

Analysis of Lung Cancer Staging using Tumour, Node, Metastasis

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Abstract: System for classification of Tumour, Node, Metastasis (TNM), Lung cancer is the basic comparison study of the modern treatment of lung cancer and however is constantly evolving due to the update of the edition. The goal of the TNM system is fivefold: clinician therapeutic guide forecasts evaluation provides a common language for information exchange and contributes to permanent human cancers.

Keywords: Tumor Node Metastasis.

1. Introduction

Lung cancer is a cancer that begins in the lungs. Cancer starts when the cells in the body begin to grow uncontrollably. There are two types of lung cancer: non-small cell lung cancer (NSCLC) About 80-85% of lung cancer is:

1. NSCLC. This type of lung cancer is particularly found in smokers. It will spread little by little.
2. Small cell lung cancer (SCLC). About 10-15% of lung cancer by SCLC. This kind of lungs cancer grows and spreads faster than NSCLC.

Lung cancer staging:

The extent to which lung cancer has spread from its original source is called the lung cancer stage. There are several ways to stage the lung cancer.

They are classified into two types: Non reverse method (including CT scans and PET scans). Reverse method (biopsy and surgery)

Minimally inverse techniques:

The methods available are: Mediastinoscopy. Endobronchial ultrasound with trans bronchial needle aspiration (EBUS-TBNA). Endoscopic ultrasound (EUS). Traditional bronchoscopic TBNA and CT-CNB (computed tomography-core needle biopsy)

Mediastinoscopy:

It is a process used to check mediastinum, behind the breastbone in the centre of the chest, middle of the two lungs. This field can be examined with instruments called Mediastinoscopy. It is a long, thin, flexible tube containing light and a thin camera. It lets us see the organs and the structure of mediastinum. The nodes are tested to help see how far the cancer has progressed.

Disadvantages are bleeding, infection, air in the space between the lung coverings.

EBUS-TBNA:

Endoscopic techniques have become the method of choice for lung cancer diagnosis and staging. This is done using a special bronchoscope. These are thin, flexible binoculars in the mouth and airways. This allows the doctor to look inside and remove the pulmonary process. Although this process is ultrasound, it is used to take tissue samples from the body by pushing tissue through the bronchi from the opposite side.

The disadvantage is that the cough in the chest continues blood, the pain of the chest, and the air can be rolled lightly or to mediastinum.

Lung cancer has been diagnosed and treated that have been many dramatic changes from the past.

TNM:

The current method used for staging lung cancer is the TNM classification. TNM staging is the system that is latest and trending techniques used for staging lung cancer. The American Joint Committee on Cancer (AJCC) and International Union Against Cancer (UICC) suggested TNM staging system.

Methodology:

TNM stands for T-tumor (represents the size and extent of the underlying tumor), N-node (represents the number of surrounding lymph nodes with cancer), and M-metastasis (represents whether the cancer has spread to other organs). Although the TNM classification is an internationally agreed system, it has evolved over time in various editions. Whenever the TNM staging system was revised, the schema changed significantly. The amendments were based on detailed analyzes of the AJCC and UICC, which examined overall survival of 81,015 patients.

TNM Staging System:

One of the leading causes for cancer-related deaths worldwide is the lung cancer. The TNM (tumor, nodule, metastasis) grading system is the primary guideline for determining treatment and prognosis. The TNM staging system is the latest and most widely used technology for lung cancer staging. TNM stands for T-tumor (indicating the size and extent of the underlying tumor), N-node (indicating the number of surrounding lymph nodes with cancer), and M-metastasis (indicating cancer metastasis).

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2. Literature Survey

6th edition of TNM cancer staging:

TNM Cancer Classification 6th Edition defined lymph node metastasis as local or distant metastasis depending on the anatomical location of the primary tumor, and N-classification was defined as the histological absence (None) or presence (N1) of the tumor obstacle. The present sixth edition of the TNM Lung Cancer Classification has not made any changes with respect to lung cancer. Compared to the 6th edition, the recently introduced 7th edition system also has a lower Akaike information standard. The strength of the 7th edition TNM staging system is the new descriptors for N and M classification.

Comparison of 6th & 7th edition of TNM staging system of lung cancer:

In the sixth version, it's clear in the above figure that we have tumor classified to T is, T1, T2, T3, T4 and Node classified as : N0:absent, N1:present

Metastasis: M0: absent, M1a: cervical LN or celiac LN, M1b: all other distant metastasis. But in 7th edition they have improved the T4 stage of tumor into T4a and T4b, as respectable and unrespectable.

Seventh edition of TNM staging system for lung cancer:

The International Association for the Study of Lung Cancer established the Lung Cancer Staging Project to create an international lung cancer database.

Using this IASLC database, survival analysis was performed for resected patients with SCLC. This TNM staging is applicable for SCLC but only presented in small surgical series. The new categories which were brought up in 7th edition are they sub categorized the tumor T1 stage into T1a and T1b; and for T2 stage as T2a and T2b, for each stage there are measures given which helps us find in which stage the cancer is in. TNM includes changes to NSCLC staging recommended by the IASLC Lung Cancer Staging Project. TNM lymph node mapping for lung cancer is that accurate assessment of lymph node involvement is an important part of lung cancer treatment. Lymph node mapping is a process used to find metastases in lymph nodes. For future analysis, a method of grouping lymph node lymph node stations is proposed.

Table 1

6 TH EDITION	7 TH EDITION	
TNM Stage	TNM Stage	Descriptor
T1	T1 a	Max dimension ≤2cm
	T1 b	Max dimension 2-3cm
T2	T2 a	Max dimension 3-5cm
	T2 b	Max dimension 5-7cm
	T3	Max dimension >7cm
T4	T3	Additional nodule in same lobe.
M1	T4	Additional nodule in ipsilateral different lobe.
M1	M1 a	Additional nodules in contra lateral lung.
M1	M1 a	Ipsilateral pleural effusion.

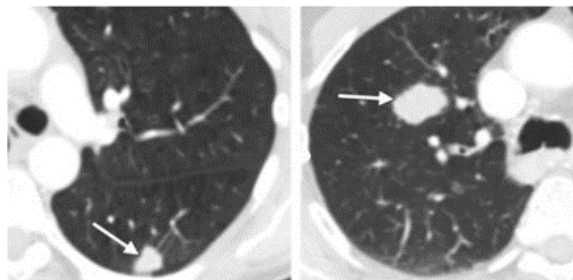


Fig. 1. Stage T1 tumors (Chest CT scan)

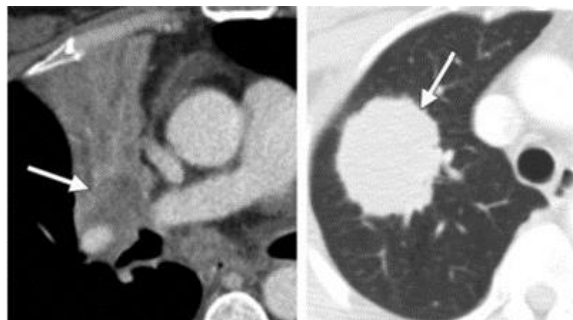


Fig. 2. Stage T2 tumors (chest CT scan)

Clinical staging of SCLC of TNM classification of Lung Cancer:

The present analysis focuses at impact of the TNM system on clinical staging of SCLC and new IASLC proposals. TNM staging was given to 8088 patients. Survival was directly correlated with both the category T and category N. The differences were more seen in patients without mediastinal or hyper classical lymph node involvement. Patients with pleural effusion, have a midway prognosis between restricted disease and widespread disease.

IASLC for TNM 7th Edition also applies to this SCLC series and SEER database:

Change recommendations for T, N, and M descriptors have been included in the TNM subset. A group of stage candidates was developed on the training subset and tested on the validation subset. This led to the proposal of including an additional threshold for tumor size with the transition of tumor TCM from T2 to T3. Reassignment of categories assigned to additional pulmonary nodules in some places and reclassification of exudates as M descriptors. Tumor size was recorded as the largest diameter measured by the pathologist. TNM staging for non-small cell lung cancer involves dividing the disease into T1 and T2 based on size cutoffs. Reassign T&M categories in the same lobe.

N descriptors of TNM Classification 8th Edition for Lung Cancer:

One of the most trusted indicators in the forecast of patients with lung cancer is the node state, so it is not required when determining the optimal therapeutic options. The analysis pointed out that the 3B, 3C, and 4A stage groups have had similar survival results and provide additional research for clarity. The doctor records the number of lymph nodes of the metastasis and uses new handles such as N1A, N1B, N2A, N2B, and N3 for additional testing to further classify categories N. One more method has been rising to classify lung cancer as

individual tumor nodes. In this method, individual tumor nodules having the same historical appearance in the lungs of a small proportion of primary lung cancer patients. This lets us know about how such tumors can be classified to report the 8th edition of the Anatomical Classification of Lung Cancer.

Comparison of stage 7 and 8 TNM lung cancer:

It's clear from the above figure that there are measurements given under each stage of tumor. In 7th edition, there exists only two subdivision T1a, T1b having (52cm) and (723cm). Now they have improvised the system in 8th edition by further adding divisions under tumor and metastasis. They have got T1c with tumor size (>2-3cm) & T1b (>1-2cm) & T1a (<=1cm), and T4. Under metastasis they added MIC-multiple extra thoracic metastases.

3. Proposed Method

The TNM system is most widely used as cancer staging system. When compared to the previous edition, here we are improving the clarity of the image. This project is designed based on the Machine Learning Concept.

4. Conclusion

TNM is a process which best suits for staging lung cancer. Although there were many enhancements made in this system, right from 6th edition to the currently used 8th edition. These changes led to the creation of new groups and modifications to the stage groups with changes to other groups. The 8th edition also introduces new guidelines for the staging of lung cancer with multiple pulmonary sites of involvement and new guidelines for tumor measurement.

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