have spread extensively. Referring to a specific cell appearance often seen when examining samples of SCLC under the microscope, these cancers are sometimes called oat cell carcinomas . [19]

NSCLC are the most common lung cancers, accounting for about 80% of all lung cancers. NSCLC can be divided into three main types that are named based upon the type of cells found in the tumor. [20]

- Adenocarcinomas are the most commonly seen type of NSCLC in the U.S. and comprise up to 50% of NSCLC. While adenocarcinomas are associated with smoking, like other lung cancers, this type is observed as well in nonsmokers who develop lung cancer.
- Squamous cell carcinomas were formerly more common than adenocarcinomas; at present, they account for about 30% of NSCLC. Also known as epidermoid carcinomas, squamous cell cancers arise most frequently in the central chest area in the bronchi.
- Large cell carcinomas, sometimes referred to as undifferentiated carcinomas, are the least common type of NSCLC.
- Mixtures of different types of NSCLC are also seen.

Other types of cancers can arise in the lung; these types are much less common than NSCLC and SCLC and together comprise only 5%-10% of lung cancers:

- Bronchial carcinoids account for up to 5% of lung cancers. These tumors are generally small (3 cm-4 cm or less) when diagnosed and occur most commonly in people under 40 years of age. Unrelated to cigarette smoking, carcinoid tumors can metastasize, and a small proportion of these tumors secrete hormone-like substances that may cause specific symptoms related to the hormone being produced. Carcinoids generally grow and spread more slowly than bronchogenic cancers, and many are detected early enough to be amenable to surgical resection.

- Cancers of supporting lung tissue such as smooth muscle, blood vessels, or cells involved in the immune response can rarely occur in the lung. [21]

As discussed previously, metastatic cancers from other primary tumors in the body are often found in the lung. Tumors from anywhere in the body may spread to the lungs either through the bloodstream, through the lymphatic system, or directly from nearby organs. Metastatic tumors are most often multiple, scattered throughout the lung, and concentrated in the peripheral rather than central areas of the lung. [22]

**Lung cancer symptoms and signs**

Symptoms of lung cancer are varied depending upon where and how widespread the tumor is. Warning signs of lung cancer are not always present or easy to identify. A person with lung cancer may have the following kinds of symptoms:

- No symptoms: In up to 25% of people who get lung cancer, the cancer is first discovered on a routine chest X-ray or CT scan as a solitary small mass sometimes called a coin lesion, since on a two-dimensional X-ray or CT scan, the round tumor looks like a coin. These patients with small, single masses often report no symptoms at the time the cancer is discovered . [23]

- Symptoms related to the cancer: The growth of the cancer and invasion of lung tissues and surrounding tissue may interfere with breathing, leading to symptoms such as cough, shortness of breath, wheezing, chest pain, and coughing up blood (hemoptysis). If the cancer has invaded nerves, for example, it may cause shoulder pain that travels down the outside of the arm (called Pancoast's syndrome) or paralysis of the vocal cords leading to hoarseness. Invasion of the esophagus may lead to difficulty swallowing (dysphagia). If a large airway is obstructed, collapse of a portion of the lung may occur and cause infections (abscesses, pneumonia) in the obstructed area.

- Symptoms related to metastasis: Lung cancer that has spread to the bones may produce excruciating pain at the sites of bone involvement. Cancer that has spread to the brain may cause a number of neurologic symptoms that may include blurred vision, headaches, seizures, or symptoms of stroke such as weakness or loss of sensation in parts of the body. [24]

- Paraneoplastic symptoms: Lung cancers frequently are accompanied by symptoms that result from production of hormone-like substances by the tumor cells. These paraneoplastic symptoms occur most

commonly with SCLC but may be seen with any tumor type. A common paraneoplastic syndrome associated with SCLC is the production of a hormone called adrenocorticotrophic hormone (ACTH) by the cancer cells, leading to over secretion of the hormone cortisol by the adrenal glands (Cushing's syndrome). The most frequent paraneoplastic syndrome seen with NSCLC is the production of a substance similar to parathyroid hormone, resulting in elevated levels of calcium in the bloodstream.

- Nonspecific symptoms: Nonspecific symptoms seen with many cancers, including lung cancers, include weight loss, weakness, and fatigue. Psychological symptoms such as depression and mood changes are also common . [25]

One should consult a health-care provider if he or she develops the symptoms associated with lung cancer, in particular, if they have

- a new persistent cough or worsening of an existing chronic cough
- blood in the sputum,
- persistent bronchitis or repeated respiratory infections
- chest pain
- unexplained weight loss and/or fatigue

breathing difficulties such as shortness of breath or wheezing. [26]

Deaths - Lung cancer is the number one cancer killer in the nation. It has been the leading cause of cancer death among men since the early 1950s, and in 1987 it surpassed breast cancer to become the leading cause of cancer deaths among women as well. In 2006, lung cancer had an age-adjusted death rate of 51.5 per 100,000 population in the U.S. and accounted for 31 and 26 percent of all male and female cancer deaths,

Smoking Related - The U.S. Surgeon Generanl estimates that 90 percent of lung cancer deaths in men and 80 percent in women are caused by smoking. Men and women who smoke are 23 and 13 times, respectively, more likely to develop lung cancer. (U.S. Department of health and services) Nonsmokers have a 20 to 30 percent greater chance of developing lung cancer if they are exposed to second hand smoke at home or work. (U.S. Department of health and human services ). [27]

**Diagnosis of Lung cancer**

Doctors use a wide range of diagnostic procedures and tests to diagnose lung cancer. These include the following:

- The history and physical examination may reveal the presence of symptoms or signs that are suspicious for lung cancer. In addition to asking about symptoms and risk factors for cancer development such as smoking, doctors may detect signs of breathing difficulties, airway obstruction, or infections in the lungs. Cyanosis, a bluish color of the skin and the mucous membranes due to insufficient oxygen in the blood, suggests compromised function due to chronic disease of the lung. Likewise, changes in the tissue of the nail beds, known as clubbing, also may indicate chronic lung disease.
- The chest X-ray is the most common first diagnostic step when any new symptoms of lung cancer are present. The chest X-ray procedure often involves a view from the back to the front of the chest as well as a view from the side. Like any X-ray procedure, chest X-rays expose the patient briefly to a small amount of radiation. Chest X-rays may reveal suspicious areas in the lungs but are unable to determine if these areas are cancerous. In particular, calcified nodules in the lungs or benign tumors called hamartomas may be identified on a chest X-ray and mimic lung cancer.
- CT (computerized tomography, computerized axial tomography, or CAT) scans may be performed on the chest, abdomen, and/or brain to examine for both metastatic and lung tumors. A CT scan of the chest may be

ordered when X-rays do not show an abnormality or do not yield sufficient information about the extent or location of a tumor.

- A technique called a low-dose helical CT scan (or spiral CT scan) is sometimes used in screening for lung cancers. This procedure requires a special type of CT scanner and has been shown to be an effective tool for the identification of small lung cancers in smokers and former smokers. However, it has not yet been proven whether the use of this technique actually saves lives or lowers the risk of death from lung cancer.
- Magnetic resonance imaging (MRI) scans may be appropriate when precise detail about a tumor's location is required. The MRI technique uses magnetism, radio waves, and a computer to produce images of body structures. As with CT scanning, the patient is placed on a moveable bed which is inserted into the MRI scanner. There are no known side effects of MRI scanning, and there is no exposure to radiation. The image and resolution produced by MRI is quite detailed and can detect tiny changes of structures within the body. People with heart pacemakers, metal implants, artificial heart valves, and other surgically implanted structures cannot be scanned with an MRI because of the risk that the magnet may move the metal parts of these structures.
- Positron emission tomography (PET) scanning is a specialized imaging technique that uses short-lived radioactive drugs to produce three-dimensional colored images of the substances in the tissues within the body. While CT scans and MRI scans look at anatomical structures, PET scans measure metabolic activity and the function of tissues. PET scans can determine whether a tumor tissue is actively growing and can aid in determining the type of cells within a particular tumor. In PET scanning, the patient receives a short half-lived radioactive drug, receiving approximately the amount of radiation exposure as two chest X-rays. The drug accumulates in certain tissues more than others, depending on the drug that is injected. The drug discharges particles known as positrons from whatever tissues take them up. As the positrons encounter electrons within the body, a reaction producing gamma rays occurs. A scanner records these gamma rays and maps the area where the radioactive drug has accumulated.
- Bone scans are used to create images of bones on a computer screen or on film. Doctors may order a bone scan to determine whether a lung cancer has metastasized to the bones. In a bone scan, a small amount of radioactive material is injected into the bloodstream and collects in the bones, especially in abnormal areas such as those involved by metastatic tumors. The radioactive material is detected by a scanner, and the image of the bones is recorded on a special film for permanent viewing.

- Needle biopsy: Fine needle aspiration (FNA) through the skin, most commonly performed with radiological imaging for guidance, may be useful in retrieving cells for diagnosis from tumor nodules in the lungs. Needle biopsies are particularly useful when the lung tumor is peripherally located in the lung and not accessible to sampling by bronchoscopy. A small amount of local anesthetic is given prior to insertion of a thin needle through the chest wall into the abnormal area in the lung. Cells are suctioned into the syringe and are examined under the microscope for tumor cells. This procedure is generally accurate when the tissue from the affected area is adequately sampled, but in some cases, adjacent or uninvolved areas of the lung may be mistakenly sampled. A small risk (3%-5%) of an air leak from the lungs (called a pneumothorax, which can easily be treated) accompanies the procedure.
- Thoracentesis: Sometimes lung cancers involve the lining tissue of the lungs (pleura) and lead to an accumulation of fluid in the space between the lungs and chest wall (called a pleural effusion). Aspiration of a sample of this fluid with a thin needle (thoracentesis) may reveal the cancer cells and establish the diagnosis. As with the needle biopsy, a small risk of a pneumothorax is associated with this procedure.

- Blood tests: While routine blood tests alone cannot diagnose lung cancer, they may reveal biochemical or metabolic abnormalities in the body that accompany cancer. For example, elevated levels of calcium or of the enzyme alkaline phosphatase may accompany cancer that is metastatic to the bones. Likewise, elevated levels of certain enzymes normally present within liver cells, including aspartate aminotransferase (AST or SGOT) and alanine aminotransferase (ALT or SGPT), signal liver damage, possibly through the presence of tumor metastatic to the liver. One current focus of research in the area of lung cancer is the development of a blood test to aid in the diagnosis of lung cancer. Researchers have preliminary data that has identified specific proteins, or biomarkers, that are in the blood and may signal that lung cancer is present in someone with a suspicious area seen on a chest X-ray or other imaging study. [27, 28]

**Nanoparticles in cancer diagnosis**

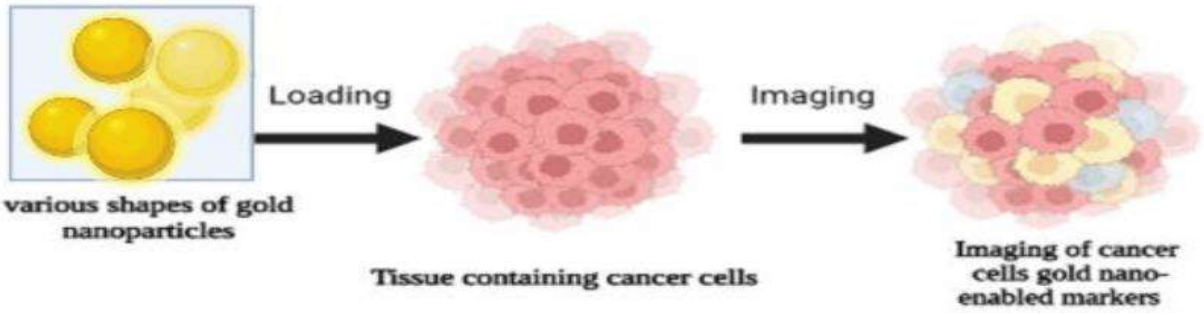
There are many types of nanoparticles, including metallic, magnetic, polymeric, metal oxide, quantum dots, grapheme, fullerene, liposomes, carbon nanotubes, and dendrimers which are used in cancer diagnosis. Additionally, they are more important for some imaging functions. It has been found that nanoparticles remain in the blood circulation for a long period of time before reaching the target cells, where they traverse many biological walls such as cell membrane and interact with biological systems. Moreover, cancer specific

antibodies can be conjugated with nanoparticles for better cancer binding and detection. Nanoparticles and sensors have significant potential for increasing the sensitivity of tumor detection and improving cancer diagnosis. It has been found that detection of methylation patterns and mutations has been used as a marker for cancer diagnosis.

Nanoparticles such as gold, silver, silica, magnetics, and iron oxide are used in cancer diagnosis due to their short detection time and low cost. The cancer detection capabilities of nanoparticles can be improved through their functionalization. For example, in the detection of breast adenocarcinoma cells, antibodies against cancer were conjugated with polyethylene glycol(PEG). This antibody –PEG complex was then linked to the surface of nanoparticles.

**Gold nanoparticles**

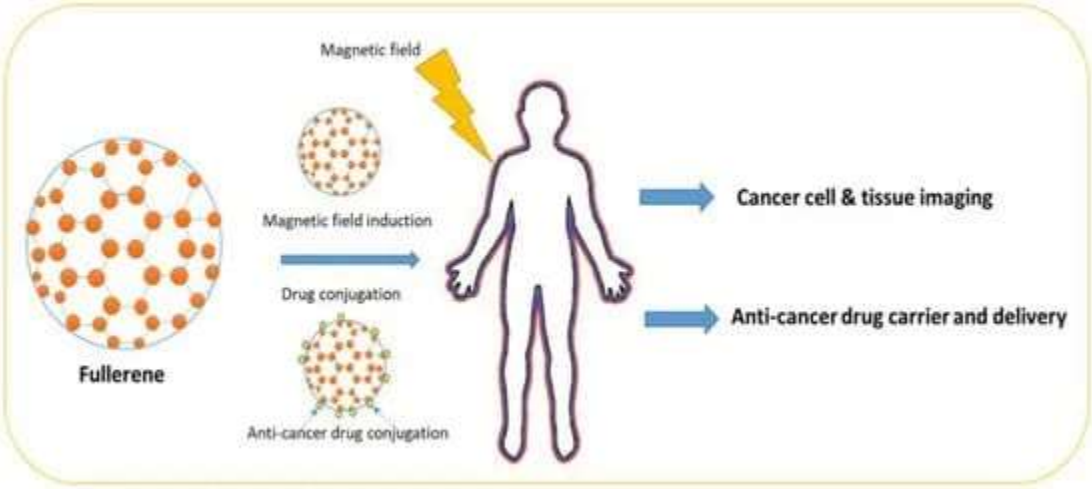
In cancer imaging techniques, gold nanoparticles offer longer circulation times in the bloodstream with better tumor targeting for better quality diagnosis. Moreover, AuNPs can be used in a wide variety of applications such as nucleic acid delivery, photothermal ablation and radiotherapy . [29]




**Fullerene**

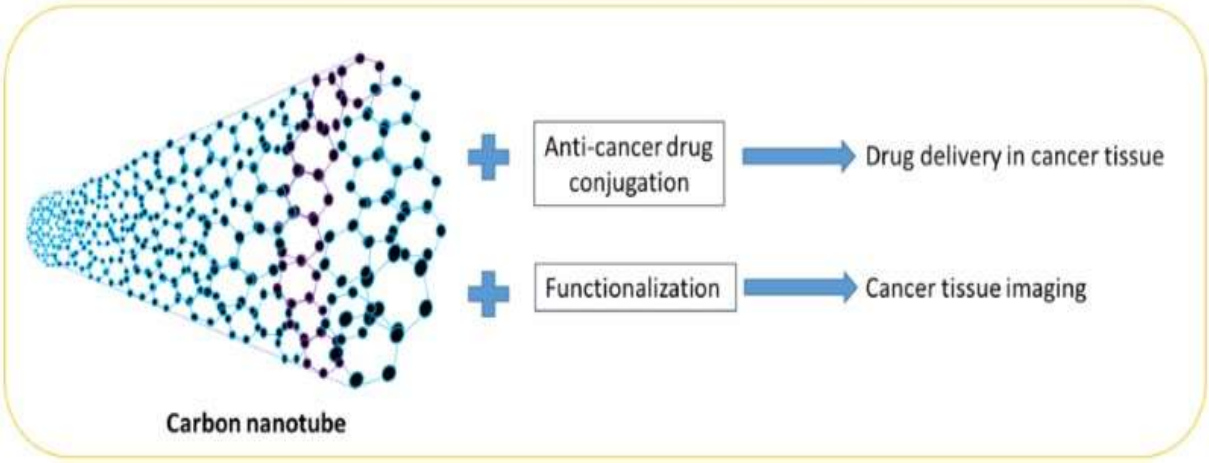
Fullerene belongs to the buckminsterfullerene family and it is an allotrope of the carbon family. Fullerene has been used in chemical applications, where drug molecules can be trapped in the fullerene mesh for successful

drug delivery. Fullerene (C60) has been used in cancer diagnosis and detection.




**Carbon nanotubes**

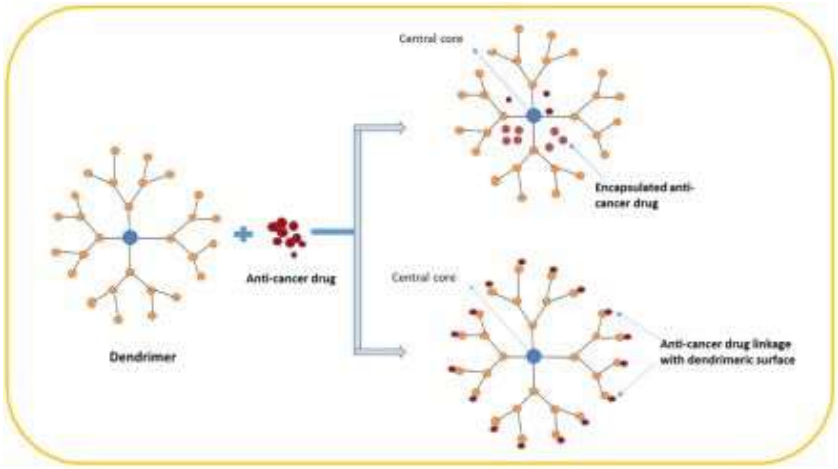
Carbon nanotubes are made of single wall carbon. Carbon nanotubes biosensors have been used to detect organophosphorous compounds such as in a study where gold nanoparticles and carbon nanotubes were deposited on a gold wire. The biosensor utilized acetylcholine-esterase enzymes on carboxylic single walled carboxylic nanotubes, which were then passed onto the heart electrode. The electrode was coated with Nafion to prevent enzyme leaching and become a sensor electrode. This nanosensor works on the principle of inhibiting the AChE enzyme . [30]




**Dendrimers**

Dendrimers are highly defined artificial macromolecules with a three dimensional network that have a high number of functional groups. Due to their size and structure consisting of dendritic arms or branches built around a linear polymer core, dendrimers have been used in nanomedicines. Due to their structure, they have multifunctional abilities, making them useful for building next generation nanodevices for imaging and diagnosis of cancer.

Dendrimers can also be used for immunodiagnosis, which is based on the generation of signals that can be easily visualized when there is an antigen-antibody interaction between certain target molecules.




## Treatment of Lung cancer

Treatment for lung cancer can involve surgical removal of the cancer, chemotherapy, or radiation therapy, as well as combinations of these treatments. The decision about which treatments will be appropriate for a given individual must take into account the location and extent of the tumor as well as the overall health status of the patient.

**Surgery**: Surgical removal of the tumor is generally performed for limited-stage (stage I or sometimes stage II) NSCLC and is the treatment of choice for cancer that has not spread beyond the lung. About 10%-35% of lung cancers can be removed surgically, but removal does not always result in a cure, since the tumors may already have spread and can recur at a later time. Among people who have an isolated, slow-growing lung cancer removed, 25%-40% are still alive five years after diagnosis. It is important to note that although a tumor may be anatomically suitable for resection, surgery may not be possible if the person has other serious conditions (such as severe heart or lung disease) that would limit their ability to survive an operation. Surgery is less often performed with SCLC than with NSCLC because these tumors are less likely to be localized to one area that can be removed. The surgical procedure chosen depends upon the size and location of the tumor. [31]

**Radiation**: Radiation therapy may be employed as a treatment for both NSCLC and SCLC. Radiation therapy uses high-energy X-rays or other types of radiation to kill dividing cancer cells. Radiation therapy may be given as curative therapy, palliative therapy (using lower doses of radiation than with curative therapy), or as adjuvant therapy in combination with surgery or chemotherapy. The radiation is either delivered externally, by using a machine that directs radiation toward the cancer, or internally through placement of radioactive substances in sealed containers within the area of the body where the tumor is localized. Brachytherapy is a term used to describe the use of a small pellet of radioactive material placed directly into the cancer or into the airway next to the cancer. This is usually done through a bronchoscope.

Radiation therapy can be given if a person refuses surgery, if a tumor has spread to areas such as the lymph nodes or trachea making surgical removal impossible, or if a person has other conditions that make them too ill to undergo major surgery. Radiation therapy generally only shrinks a tumor or limits its growth when given as a sole therapy, yet in 10%-15% of people it leads to long-term remission and palliation of the cancer. A type of external radiation therapy called the "gamma knife" is sometimes used to treat single brain metastases. In this procedure, multiple beams of radiation coming from different directions are focused on the tumor over a few minutes to hours while the head is held in place by a rigid frame. This reduces the dose of radiation that is received by noncancerous tissues.

For external radiation therapy, a process called simulation is necessary prior to treatment. Using CT scans, computers, and precise measurements, simulation maps out the exact location where the radiation will be delivered, called the treatment field or port. This process usually takes 30 minutes to two hours. The external radiation treatment itself generally is done four or five days a week for several weeks. [32]

**Chemotherapy**: Both NSCLC and SCLC may be treated with chemotherapy. Chemotherapy refers to the administration of drugs that stop the growth of cancer cells by killing them or preventing them from dividing. Chemotherapy may be given alone, as an adjuvant to surgical therapy, or in combination with radiotherapy. While a number of chemotherapeutic drugs have been developed, the class of drugs known as the platinum-based drugs have been the most effective in treatment of lung cancers.

Chemotherapy is the treatment of choice for most SCLC, since these tumors are generally widespread in the body when they are diagnosed. Only half of people who have SCLC survive for four months without chemotherapy. With chemotherapy, their survival time is increased up to four to fivefold. Chemotherapy alone is not particularly effective in treating NSCLC, but when NSCLC has metastasized, it can prolong survival in many cases . [33]

**Targeted therapy**: The drugs erlotinib (Tarceva) and gefitinib (Iressa) are so-called targeted drugs, which may be used in certain patients with NSCLC who are no longer responding to chemotherapy. Targeted therapy drugs more specifically target cancer cells, resulting in less damage to normal cells than general chemotherapeutic agents. Erlotinib and gefitinib target a protein called the epidermal growth factor receptor (EGFR) that is important in promoting the division of cells. This protein is found at abnormally high levels on the surface of some types of cancer cells, including many cases of non-small cell lung cancer.

Other attempts at targeted therapy include drugs known as antiangiogenesis drugs, which block the development of new blood vessels within a cancer. Without adequate blood vessels to supply oxygen-carrying blood, the cancer cells will die.

**Radiofrequency ablation (RFA)**: Radiofrequency ablation is being studied as an alternative to surgery, particularly in cases of early stage lung cancer. In this type of treatment, a needle is inserted through the skin into the cancer, usually under guidance by CT scanning. Radiofrequency (electrical) energy is then transmitted to the tip of the needle where it produces heat in the tissues, killing the cancerous tissue and closing small blood vessels that supply the cancer. RFA usually is not painful and has been approved by the U.S. Food and Drug Administration for the treatment of certain cancers, including lung cancers. Studies have shown that this

treatment can prolong survival similarly to surgery when used to treat early stages of lung cancer but without the risks of major surgery and the prolonged recovery time associated with major surgical procedures.

**Experimental therapies**: Since no therapy is currently available that is absolutely effective in treating lung cancer, patients may be offered a number of new therapies that are still in the experimental stage, meaning that doctors do not yet have enough information to decide whether these therapies should become accepted forms of treatment for lung cancer. New drugs or combinations of drugs are tested in so-called clinical trials, which are studied that evaluate the effectiveness of new medications in comparison with those treatments already in widespread use. Experimental treatments known as immune therapies are being studied that involve the use of vaccine-related therapies or other therapies that attempt to utilize the body's immune system to fight cancer cells.

**Nanoparticles in cancer treatment**

Magnetic nanoparticles: The immune supermagnetic iron oxide nanoparticles are coated with oleic acid and carboxymethyl dextran, and then conjugated to mouse anti CD44v6 monoclonal antibody, a protein marker for metastatic cancer. These nanoparticles could be used as a T2 contrast agent to improve the detection and diagnosis of lung cancer. The use of heat for the treatment of disease can be used in two ways : Thermoablation, when temperature is raised high enough to cause immediate cellular death, and hyperthermia. Hyperthermia refers to mild temperature rises (40 degree celcius - 45degree celcius) that causes various forms of cellular damage and finally leads to apoptosis.

In lung cancer, iron oxide magnetic nanoparticls were incorporated into magnetic nanocomposite microparticles through spray drying. These materials can be remotely heated in the presence of an alternating magnetic field and be used to trigger other therapies.

Magnetic nanoparticles can also be attached to carriers like hydroxyapatite, a chemical structure with affinity for chemotherapy drugs and high biocompatibility. The iron and platinum incorporation to the hydroxyapatite creates a dual agent with chemo-hyperthermia properties with future application in treatment of lung cancer.

Magnetic nanoparticles may also achieve cell death in lung cancer cells in the presence of a pulsed electromagnetic field. Another promising approach in the treatment of lung cancer is the use of fercucarbortan as inductive hyperthermia. Ferucarbortan is a MRI contrast agent reported to be able to generate heat in an alternating magnetic field. The hyperthermia efficacy and cytotoxicity of porous magnetic nanoparticles coated by a polyethylene glycol (PEG) layer, and doxorubicin loaded has been tested against human lung adenocarcinoma cells with promising results.

Polymer nanoparticles : Polymeric nanoparticles have been widely used in cancer treatment. Their chemical and physical properties make polymeric nanoparticles attractive carriers for anticancer drugs. Both natural and synthetic polymers of different structures can be used. Most common natural polymers include polypeptides, albumin, gelatin, or chitosan are frequently utilized because most of them are biocompatible and biodegradable. Synthetic polymers such as polyethylene PEG, poly lactic-co-glycolic acid (PLGA), polylactic acid (PLA), and poly caprolactone are also employed. The efficacy of nanocarriers for targeted therapy has also been explored. EGF peptides conjugated with gelatine nanoparticles have shown greater cellular uptake than intravenous chemotherapy in lung adenocarcinoma cells in aerosol administration *in vivo* and *in vitro*.

Gold nanoparticles: Gold nanoparticles possess unique optical and surface properties, making them the main choice for researchers, especially in biological and pharmaceutical fields. Gold nanoparticles are colloidal and clustered particles consisting in an Au core and a surface coating. Size and shape control can be easily achieved to obtain Au nanoparticles in the range of 1-150 nm with diverse morphologies that offer unique chemical, electrical, and optical properties. Among the available nanoparticles, gold nanoparticles have several advantages: they are biocompatible, can be synthesized in a wide range of sizes, and can be coated with a large number of molecules including chemotherapy drugs.

Due to the optical properties of Au nanoparticles they are used especially in ultrasensitive detection and image based therapeutic techniques required for the treatment of lung cancer. Bortezomib (BTZ), a proteasome inhibitor, conjugated with pegylated gold nanoparticles (PEGAuNPs) in an *in vitro* model of pancreatic and lung cancer cells lines.

Afatinib (Afb), a chemotherapeutic drug approved for the treatment of EGFR positive lung cancer, has been conjugated with gold nanoparticles, to improving drug efficacy and biocompatibility administered to *in vitro* lung cancer cells. Afb-Au nanoparticles were found to be up to 3.7 times more powerful when administered to lung cancer cells *in vitro* and were able to significantly inhibit cancer cell proliferation.

NP assisted radiation therapy is emerging as a promising modality of highly localized radiation boosting due to the photoelectric interaction of radiation therapy photons with high atomic number nano particles such as gold nano particles. This approach may allow for increased radiation dose delivery with minimal increase in toxicities to normal tissues. Early results show major dose enhancement to lung tumours can be achieved using nano particles with high Z components administered through IR . [34, 35]

## DISCUSSION

Facts about Lung cancer states that:

- Lung cancer is the number-one cause of cancer deaths in both men and women in the U.S. and worldwide.
- Cigarette smoking is the principal risk factor for development of lung cancer.
- Passive exposure to tobacco smoke also can cause lung cancer.
- The two types of lung cancer, which grow and spread differently, are the small cell lung cancers (SCLC) and non-small cell lung cancers (NSCLC).
- The stage of lung cancer refers to the extent to which the cancer has spread in the body.
- Treatment of lung cancer can involve a combination of surgery, chemotherapy, and radiation therapy as well as newer experimental methods.
- The general prognosis of lung cancer is poor, with overall survival rates of about 16% at five years.
- Smoking cessation is the most important measure that can prevent the development of lung cancer.

## CONCLUSION

The prognosis of lung cancer refers to the chance for cure or prolongation of life (survival) and is dependent upon where the cancer is located, the size of the cancer, the presence of symptoms, the type of lung cancer, and the overall health status of the patient. SCLC has the most aggressive growth of all lung cancers, with a median survival time of only two to four months after diagnosis when untreated. (That is, by two to four months, half of all patients have died.) However, SCLC is also the type of lung cancer most responsive to radiation therapy and chemotherapy. Because SCLC spreads rapidly and is usually disseminated at the time of diagnosis, methods such as surgical removal or localized radiation therapy are less effective in treating this type of lung cancer. When chemotherapy is used alone or in combination with other methods, survival time can be prolonged four- to fivefold; however, of all patients with SCLC, only 5%-10% are still alive five years after diagnosis. Most of those who survive have limited-stage SCLC.In non-small cell lung cancer (NSCLC), the most important

prognostic factor is the stage (extent of spread) of the tumor at the time of diagnosis. Results of standard treatment are generally poor in all but the most smallest of cancers that can be surgically removed. However, in stage I cancers that can be completely removed surgically, five-year survival approaches 75%. Radiation therapy can produce a cure in a small minority of patients with NSCLC and leads to relief of symptoms in most patients. In advanced-stage disease, chemotherapy offers modest improvements in survival although rates of overall survival are poor. The overall prognosis for lung cancer is poor when compared with some other cancers. Survival rates for lung cancer are generally lower than those for most cancers, with an overall five-year survival rate for lung cancer of about 16% compared to 65% for colon cancer, 89% for breast cancer, and over 99% for prostate cancer.

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