

Lung Cancer

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Introduction

Lung cancer remains currently the chief cause of cancer deaths in both men and women in the USA. It causes more deaths than the next three common cancers-Breast, Colon and Prostate. Roughly, 1 million people die of lung cancer every year all over the world.

Cigarette smoking and Lung cancer are inseparably linked. There are strong psychological issues attached to lung cancer. Since smoking is a voluntary activity, there is a strong element of guilt among lung cancer patients with reluctance of public support campaigns as with other cancers. These patients receive well meant but often inappropriate advice from friends, family and often members of the medical community-not directly involved in the field of lung cancer.

The Medical literature shows survival statistics of in Lung cancer to be much lower than other cancers-this often adds a feeling of hopelessness in these patients. There is however strong hope in the fact that those who survive 5 years today, would not have done so 20 years ago. Every patient in that sense is his own statistic, and each case is individualized in its own way. Treatment modalities are much more standardized, Postoperative care is much better, and adjuvant forms of treatment (radiation and chemotherapy) are more advanced. There are promising new treatments such as immunotherapy in the future. Hopefully, Preventive strategies and cancer screening will change the grim outlook in this disease.

The diagnosis of lung cancer is therefore not a time for blame. It is a time for organizing thought, gaining the confidence of the patient that the best is being offered to him or her, and that they are an integral part of the decision making process. It is most important that everybody involved in the care of the patient support him or her morally and spiritually during the period of illness and recovery.

In order to have an informed opinion of what is going on, what treatment options are available based on current scientific opinion and evidence-early interview with a cancer specialist team is important. Most important of all every patient has to realize that every individual is different, and that all is not hopeless. Decisions need to be made at a time of intense personal and familial stress, without guarantee of outcomes. However in this time and day, proper Staging of the disease (Finding out the extent of spread in scientific terms) is crucial for prognostic and therapeutic options and is possible only through a systematic workup. This can be trying on the patience of someone already stressed-and wanting it 'out', and therefore a working knowledge of the disease process is important.

We will try to provide an overview of the aspects of what we do when we see a patient with lung cancer, why and how we do it, and how it helps us to take care of the patient. There is a team of Doctors and other Health Professionals who work with the patient and work out the best course of action for him or her. This includes Physicians, Thoracic Surgeons, Pulmonologists (lung specialists), Oncologists (Cancer specialists) to name a few. The important role of the Support personnel involved in the care of a cancer patient cannot be over emphasized. Feelings of guilt and hopelessness are often present in these patients. Maintenance of a Positive attitude on the part of everybody involved is very important. Nowhere does the old saying become more relevant, "God helps those who help themselves".

What is Lung Cancer?

The lungs are extremely complex paired organs, which besides the well-known function of breathing also secrete hormones, help in the water regulation function of the body, and help the body fight infections. The airway (the windpipe or trachea) leads to the lungs on either side, while the nose and upper part of the mouth warm and humidify the air that travels down. These passages have different kinds of lining called epithelia, which are different in different parts depending on function. Cancer is a condition where there is an uncontrolled growth of these lining cells, not following the usual rules of cell growth with spread outside of normal boundaries and the organ of origin. In the case of lung cancer the strongest known stimulus to cancer transformation is the toxins in cigarette smoke.

There are different types of cancer depending on the type of lining cell they arise from. The cells in the upper air passages are thin and have protective hairs called cilia. These cilia propel debris and irritant matters to be coughed out. The earliest effect of smoking is to destroy this protective function so new smokers note that their 'cough' went away. After quitting initially these cilia grow back and the patients get back their cough, which is actually a good sign ---but often misunderstood by the smoker who reverts back to smoking.

The cells in the intermediate and inner airways are also involved in the secretion of hormonal substances, as well as being part of the air sacs, which are involved in the exchange of oxygen and carbon dioxide in the lungs. Evaporation takes place here too and helps in the water balance regulation of the body. These cells also secrete a substance called surfactant, which is like an emulsifier and helps to keep the air sacs open. Cigarette smoking produces the changes of emphysema in the air sacs, bronchitis, irritation and cancer in the intermediate airways, and

cancerous changes in the hormone producing cells as well. In the normal lung of a non-smoker, the process of cells being replaced as they die is tightly controlled. Chronic irritation from smoking makes this process haphazard and ultimately gets out of control-leading to cancer.

There are **at least 4 different cancer types**, but for purposes of clinical outcomes and treatment options we tend to divide them into:

- 1.) Small cell cancers-generally arising from the hormone producing cells, with cells that look small on the microscope. Their behavior and patterns of spread and hence treatment is quite different from the second type .
- 2.) Non-Small cell cancers-which by definition look larger on the microscope and behave differently from small cell types. Three subtypes are identified:
 - a.) Squamous cell cancer-generally in the larger central airways
 - b.) Adenocarcinomas (also large cell cancers) arising in the more further out secreting part of the lung.
 - c) Bronchoalveolar cancers which arise in the cells making up the air sacs (alveoli).

The cancers arising from these different types of cells tend to retain their own characters to an extent. Moreover the treatment of Small cell cancers is very different from that of non-small cell cancers. Having an exact tissue diagnosis about the type of cancer is thus of paramount importance.

Why do people get cancer?

The lining cells of the lung (epithelium) like every other organ have a controlled process by which they are shed after a certain period of time and replaced by new cells. Under various conditions (which includes chronic irritation from tobacco smoking), there is some loss of control of this process. This is related to injury to control mechanisms inside the cell. Early signs of such changes which left unchecked will proceed to cancer can be seen on biopsies showing specific changes called Hyperplasia, metaplasia and Dysplasia.

Continuing insult to that cell or cells will lead to cancer initially localized to that area. Cancer cells are different from normal cells that they like to migrate away from the original site following available pathways. This process is called Metastasis or Spread of cancer. The common routes of this spread are the Blood stream or the Lymph channels. Certain cancers have tendency to spread by one or the other route initially, but eventually both are possible. Early on the cancer may be limited to the site of origin in the lung, but later involvement of lymph glands or major organs in the body like Liver, Kidney, and Brain etc may occur. Whether or not these are involved has a tremendous impact and bearing on treatment and the likelihood of cure or success. That is a procedure called Staging - to be discussed later. Some cancer cells will also undergo a second internal change (mutation), which may make the cell more resistant to treatment (refractory).

The vast majority of Lung cancers are seen in smokers, and caused by toxic chemicals in cigarette smoke. Not all smokers develop cancer, (though they have other problems with the heart, COPD etc). The relationship between the quantity, duration and quality of tobacco smoked is ill defined. Casual or incidental exposure occasionally to tobacco smoke (as in a

restaurant or bar) does not increase risk of lung cancer. Non-smokers may develop cancer, especially of the Bronchoalveolar type. Their prognosis is usually better than those cancers in smokers. Passive exposure to smoke for chronic periods of time may lead to cancer-especially the adenocarcinoma type.

Smokers remain at risk for life even if they quit, but the risk is much smaller than those who continue to smoke. There is significant improvement however in the other body systems so in 10-15 years they become at par with non-smokers from a cardiovascular risk point of view. Certain kinds of industrial fumes and noxious vapors may cause cancers, but usually just increase the susceptibility to cancer. Asbestos fiber is one such example-it takes years and decades for this to happen. Adding smoking merely accelerates the cancer process. This is called a Synergistic effect.

What do people with Lung Cancer complain of?

Generally early cancers do not cause any symptoms and thus cancer detected incidentally at the time of other unrelated tests is probably early stage. Lung cancer may cause symptoms due to its local effects or widespread symptoms from spread of the cancer outside the lung. Sometimes cancer that is not very advanced and limited to the lung may cause early symptoms due to its location in the lung.

Cancer confined to the lung may cause cough from irritation of the airways with narrowing if large enough. Most smokers cough therefore a change in the pattern of cough is more commonly reported. Coughing blood-tinged phlegm (hemoptysis) will happen if the tumor grows into a blood vessel in the airway-this is usually small and not life threatening. Blockage of a smaller airway may lead to pneumonia in the lung beyond the tumor-because the lung cannot empty its secretions. This is a fairly common presentation of cancer that is still locally confined to the lung. Fever and pus in the phlegm is often present. An unresolving pneumonia in an adult with smoking history should always raise suspicion of lung cancer.

In Non-small cell lung cancer the next step in the spread is to the lymph glands, which can be within and around the lung or in the space between the lungs and towards the neck called the mediastinum. This generally does not cause symptoms but does represent a slightly more advanced form of disease. The lymph nodes themselves may press on structures in the neck such as great veins and cause symptoms of congestion. Invasion of the lining of the heart (pericardium) and blockage of lymph channels may cause fluid collections (effusions) in the lungs or heart sac (pericardium).

When the cancer is close to the chest wall or located specifically in the top of the lung, it may cause local symptoms from invasion of the ribs or nerves or blood vessels (in the top of the lung-called a Pancoast tumor). These tumors may still be very much localized to the lung but they represent a unique challenge to surgical removal. Once the tumor spreads to lymph glands outside the lung it is regarded to be at a higher (worse) stage. Spread to other organs via the bloodstream may cause local symptoms related to the organ-headaches or fits (seizures) in the brain, bone pain or abnormal fractures from bony spread, Paralysis from spread to spinal cord

etc. Spread to the liver may be asymptomatic except for mild abnormalities of liver function on the blood tests.

Diagnosis and Work Up of Lung Cancer

Lung cancer cannot be diagnosed before it happens. It is crucial to understand that to be visible as a "shadow" on a Routine Chest X-ray without symptoms; the cancer has to be at least 1 cm in diameter. A 1 cm tumor contains roughly 1 billion cancer cells, which takes a period of up to 10 years since the first cell became cancerous. Therefore days, weeks or even months probably do not make a difference in terms of time of diagnosis. There are some situations where a shadow or abnormality on the X-ray is due to a benign condition. Unfortunately there are few such conditions. Once a lesion is seen, it is presumed to be cancer until proven otherwise.

Whether or not cancer is discovered incidentally, or in a symptomatic patient, a systematic approach is used for two reasons:

- 1) Diagnosis of the cancer itself, and the extent of spread, the tissue type of cancer and therefore the therapeutic options.
- 2) To determine the patient's functional status from a general and cardiovascular point of view to see whether the patient could tolerate the treatment that could be offered.

A Complete History and Physical Exam is usually performed first. Besides the importance of personal habits, family history and other risk factors the examination may be completely negative. Physical signs of pneumonia, wheezing, local pain on pressing on ribs, or swollen arm or abnormal sensation or loss of pulse in the arm may be seen, Lymph glands may be felt in the neck or more importantly in the area above the collarbone (Supraclavicular lymph nodes). There may be back or other bone pain, and the liver may be enlarged. There may be fluid in the chest or abdomen. Examination of the back of the eye with an ophthalmoscope may show evidence of increased pressure from spread of disease to the brain in a patient with symptoms. Each of these findings has a different significance and will be discussed in their own context.

Currently there is no recommended Screening Test for Lung cancer in an asymptomatic patient. The Chest X-ray is usually the first test done, (often the reason why an asymptomatic cancer is detected in the first place). It usually needs to be as mentioned 1 cm in size to be appreciated on Chest X-ray. The mass can be localized to a specific zone of the lung, any abnormalities in the ribs or other bones in the chest detected including destruction (eating away) of the bone. Lung collapse and areas of pneumonia can be identified as well as fluid in the lung lining (pleural effusion) or heart sac (pericardial effusion). What the Chest X-ray cannot tell is whether or not the lymph glands in the mediastinum (the area between the lungs and upper chest along the windpipe) are enlarged or not. This is crucial in Staging the cancer (the next step) to determine whether Surgery can be offered in an attempt to cure the cancer. The CT or CAT scan is usually the next step or sometimes the first test to be performed. Using modern scanning techniques, very fine detail of the lungs, the tumor, and exact information of its location can be obtained. Involvement of adjacent parts of the lung or chest can be seen. The upper cuts of the abdomen are also taken to include the liver and the adrenal glands (the most common sites of spread). Most important of all, Enlarged lymph nodes in the mediastinum can be visualized. Once again

the current opinion is that lymph nodes need to be at least 1 cm in size to be considered suspicious for containing tumor. It is very important to understand that involvement of the lymph nodes with tumor is by far the most important event that will have a bearing on the Staging of the cancer. That in turn determines early vs. late and whether or not Surgery could be offered for attempting cure. Details of the location of the tumor and its relationship with the surrounding structures, involvement of vital organs or body wall can be generally seen well enough. In specific situations such as the tumor at the top of the lung (Pancoast tumor), or where invasion of vital organs is not clear, a MRI scan may be preferred. This gives clearer visualization in some situations. In general satisfactorily performed CT scan is adequate for all of the above.

As the next step sometimes a test called a PET scan is carried out. Here a radioactive tracer is mixed with glucose and injected into the blood. Cancer cells have high rates of glucose usage and the tracer is taken up in high concentrations (PET positivity) by cancer cells and in metastatic cancer cells. There are some pitfalls in this test too and it is important to correlate with the clinical situation and the physical abnormality seen on the CAT scan. It is a whole body scan and is designed to detect cancer deposits anywhere in the body.

Bronchoscopy is usually performed at some point during the evaluation process. A flexible tube (the endoscope) is passed down the patient's airway under local anesthesia, and the inside is examined to the point where it gets too small for the passage of the endoscope. Centrally located cancers, in the larger airways, those which cause blood in the phlegm or obstruct larger airways can be seen and biopsied. Sometimes a tumor is not seen but abnormality in the part of the airways gives indirect evidence of the location. Washout of those areas can be done and sometimes cancer cells are seen in the specimen. Certain lymph glands in specific locations can be biopsied through the wall of the airway using a special needle. Another very important reason for bronchoscopy is to see whether surgery can be performed safely to get out the entire tumor, and the amount of lung that needs to be taken out to remove the whole tumor.

Mediastinoscopy is an important procedure, which is needed to find out whether lymph glands in the mediastinum have been invaded with cancer, or not. This information is critical in deciding whether the patient will be a candidate for surgery or not, by determining the Stage of the cancer (discussed in the later section). This procedure is done under a general anesthetic and a small incision is made a fingerbreadth above the breastbone in the middle of the neck. After reaching the front of the windpipe a special instrument is passed downward in front of the trachea and the lymph nodes of the upper mediastinum can be reached. These are sampled in a systematic fashion, and sent for biopsy. There is a limit to which areas can be sampled safely, because there are many important and vital structures in that small area, which have to be avoided. Mediastinoscopy is a safe procedure, and provides critical information in staging the cancer, and is still the gold standard in that regard.

The PET scan has now supplanted most of the blood tests that used to be done in the past to detect changes in normal values to detect spread of cancer to other organs. Some cancers have so called chemical or biochemical 'tumor markers' which can be diagnostic and prognostic. In lung cancer unfortunately there are none that are specific to it and therefore these are not checked routinely.

After the staging workup has been completed and it decided that a patient may benefit from surgical therapy, the next thing to be determined is: *Is the patient fit to undergo Major surgery with removal of either part or whole of his or her lung safely?*

There are two aspects to this above question:

- 1) How is the patient's cardiovascular status-is his heart strong enough to go through major surgery? Simple and routine tests (starting from Stress testing and sometimes to Coronary angiograms) will give us a reliable answer to that. Other organ systems such as the kidneys, liver etc are also important, but unless grossly diseased do not constitute a contraindication to surgery.
- 2) Removal of lung tissue always affects the breathing capacity. Most people with lung cancer have already compromised lung function. Therefore, the vital question is "Can I remove the necessary amount of lung in this person to take away the cancer, and yet leave enough for him to breathe without support?" Sometimes special tests have to be carried out to make a decision. Spirometry and Nuclear scans are some such tests. It is important to note that each person is individualized on his own merit and functional test such as stair climbing without severe distress are sometimes a better measure of breathing capacity than sophisticated tests.

Staging of Lung Cancer and Why It Is So Important

"How far advanced is my cancer?"

"Will you be able to take away all my cancer?"

"How long do you think I will live?"

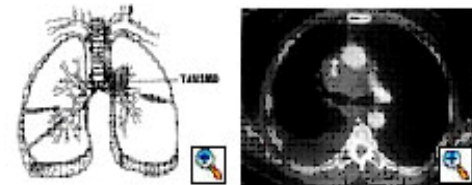
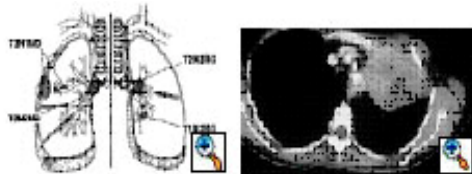
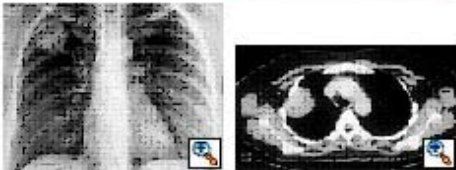
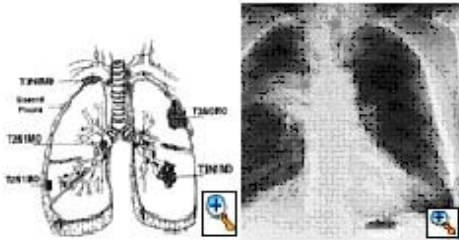
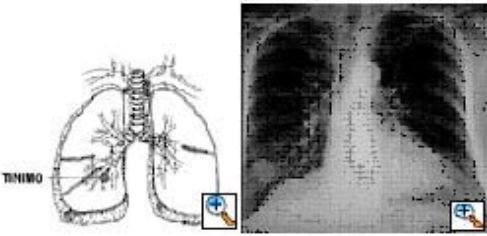
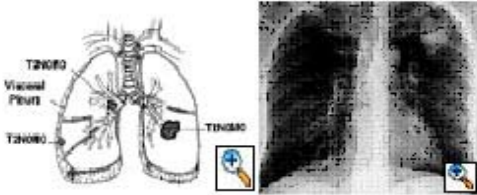
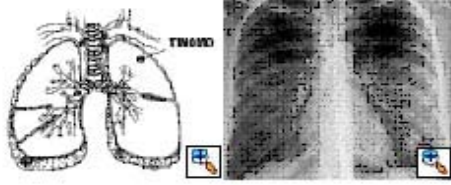
"Will I need Chemotherapy or Radiation?"

These are some of the questions frequently asked by patients after being diagnosed with lung cancer.

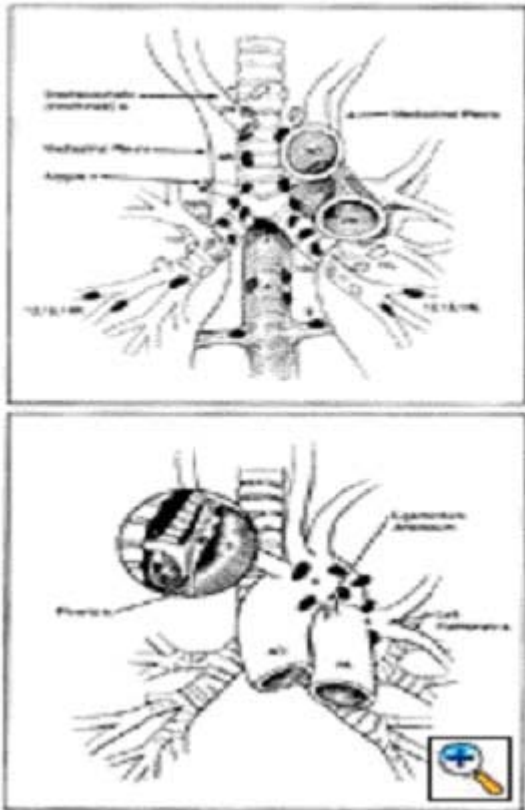
The only way that a scientific and informed answer to these questions can be given is to do what is called staging the cancer.

When staging cancer, the three main objectives are as follows:

- 1) What is the status of the Original (Primary) Tumor-the T status.
- 2) What is the status of the Regional Lymph glands-the N status.
- 3) Whether or not distant metastasis (spread) to other organs is presents-the M status.



Cartoons diagrams and Radiologic Examples of the various stages of lung cancer:



Lymph node stations in the mediastinum used in the staging process:

With the tests that have been mentioned before, usually all these three parameters can be determined with reasonable degree of accuracy. Based on the TNM status, various Stages I-IV can be assigned to the cancer. This can be done both prior to surgery or other treatment, (TNM clinical), and after treatment especially if surgery is an option. (TNM final or Pathologic)

The TNM subsets are combined in seven stage groups, in addition to stage 0, that reflect fairly precise levels of disease progression and their implications for treatment selection and prognosis.

Stage 0 is assigned to patients with carcinoma in situ, which is consistent with the staging of all other sites.

Stage IA includes only patients with tumors 3 cm. or less in greatest dimension and no evidence of spread, the anatomic subset T1 N0 M0.

Stage IB includes only patients with a T2 primary tumor classification and no evidence of spread, the anatomic subset T2 N0 M0.

Stage IIA is reserved for patients with a T1 primary tumor classification and spread limited to the intrapulmonary, including hilar, lymph nodes, the anatomic subset T1 N1 M0.

Stage IIB includes two anatomic subsets: patients with a T2 primary tumor classification and spread limited to the ipsilateral intrapulmonary, including hilar, lymph nodes, the anatomic subset T2 N1 M0; and patients with a primary tumor classification of T3 and no evidence of spread, the anatomic subset T3 N0 M0.

Stage IIIA includes four anatomic subsets that reflect the implications of ipsilateral, limited, extrapulmonary extension of the lung cancer. Patients included are those with a T3 primary tumor classification and metastasis limited to the ipsilateral intrapulmonary, including hilar, lymph nodes, T3 N1 M0 disease, and patients with T1, T2, or T3 primary tumor classifications and metastasis limited to the ipsilateral mediastinal and subcarinal lymph nodes--the T1 N2 M0, T2 N2 M0 and T3 N2 M0 subsets.

Stage IIIB designates patients with extensive primary tumor invasion of the mediastinum and metastases to the contralateral mediastinal, contralateral hilar, and ipsilateral and contralateral scalene/supraclavicular lymph nodes. Patients with a T4 primary tumor classification or N3 regional lymph node metastasis, but no distant metastasis, are included.

Stage IV is reserved for patients with evidence of distant metastatic disease, M1, such as metastases to brain, bone, liver, adrenal gland, contralateral lung, pancreas and other distant organs, and metastases to distant lymph node groups such as axillary, abdominal, inguinal, etc. Patients with metastasis in ipsilateral non-primary tumor lobes of the lung are also designated M1.

TNM Subsets by Stage

Stage 0	Carcinoma in situ		
Stage IA	T1 - N0 - M0		
Stage IB	T2 - N0 - M0		
Stage IIA	T1 - N1 - M0		
Stage IIB	T2 - N1 - M0		
	T3 - N0 - M0		
Stage IIIA	T3 - N1 - M0		
	T1 - N2 - M0	T2 - N2 - M0	T3 - N2 - M0
Stage IIIB	T4 - N0 - M0	T4 - N1 - M0	T4 - N2 - M0
	T1 - N3 - M0	T2 - N3 - M0	T3 - N3 - M0
	T4 - N3 - M0		
Stage VI	Any T	Any N	M1

The type of cancer is of course important especially whether surgery is the option of choice in early stage. For Non-small cell cancers (discussed earlier), generally Surgery is the standard of care for Stages I&II. Each case is considered on its own merits, but current opinion indicates the best and possibly the only complete cure results when the disease is surgically removed at this stage. Specific Stage III cancers may benefit from surgery, but these are considered on a case-by-case basis. When diagnosis is made in more advanced stages, (including spread to other organs),

there is no known survival benefit to justify a major operation with all its risks. Staging therefore must be achieved at all costs so that the best possible treatment option can be offered to the patient, with least possible risks of major surgery. Small cell cancers are regarded as systemic disease from the start. This means that even at early detection they are suspected to have spread beyond the lung. When diagnosed (either by tissue biopsy via a minor resection of the lung, or needle biopsy) the treatment is with systemic form of therapy such as Chemotherapy. As yet there is no evidence to show that performing surgery to remove small-cell cancer in the early stages has any survival benefits.

Staging for Small Cell Lung Cancer

In patients with small cell carcinoma, the anatomic extent of disease is a major factor in the proportion of patients that achieve the complete response required for long-term survival. Consistent and reproducible TNM and stage classifications are useful for this cell type as well as for non-small cell lung cancer. For example, the selection of patients for treatment programs involving adjuvant surgery depends on the initial TNM and stage classifications or the re-treatment evaluations following induction therapy. Review of the literature confirms that it is common for the terms "limited" and "extensive" disease to be inconsistently applied to small cell lung cancer. The use of these designations defeats the purpose and utility of consistent, reproducible classification, which is now, and will continue to be useful in the milieu of evolving cancer knowledge. The structure of new treatment plans depends on the results achieved for specific groups of patients that are best described in terms of the TNM and stage categories.

As one can see from the above discussion, that Staging and Diagnosing Lung cancer can be a laborious process involving 2 or more procedures and multiple scans and tests. Yet its importance cannot be overemphasized - as it is the only way to plan treatment, predict the future to some extent and to compare treatment protocols both established and experimental. This is the answer to the commonly asked question **"Why are so many tests being performed when you know that I have cancer? I just want to have it taken out."**

Treatment of Lung Cancer: Current Strategies and Options

It is important to understand which modalities of treatment are offered for which kind of cancer and at which stage of the disease. It is also important to know the potential benefits from each modality in terms of survival advantage, and the potential complications. It is also crucial to understand that the Stage of the cancer may change after treatment and examination of the specimen if surgery was performed. We will therefore discuss the treatment options for Non-small cell cancer and Small cell cancer stage by stage.

Non-small cell cancer:

- 1) Stage I disease: This implies that there is absence of cancer spread to any lymph node group whatsoever. **Stage IA** means a small tumor without nodal spread and **IB** means a larger tumor but no lymph node involvement. The Primary treatment at this stage is

Surgery, which offers a real chance of cure. It is crucial therefore to know whether the cancer is 'resectable', meaning can it be readily removed for a potential cure. Equally important is whether the patient is an operative candidate or not-meaning can the necessary surgery be performed safely on him without compromise to his life or lung function after surgery. It is also important to know that micro-spread without any evidence may be present with these early stage cancers, and recurrences may take place. When the criteria of 'resectability' and operability are met, Surgery alone will cure 65-80% of patients. No other therapy is indicated at this stage. For **Stage IB** also surgery is curative in 50% of patients. There are some studies looking at Chemotherapy in addition, but whether this is beneficial or harmful to the patient has not yet been decided.

At Surgery, besides removal of the part of the lung or whole lung (the tumor), the lymph nodes in each group must also be removed for sampling. It is impossible to tell from looking whether the lymph node contains cancer. Only after the whole specimen (tumor and lymph nodes) are examined under the microscope that the final stage of the cancer determined. This may be different from the stage before surgery and the prognosis will depend on the survival and cure rate statistics for that stage. The amount of lung that needs to be removed for an adequate cancer removal is usually a part of the lung called a lobe-the operation is called Lobectomy. The right lung has 3 lobes and the left has 2 lobes. Sometimes the position of the tumor is such that taking only the lobe with the tumor would either leave tumor behind or compromise the function or blood supply of the remaining lung. In that event the whole lung has to be removed (if it has been decided that the patient can survive reasonably with the remaining lung). This is called Pneumonectomy. Sometimes a tumor by its position is close to the bronchus (airway) of the remaining lung. If such a patient is not suitable for pneumonectomy, then a part of the airway with tumor is removed and rejoined like a sleeve. This is called Sleeve Resection and is more technically challenging. Sometimes in selected cases, and in patients with very poor reserve, a smaller resection called a wedge resection or segmentectomy is performed, with full knowledge that this may not remove cancer completely.

- 2) Stage II disease means that cancer involves the lymph nodes on the lung and the root of the lung (hilar nodes), all still presumably within the field of the lung to be removed. These are also potentially curable with surgery, but the cure rates drop off down to 30-40%. This is true for both Stage IIA and B stages. Once again the role of chemotherapy is not yet clear, some studies seem to show a survival advantage with it. Radiation does not seem to help at all, and may be harmful at this stage-there is no clear evidence on this issue at all. A large tumor involving chest wall but without lymph nodes even though staged as T3 N0, will receive radiation in most centers though a clear cut benefit has not been shown.
- 3) Stage III disease implies spread to lymph nodes in the N2 area, i.e. in the mediastinum. This in the past was considered inoperable, and other forms of therapy were the main modality of management. Today, in selected patients with limited N2 disease (IIIA), evidence seems to support surgery as a primary modality. In this scenario however, Pre or Postoperative Chemotherapy and/or Radiation seem to improve outcomes. The so called Neo-adjuvant therapy, with strict protocols of Pre-operative chemotherapy and

fractionated doses of radiation are currently used for this stage, though clear cut clinical benefits are yet to be shown. Similar regimens are used for Stage IIIB disease, but here surgery is not performed.

- 4) For Stage IV cancer (spread beyond the primary site and lymph nodal drainage) Chemotherapy is the only active treatment modality. It is to be understood that cure is not an option here. Two issues need careful consideration. The first issue is with prolongation of life with chemotherapy and its attendant side effects. The other issue deals with purely symptom control in patients with advanced disease to make life comfortable-also called Palliative care. These are never easy decisions to make for both patient and physician and have to be considered on their own merit. When opting for the first choice it is also important to determine whether the patient is fit enough to withstand chemotherapy. There are a variety of ways to evaluate this so-called Performance status based on the patient's daily activities.

A brief mention of the advances in chemotherapy is worthy at this point. Chemotherapy in the past was associated with significant morbidity, and most patients became so sick from it that the minor benefit of prolongation of life was not appreciated. The Chemotherapy of today is very different and there are better drugs to control the side effects (such as nausea etc.) and more support groups for patients to relate to. Before starting this form of treatment full discussion with patient and family and all personnel concerned should take place-more than once if necessary. The actual drugs used, their side effects and details of administration should be discussed with an Oncology specialist. Even though benefits are in small numbers (10-20% will be alive at 2 years), this is a major improvement over the past. Future developments will hopefully make this even better, with lesser toxicity using more targeted therapy.

Small Cell Cancer:

Small cell cancer has been regarded as a systemic disease from the get go, due to its tendency to spread extensively. The only time that surgery plays any part is if a small nodule is removed surgically and is found to contain small cell lung cancer. Patients with disease limited to the chest are said to have limited disease and are treated with Chemotherapy and Radiation to the chest. These treatments can be given simultaneously or one after the other---this is up to the local protocols used. There is no proof showing superiority of one way over other. If diagnosis of small cell cancer was made prior to surgery (excision of nodule), mediastinoscopy is recommended also. A reasonably good cure rate (50-70%) is achieved in this early stage. With Extensive Small cell cancer, the disease is not limited to the chest. The only available mode of treatment is Chemotherapy. 5% of patients will achieve cure with this. A complete pathologic response to chemotherapy is predictive of long-term survival. Extensive disease with spread limited only to the lung lining (pleura) may behave more like limited disease. Small cell lung cancer has certain peculiarities due to its spreading potential. Specific areas of target are the brain and the bone marrow. Currently it is felt that Bone marrow biopsy or aspiration is not warranted if there is no evidence of spread elsewhere. Bone scans may be performed if there are symptoms. MRI of the brain is routinely performed. The brain lining prevents chemotherapy from reaching these at effective levels. In those patients whose disease goes into remission with

chemotherapy, Prophylactic Radiation to the brain is given. The same is done for Extensive disease when there is complete response with no evidence of disease in the body. This radiation to the brain is not completely without side effects. Loss of short and long time analytic and cognitive brain function may occur, and this may be unacceptable to people who need that for a living. The details of the treatments are generally discussed with the Specialist Oncology team who will be taking care of the patient. There is another group of tumors, which arise from the same kind of cells that the small cell cancers arise. These are called "Carcinoid" tumors- suggesting that they are cancer-like, which is a misnomer. Some of these act as benign tumors and are curable with surgical resection, whereas others behave similar to small cell cancer. Future trends seem to look at immunologic approaches (using the body's own defense mechanisms). Vaccines and gene therapy may be treatment of the future. Currently they are only part of research protocols and as such not standard of care or better than currently available therapy.

Follow Up Treatment in Lung Cancer

The sequence and timing with which the Surgeon, Pulmonologist or Oncologist follow the patient is variable from practice to practice.

The objectives of follow up are the following:

- 1) Monitor the result of the Primary treatment. This is usually a repeat of the primary evaluation exam, and Radiologic exams as necessary. Abnormalities in these exams and tests should have disappeared with successful treatment, either completely or partially. Blood tests are sometimes useful to monitor, especially if they were abnormal before. The first exam is usually within 3-4 weeks of initial therapy, this includes post-operative check up too if surgery was performed. Thereafter we see the patient every 3 months for a year at least and then twice a year the next and then annually for 5 years. The same physician may not perform these checkups and documentation is very important.
- 2) Any new symptoms or worries on the part of the patient merit repeat workup whatever the prior status. Weight loss, new aches and pains persisting beyond reasonable time are especially suspicious.
- 3) Patients who respond to treatment are regarded as being in remission-this may be partial or complete. Either ways this may represent either cure or dormant cancer. With passage of time this becomes clearer, but till then especially in those with partial remissions, comparative exams need to be performed to see which direction the disease is heading.
- 4) Secondary cancers may develop in patients who have had Chemotherapy and Radiation. Follow up is needed to detect these, which may be subtle.
- 5) A second Primary cancer (meaning a new cancer in the lung of the same or different type) may appear after the first one has been treated or cured. This needs to be monitored also.

In general it follows common sense patterns as to which patients achieve cure (5 years +) and those that do not fare so well. Recurrences and return of symptoms or partial remissions usually are noticeable within the first few months of follow-up. That usually signifies a not so favorable

outcome. Support systems for new symptoms (especially intractable pain), paraplegia etc need to be in place for these patients.

Preventive Strategies in Lung Cancer

The avoidance of smoking is the key to this-and for every stage of life. It is never too late to stop, and better "never to start" at all. The risk is minimum to zero in someone who never smoked and gets greatly reduced in someone who quits. 10-15 years after quitting even moderately heavy smoking, risks of cardiovascular and other health are almost equalized. The risk of lung cancer remains always in the former smoker, but gets greatly reduced when compared to the person who continues to smoke.

There are many agencies both government and privately run which help people to quit, and several others which try to prevent the start of smoking. The teenage population is the target population and it is a social duty to prevent these from ever starting to smoke. Second hand smoke is another issue which is being dealt with in many states, banning smoking in public institutions. There should be incentives for smokers to quit rather than just public stigma, and this is probably more helpful in getting rid of what is indeed a true addiction. Extensive information on this topic can be found over the internet, and readers are encouraged to go to those for help. Though there may be some light in the future, currently there are no reliable 'vitamins' or 'antioxidants' which can reliably reduce cancer risk in former or current smokers. The good news is that quitting significantly improves overall health, with reduction in heart attack risks to almost normal within a year. Other benefits include significant risk reduction in development of chronic lung diseases such as emphysema and COPD.

Coping with Established Lung Cancer

These patients fall into several broad categories:

First is a phase of denial-how did it happen to me? Once that is over, and if they are treatable, they undergo treatment appropriate to their stage. Of the treated patients, some will be cured, and some will either achieve partial cure or will have residual or recurrent disease. The ones who will have residual or recurrent disease may develop new symptoms or disabilities which may need specialized care. When pain is a significant issue when the disease is incurable or terminal, Hospice care may be appropriate.

In those who are fortunate to be disease free for at least 5 years, anxiety is often prominent. Support survivor groups and having these 'survivors' involved in Prevention groups helps tremendously both ways. It should not be forgotten that dealing with cancer and its treatment is a tremendous strain not on just the patient but also their families and loved ones. Support groups for these should also be available in coping with the illness and morbidity of a loved one.